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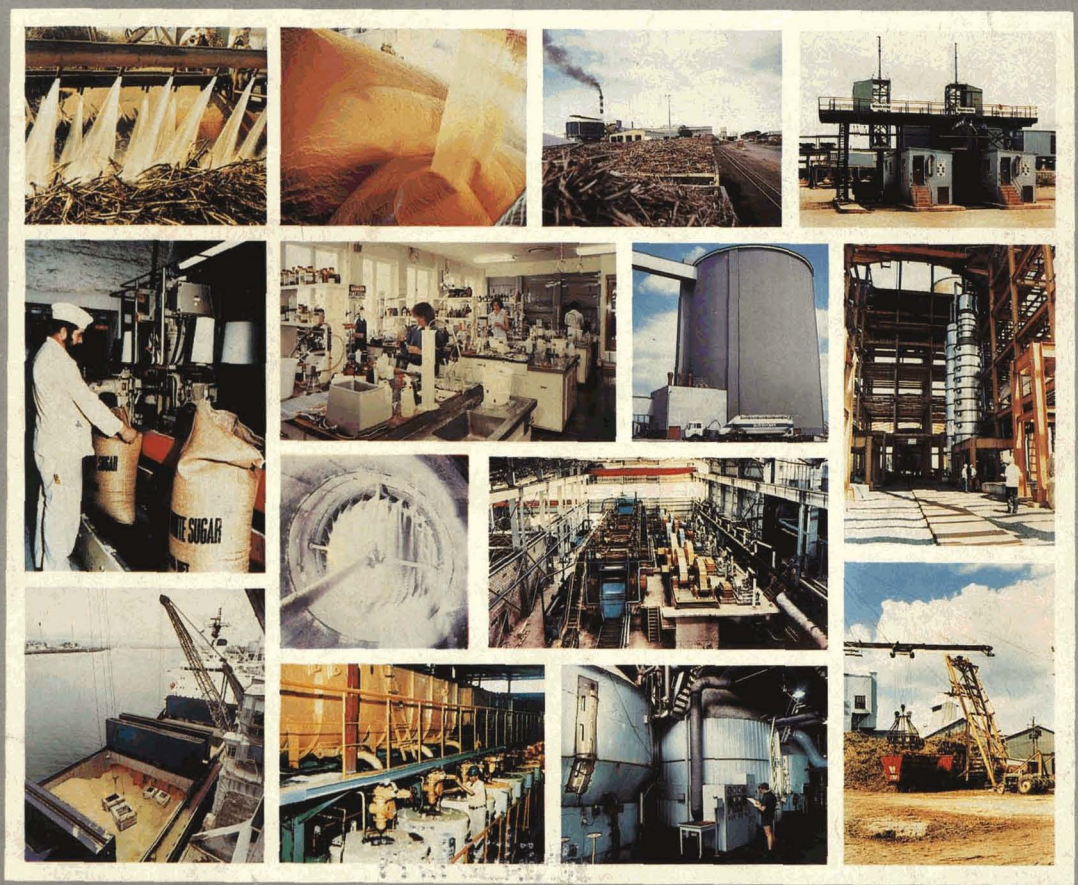

VOLUME LXXXVI/ISSUE No. 1032 DECEMBER 1984

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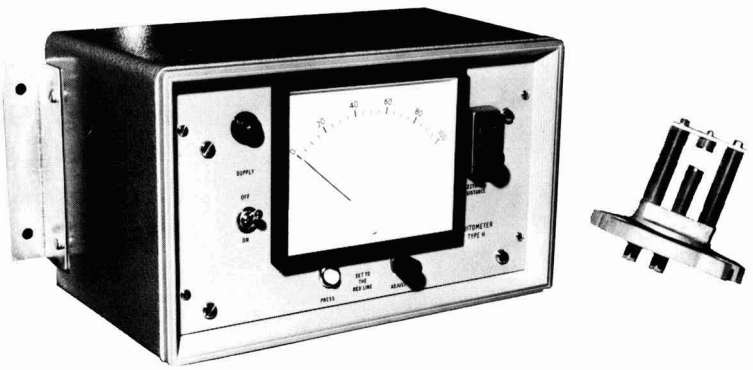

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Notes and comments

World sugar prices

There was a welcome rally in sugar prices during October ; the London Daily Price for raw sugar rose from $114 (£92.50) on October 1 to a peak of $130 on October 10 before ending the month at $123.50 (£101.50) per tonne on October 31. On the white sugar market the LDP(W) rose from $162.50 to a peak of $180 before ending the month at $167. The improvement was sparked by higher than expected purchases by Egypt and sales of raws by the Philippines and Thailand, as well as rumours of further purchases by the USSR. Lack of business during the end of the month caused the weakening of market prices from the levels which had applied during most of the period.

E. D. & F. Man Ltd. comment[1] that, while there is little evidence to suggest that short-term prospects are brighter, the outlook in the longer term is perhaps less gloomy. Whilst a dramatic improvement is unlikely, particularly in the coming weeks, there is little doubt that prices have reached the nadir of the current bear market and may well begin to edge higher in the New Year.

EEC supply quota for Trinidad cut

The EEC Commission has decided to cut the amount of sugar which Trinidad may sell to the Community from 69,000 to 44,000 tonnes, raw value, following its failure to fulfill its quota in three successive years. F. O. Licht GmbH note[2] that the cut applies retro-actively from July 1, 1984; supplies by Trinidad have been less than the quota, and on two occasions Trinidad was allowed to claim *force majeure* because of bad weather. In 1983/84, however, it had no such excuse; yields and cane area had been declining and it had been concentrating its sales efforts on the US where it also has a guaranteed supply quota. Trinidad is thought unlikely to appeal against the decision but other ACP countries are likely to seek to take up the released quota. However, redistribution is entirely at the discretion of the Commission.

US blended sugar imports and the quota program[3]

As more figures are made available on the quantity of the various mixtures and blends coming into the US outside of the quota system, the extent of this alternative market is becoming more apparent. Most sources now estimate that 1984 imports of these products will reach at least 200,000 short tons of sugar equivalent (a figure considerably higher than some USDA estimates). The growing awareness of this problem is being cited as an important reason for the 500,000 tons cut in the 1984/85 fiscal year quota[4] and for the current rather lethargic performance of the market for quota sugar. Whether the administration will act to limit these imports is still a matter of debate but the quantity is becoming sufficiently large to imperil the functioning of the sugar program and is therefore of concern to a broadening segment of the producing industry.

World sugar trade in 1984/85

World Sugar Journal has recently published[5] details of a survey into production and consumption by region and economic group (developed and developing countries) and concludes that, in spite of the fact that India – normally an exporter – will be importing sugar, imports will fall between 1983/84 and 1984/85 by 1.4 million tonnes from 27.7 million, or about 5%. In the short term, unless increased demand from the other sugar importing countries exceeds the reduction in demand caused by the expansion in HFS and synthetic sweetener usage in a number of developed countries, international sugar trade will continue to decline. In the medium term, this situation will correct itself once HFS users reach saturation point.

WSJ foresees an increase in world sugar production from 94.77 to 95.59 million tonnes, raw value, between 1983/84 and 1984/85, an increase of 820,000 tonnes or 0.87%. Consumption is expected to rise from 95.19 to 97.26 million tonnes, an increase of 2,070,000 tonnes or 2.16%. Importers as a group are expected to increase production while production in exporting countries, on the other hand, is not expected to show any change from 1983/84. This development is clear evidence that producing importers are insensitive to the price of the free market, as are some exporters whose sales are subsidized or whose export earnings do not rely on the free market price.

"In an economic sense, importers today could import sugar more cheaply than what it costs to produce it. But this topic is more complicated than a simple comparison of import price and cost of production. Social considerations as well as foreign exchange expenditure are two important factors which have a bearing on a country's decision whether to import or produce more".

World Sugar Journal's estimates of production and consumption by region are tabulated below.

	1983/84	1984/85	Change, %
	tonnes, raw value		
Production			
Europe	30,050,000	31,010,000	+ 3.10
N. America	5,160,000	5,440,000	+ 5.15
C. America	14,760,000	14,160,000	– 4.24
S. America	14,320,000	13,540,000	– 5.76
Asia	20,500,000	20,370,000	– 0.64
Africa	6,420,000	7,060,000	+ 9.07
Oceania	3,560,000	4,020,000	+11.44
World	94,770,000	95,590,000	+ 0.87
Consumption			
Europe	34,080,000	34,490,000	+ 1.20
N. America	8,950,000	8,800,000	– 1.68
C. America	5,740,000	5,740,000	0
S. America	10,210,000	10,860,000	+ 6.37
Asia	27,210,000	28,130,000	+ 3.38
Africa	7,970,000	8,200,000	+ 2.89
Oceania	1,030,000	1,040,000	+ 0.97
World	95,190,000	97,260,000	+ 2.16

Sugar in Africa[6]

Sugar use in Europe, North America and Japan has been greater than other areas for many years and it has been recognized that it is in the areas of the world with

1 *The Sugar Situation*, 1984, (402).
2 *International Sugar Rpt.*, 1984, **116**, 516.
3 C. Czarnikow Ltd., *Sugar Review*, 1984, (1724), 189.
4 *I.S.J.*, 1984, **86**, 274.
5 1984, **7**, (2), 23-26.
6 *International Sugar Rpt.*, 1984, **116**, 439-446.

large populations and low per caput consumption that future growth of the sugar industry is likely to occur. South and Central America have increased their offtakes and it is thus in the developing countries of Africa and Asia where growth has been expected. African sugar consumption grew at an average annual rate of 5% between 1970 and 1980, considerably above the world average of 2%, and the continent has become a major market for exporters, as production has not kept pace with consumption.

The situation has been examined by F. O. Licht GmbH who have published the results of their survey. Currency problems, economic difficulties and low oil prices in some cases, they note, have recently affected consumption growth. Low world prices have forced exporting countries to raise domestic prices, and high levels of government protection have meant that low world prices have not encouraged consumption in producing countries. Even in developing countries low income per head has inhibited consumption growth.

In 1984 production is likely to rebound to 1982's level of 7.3 million tonnes after the drought-affected 1983 output of 6.7 million tonnes, increases in South Africa and the Sudan accounting for almost all of this recovery. As a consequence, net sugar imports by the continent are likely to fall by 30%, from 1,262,300 tonnes, raw value, in 1983 to 883,000 tonnes in 1984. Further, this trend is likely to continue if importing countries continue to pursue a policy of self-sufficiency in spite of current low world prices. Low world prices, on the other hand, could affect export production, which may slow down the fall in net imports requirement.

Japanese sugar market stabilization measures[1]

Japanese sweetener consumption is expected to be little different in the sugar year October 1984/September 1985 from the previous year; white sugar consumption will remain at 2,550,000 tonnes while HFS consumption is estimated at 546,000 tonnes against 542,000 tonnes in 1983/84. However, domestic sugar production is likely to reach 858,000 tonnes in 1984/85 (including 602,000 tonnes of beet sugar) against 762,000 tonnes (including 469,000 tonnes of beet sugar) in 1983/84. Refined sugar production from imported raws is estimated at 1.72 million tonnes against 1.76 million and end-year stocks are expected to rise from 258,000 to 287,000 tonnes.

Japanese refiners have agreed to limit imports despite the present attractive world prices: after a vast oversupply of sugar threatened to destabilize prices early in 1983, refiners appealed to the Ministry of Trade and Industry for permission to operate a price cartel whilst they cut capacity. This was granted and the refiners adopted measures to cut capacity from 3.8 million to 2.8 million tonnes by September 1986. Current capacity is estimated at 3.2 million tonnes.

Refiners' prices are threatened by expanding beet sugar production and they have negotiated with beet sugar manufacturers to buy the expected surplus and to hold it as a buffer stock for remelting when demand justifies. This measure is expected to contribute greatly towards stabilizing prices. Although volumes have not been agreed, beet sugar manufacturers and refiners may continue these measures to stabilize domestic white sugar prices in future.

Cuban ISO quota shortfall declaration[2]

Near the end of October the Cuban authorities officially notified the ISO Secretariat in London that they do not expect to be able to fulfil their ISA export entitlement this year. Apart from the fact that a shortfall is expected it has not been possible to quantify the amount. It may be argued that current limitations are a rather academic exercise in present circumstances but it does seem surprising that at this stage in a quota year an indication of the extent of the shortfall cannot be given. According to the ISO's *Statistical Bulletin*, production in the season from October 1983 was 8,331,178 tonnes, raw value; official statements at the time the crop closed mentioned a performance that was a little in excess of 8.2 million tonnes. It must be presumed that this was issued on a tel quel basis whereas the statistics submitted to the ISO have been converted to raw value. Given a crop of this size, it would appear that there have been heavy deliveries to Cuba's socialist trading partners if she is not in a position to meet her ISA export entitlement of 2,403,094 tonnes, raw value.

Typhoon damage in China[3]

Typhoon Ike, which devastated the Philippines earlier, also ripped through Guangxi province of China, demolishing factories and sugar cane fields in the worst typhoon-related destruction in 30 years.

Alcohol production program for Central America and the Caribbean[4]

At a meeting of the Inter-American Social and Economic Council, sponsored by the Organization of American States, it was concluded that to combat the energy crisis and the fall in their export earnings from sugar, a group of countries (Costa Rica, Dominican Republic, Guatemala, Honduras, Jamaica, Nicaragua, Panama and El Salvador) propose to set up a system of national alcohol programs which provides for the establishment of 25 new sugar-based distilleries in addition to those existing in the countries. Total annual production is likely to amount to between 4726 and 6080 million litres; this will allow addition to petrol at the rate of 10-20% and also leave a surplus for export.

Consolidated Westway Group profile

References appear occasionally in this Journal to news items taken from the *Amerop-Westway Newsletter*. This is published by the Consolidated Westway Group who have now produced a booklet providing a corporate profile. The Group, through its subsidiary companies, is a major sugar trading firm and molassses distributor as well as being engaged in trading in precious metals, coffee, etc., real estate, farming, etc. Amerop Sugar Corporation is the subsidiary which trades in sugar, amounting to about 1,000,000 tonnes a year, while Westway Trading Corporation deals in molasses in the US, Canada and Brazil, operating its own terminals and tanker truck fleet. Amerop Chile packages and distributes imported refined sugar, while the group is affiliated to Sucres et Denrées of Paris, a major European sugar trader also active in agri-business and financial services.

1 F. O. Licht, *International Sugar Rpt.*, 1984, **116**, 533-534.
2 C. Czarnikow Ltd., *Sugar Review*, 1984, (1724), 197-198.
3 F. O. Licht, *International Sugar Rpt.*, 1984, **116**, 518.
4 *World Economic Service Information Bull.*, 1984, (166).

Observations on the structure of I.S.P.

By J. D. Blake and M. L. Clarke

(Sugar Research Institute, Mackay, Qld., Australia 4740)

Introduction

In the last decade or so, increasing research has been directed at classifying and characterizing polysaccharides associated with cane sugar production. The objectives have been better understanding of their roles in processing sugar cane and their influence on raw sugar quality.

Imrie & Tilbury[1] reviewed polysaccharides in sugar cane and its products in 1972. They noted that comparatively little information had been published on the nature of polysaccharides present in juice from freshly harvested cane free of microbial spoilage. Where emphasis was directed at post-harvest deterioration and microbial polysaccharides a lot of work suffered from the use of non-specific methods. Changes were frequently attributed to the collective "gums" present in cane and its process materials.

Research on polysaccharides using more specific methods, however, has resulted in characterization of some of the polysaccharides found in sugar cane. For example, Nicholson & Lilienthal[2] used periodate oxidation and degradation with α-amylases to describe an "abnormal dextran" from deteriorated cane. Bruijn[3] completed this work with the comprehensive characterization of a similar polysaccharide which was shown to be of the pullulan type.

Hawes[4] and Leonard[5] used chemical methods to characterize dextrans while Covacevich & Richards[6,7] have demonstrated that dextrans isolated from a number of raw sugar samples contained 95.5 ± 1.2% α (1 → 6)-linkages and 4.5 ± 1.5% α (1 → 3)-linkages. The great majority of dextrans found in Australian sugars have similar structures to B-512 native dextran.

Apart from starch, naturally occurring polysaccharides in sugar cane have not been intensively studied. Roberts *et al.*[8] reported the presence of a polysaccharide of negative specific rotation in freshly cut cane. Quantitative monosaccharide analysis[9] revealed that galactose predominated with decreasing quantities of arabinose, mannose, xylose and glucose. It was classified as an arabinogalactan and

J. D. Blake

M. L. Clarke

designated indigenous sugar cane polysaccharide (I.S.P.). It was found as a component of the flocculant precipitates sometimes occurring in carbonated beverages and acidified syrups.

Hawes[4] isolated an arabinogalactan in his studies on water-soluble polysaccharides from sugar cane and his methylation analysis suggested that it was a structurally unusual arabinogalactan.

In the course of studies on polysaccharides from Australian sugar cane varieties, an arabinogalactan has been found to be a common constituent. It was structurally classifiable as of the 3,6-type found widely distributed in plant tissues[10].

It was of interest to compare this with I.S.P. from American cane varieties and when a generous sample of crude I.S.P. was obtained from the Director, Sugar Processing Research Inc., Louisiana, a comparative structural analysis was made. This paper outlines the results of that analysis.

Experimental and results

Procedures for the preparation of arabinogalactan from the variety Q 80 harvested in the Burdekin district have been detailed elsewhere[10]. Details for I.S.P. from Louisiana are as follows:

(a) Prior history of the sample received for comparative evaluation

Cane was milled within one hour of cutting and stripping at the U.S.D.A Field Station in Houma, Louisiana. This produced 200 litres of juice of 20°Brix. Celite No. 503 filter aid (1 kg) was added to the juice together with acetic acid (2 kg) and absolute ethanol (600 l). The final pH was 3.5.

After standing for 4 hours the sediment was recovered by decantation and the slurried precipitate (340 l) was filtered and dried (1191 g). The precipitate in 250g lots was extracted in boiling water and the extract filtered hot. This was repeated. The combined filtrates were digested with α-amylase overnight before a final filtration, exhaustive dialysis, concentration and lyophilization.

Analysis by gas chromatography[11] of the sample as received revealed a relative composition of 3% rhamnose, 1% fucose, 26% arabinose, 5% xylose, 9% mannose, 34% galactose and 23% glucose.

(b) Fractionation scheme

Fractionation and purification involved fractional precipitation with ethanol and subsequent chromatography by ion exchange and gel filtration. The scheme is outlined in Fig. 1.

Monosaccharide compositions of fractions precipitated by ethanol at 50 and 55% and that fraction not precipitated at 70% ethanol are shown in Table I. Material precipitated between 55 and 70% ethanol concentration was not analysed but immediately chromatographed on a Bio-Rad AG.MP.1 column equilibrated to phosphate at pH 7.5. After elution of an unretained fraction a linear gradient to 0.5M sodium chloride produced two fractions. These were separately concentrated and dialysed to remove sodium chloride and to re-equilibrate to starting 0.005M phosphate buffer of pH 7.5. They were then rechromatographed under similar conditions to those used initially. Results are shown in Fig. 2.

Fractions A and B after rechromatography were equilibrated by dialysis to

1 *Sugar Tech. Rev.*, 1972, **1**, 291.
2 *Aust. J. Biol. Sci.*, 1959, **12**, 192.
3 *I.S.J.*, 1966, **68**, 356.
4 *Ph.D. Thesis* (James Cook University of North Queensland), 1970.
5 *Ph.D Thesis* (James Cook University of North Queensland), 1972.
6 *I.S.J.*, 1977, **79**, 3.
7 *ibid.*, 33.
8 *Proc. Tech. Session Cane Sugar Refining Res.*, 1964, 76.
9 Idem: *I.S.J.*, 1976, **78**, 163.
10 Blake *et al.*: *Carbohyd. Res.*, 1983, **115**, 265.
11 Blake & Richards: *Carbohyd. Res.*, 1970, **14**, 375.

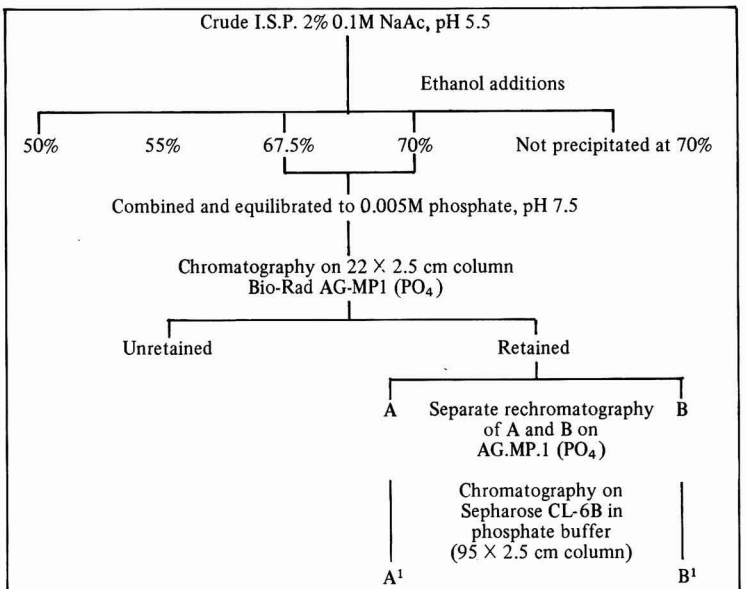

Fig. 1. Fractionation scheme for components of I.S.P.

Table I. Compositions of some fractions of I.S.P. from U.S.A. using ethanol precipitation

	Fraction		
	50%	55%	Unprecipitated at 70%
	Relative % neutral monosaccharides		
Rhamnose	4	4	2.5
Arabinose	12	15	37
Xylose	6	4	10
Mannose	16	15	8
Galactose	35	47	31
Glucose	27	15	12

Table II. Composition of fractions A and B obtained by chromatographic purification

Fraction	Chromatography	Relative % neutral monosaccharides					
		Rhamnose	Arabinose	Xylose	Mannose	Galactose	Glucose
Unretained	AG MP-1 (PO_4)	2	17	5	18	34	24
Fraction A	AG MP-1 (PO_4)	1.5	38	1	2	54	3
Fraction B	AG MP-1 (PO_4)	3.5	40	2	2	51	2
Fraction A^1	Sepharose CL-6B	2	44	0.5	1	51	1
Fraction B^1	Sepharose CL-6B	3.5	43	1	1	48	3

0.02M phosphate at pH 7.5 and separately chromatographed on a 95 x 2.5 cm column of sepharose CL-6B in the same buffer. This column had been calibrated to dextrans of known molecular weight. Chromatograms are shown in Fig. 3, while changes in composition occurring throughout the purification steps for the combined 55-70% fractions are given in Table II.

(c) Structural studies

(i) Monosaccharide composition is shown in Table II. These results are normalized for neutral sugars only.

Hexuronic acids were eluted from the anion exchange resin[11] and identified by co-chromatography with authentic standards using the solvent system 18:3:1:4 ethyl acetate:acetic acid:formic acid:water. Alkaline silver nitrate and *p*-anisidine hydrochloride revealed the presence in both A^1 and B^1 of glucuronic acid and a less mobile component which may have been aldobiouronic acid(s).

(ii) Specific optical rotation was measured at 589 nm at 20°C for fractions A^1 and B^1 (C. 0.2%). Values $-57.4°$ and $-50.7°$ were obtained, respectively.

(iii) The arabinogalactan fraction A^1 was methylated using the Hakomori method and analysed using combined gas chromatography-mass spectrometry[12]. The arabinogalactan from the Australian variety Q80 was analysed at the same time. Chromatographic profiles of the partially methylated alditol acetates on 3% OV.225 at 170°C are shown in Fig. 4 to illustrate the similarity of the methylation products of the two samples. The components identified and their relative compositions appear in Table III.

Discussion of results

Compositions in Table I provide further support for the existence in arabinogalactans from sugar cane of a range of molecular species in which there is continuing variation in the arabinose: galactose ratio[10]. Hawes[4] actually isolated a fraction containing 56.4% arabinose and 36.6% galactose with minor amounts of

12 Jansson *et al.: Chem. Commun.* (Dept. Org. Chem., Arrhenius Lab., Univ. of Stockholm), 1976, (8).

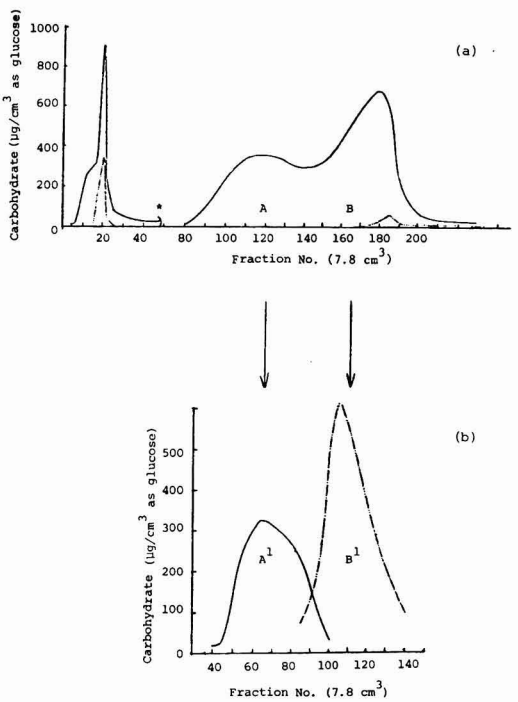

Fig. 2.(a) Ion exchange chromatography of arabinogalactan U.S.A. on macroporous AG.MP.1 (PO_4)
(b) Re-chromatography of fractions A & B under similar chromatographic conditions
—— phenol-sulphuric acid assay ..... UV-absorption in (a)
*** Gradient started at fraction No. 66 in (a) and at fractions Nos. 34 and 41 for re-chromatography of A & B respectively in (b)**

Table III. Methylation analysis of arabinogalactans from sugar cane

Peak[a] No.	Methylated[b] sugar	T(OV-225)[c]	T(ECNSSM)[c]	Mole %[d]	
				Q80	U.S.A.
1	2,3,5-Ara	0.50 (0.41)	0.52 (0.48)	35.6	37.2
2	3,5-Ara	0.81 (0.80)	0.93 (0.91)	1.5	1.5
3	2,3-Ara	1.06 (1.07)	1.25 (1.25)	8.8	11.7
4	2,3,4,6-Gal	1.19 (1.19)	1.25 (1.25)	6.0	4.0
5	2,4,6-Gal	2.00 (2.03)	2.25 (2.28)	13.1	8.4
6	2,3,4-Gal	2.74 (2.89)	3.32 (3.41)	4.5	4.1
7	2,4-Gal	5.00 (5.1)	6.4 (6.35)	30.5	33.0

[a] As labelled in Fig. 4.
[b] 2,3,5-Ara ≡ 1,4-di-O-acetyl-2,3,5-tri-O-methyl arabinitol etc.
[c] Retention times of the corresponding alditol acetate from Q80 relative to 1,5-di-O-acetyl 2,3,4,6-tetra-O-methyl-D-glucitol on OV-225 at 170°C and ECNSS-M at 150°C. Times were calculated from the retention time of 2,3,4,6-Gal. Figures in brackets are retention times from the literature[9].
[d] Calculated from integrated areas measured on OV-225.

rhamnose and xylose. Increasing arabinose content promotes greater water solubility in the polysaccharide.

This continuum in saccharide variation extends to glucuronic acid composition. Glucuronic acid has been identified and estimated in I.S.P.[13]. It varied from 3 to 8.5% in polysaccharide obtained from cane juice and raw and refined sugar and its presence was confirmed in arabinogalactans isolated in these studies. While fractions A and B exhibited reproducible behaviour in ion exchange chromatography (Fig. 2) gel permeation chromatography demonstrated that they were of comparable molecular size (Fig. 3). Since they were also of similar neutral monosaccharide composition (Table II) their performance on ion exchange chromatography must reflect differences in glucuronic acid composition.

The actual content of glucuronic acid may be quite small; Hawes[4] could not detect any acid in the arabinogalactan from Q 57 variety and it was insufficient to generate a carboxylic acid signal in the ^{13}C-nmr spectrum of the Q 80 species[10].

The I.S.P. arabinogalactans were chromatographically homogeneous on Sepharose CL-6B with molecular weights, referenced to B-512 dextran, of about 110,000. The molecular weight of the highly-branched arabinogalactans may show little correlation with the more linear dextrans.

Fraction A^1 was chosen for methylation because of its chromatographic similarity to the arabinogalactan from Q 80. This similarity extended to methylation analysis as revealed by Fig. 4 where the chromatograms of the methylated polysaccharides after hydrolysis are virtually superimposable. Slight differences in quantitative analysis of the O-methyl sugars may be attributed to integration and the normalization of areas.

Overall, the I.S.P. can be classified as of the 3,6-type[14] as shown in Fig. 5. In general, they possess a framework of 1,3-β-D-galactopyranose residues to

13 *Tech. Rpt. Cane Sugar Refining Res. Project*, 1977, (38).
14 Aspinall: "Polysaccharides" (Pergamon, Oxford), 1970, p. 100.

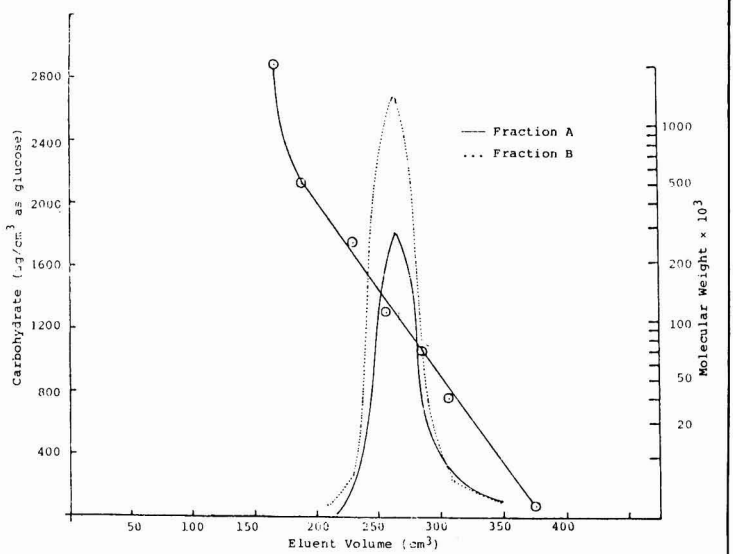

Fig. 3. Gel permeation chromatography on Sepharose CL-6B of fractions A & B from arabinogalactan U.S.A. after ion exchange separation. The column was calibrated with dextrans of known molecular weight

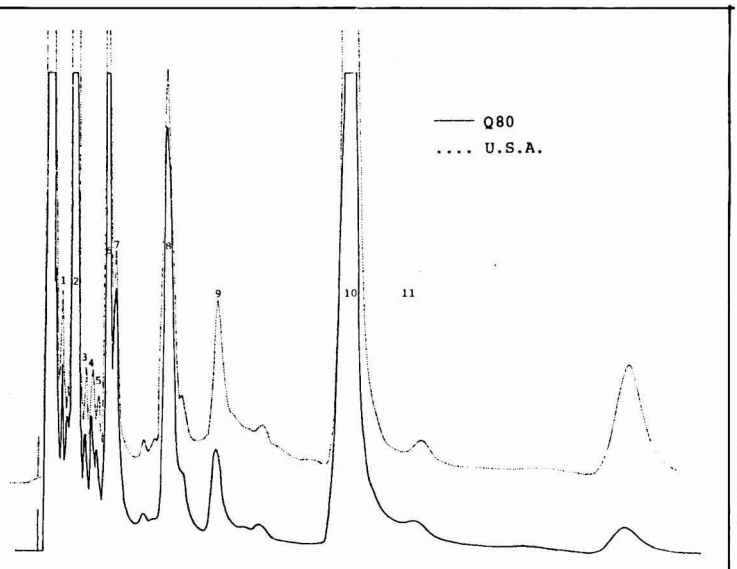

Fig. 4. Chromatography of methylation products of arabinogalactans on 3% OV-225 at 170°C. Peaks are reported in Table III

which galactosyl and arabinosyl side chains are attached at position 6. They may also carry additional, less abundant monosaccharides such as L-rhamnopyranose, D-xylopyranose, D-mannopyranose, D-glucopyranose and D-glucuronic acid, usually as terminal substituents[15].

The similarity of the A^1 fraction from I.S.P. and the Q 80 arabinogalactan is also demonstrated in their respective specific optical rotations where values of $-57.4°$ and $-56.0°$ were obtained. The more acidic B^1 fraction was a little less negative at $-50.7°$. A figure of $-46°$ has been reported by Roberts *et al.*

The most significant difference between I.S.P. and its Q 80 counterpart is the presence in I.S.P of two acidic components separable by ion exchange chromatography. There was no evidence for the presence of a comparable fraction B^1 in Q 80 arabinogalactan.

Acknowledgements

The authors wish to thank Dr. M. Clarke, Director, Sugar Processing Research Inc., Louisiana, for a sample of I.S.P. that made this comparative analysis possible.

We also thank Professor B. Lindberg, Department of Organic Chemistry, Arrhenius Laboratory, University of Stockholm, Sweden, for use of facilities at which the methylation analysis was undertaken.

Summary

Samples of indigenous sugar cane polysaccharide obtained from Louisiana and a polysaccharide isolated from Australian cane have been obtained and fractionated. The fractions have been analysed by fractional precipitation with ethanol followed by chromatography on ion exchange resins and gel filtration. There were important similarities between the major fractions of the two materials, which were identified as 3,6-arabinogalactans, with differences in their contents of glucuronic acid and in the minor monosaccharides attached to the side-chains.

15 Andrew & Stone: *Carbohyd. Poly.*, 1983, **3**, 227.

Observations à propos de la structure des polysaccharides indigènes de canne à sucre

On a obtenue des échantillons des polysaccharides indigènes de canne à sucre provenant de la Louisiana et des polysaccharides isolés de canne Australienne. On les a fractionnés et on a analysé les fractions en utilisant la précipitation fractionnée avec de l'alcool suivie de chromatographie sur échangeurs ioniques et de filtration sur gel. On a trouvé des similarités importantes entre les principales fractions des deux matériaux. Elles furent identifiées comme des arabinogalactanes du type 3-6 avec des différences dans la teneur en acide glucuronique et avec des monosaccharides mineurs attachés aux chaines latérales.

Beobachtungen zur Struktur von im Zuckerrohr enthaltenen Polysacchariden (I.S.P.)

Proben von im zuckerrohr enthaltenen Polysacchariden (I.S.P.) aus Louisiana und Australien wurden mittels fraktionierter Ethanolfällung aufgetrennt und die Fraktionen mittels Ionenaustausch-Chromatographie und Gelfiltration analysiert. Beträchtliche Übereinstimmungen zeigten die Hauptfraktionen beider Proben, die als 3,6-Arabinogalactane mit unterschiedlichem Glucuronsäuregehalt und Variationen in den Monosacchariden, die an die Seitenketten gebunden sind, identifiziert wurden.

Observaciones sobre la estructura de 1 S.P. (polisacarido indígena de caña de azúcar)

Se han fraccionado muestras de I.S.P. obtenidas de Louisiana y un polisacarido aislado de caña australiana y se han analisado las fracciones por precipitación fraccional con etanol y, después, cromatografía sobre resinas cambiadores de iones y filtración sobre material gelatinoso. Había semejanzas notables entre las fracciones principales de ambos materiales, que se identificaron como arabinogalactanes del tipo 3-6, con diferencias en su contenidos de ácido glucurónico y con variaciones en los monosacaridos menores atados a las cadenas laterales.

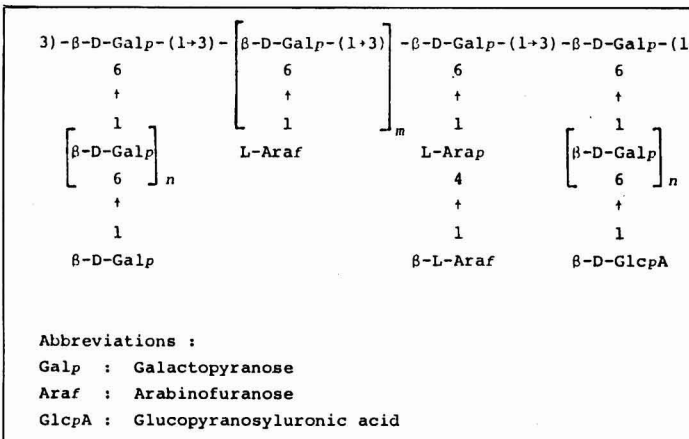

Fig. 5. Generalized structure for arabinogalactans of the 3,6-type

Brevities

Nigeria sugar situation[1]

Nigeria's two sugar producing companies need financial support from the government totalling $173 million if they are to reach their combined production capacity of 170,000 tonnes a year. 1983 white sugar imports were 660,000 tonnes, well below the 960,000 tonnes of 1982, but this was due to a lack of foreign exchange rather than an increase in domestic production. Combined output is expected to reach 60,000 tonnes in 1984 but funds have been promised to get the Savannah Sugar Company at Numan, in Gongola stage, into full production of 100,000 tonnes a year. Nigeria could be self-sufficient in ten years with active expansion of production. Studies by the Dutch company HVA have established that as many as 35 sugar plantations could be set up in various parts of the country.

Jordan sugar production plans[2]

First steps have been taken in a government agricultural project, involving 20,000 hectares, to provide self-sufficiency in food. Among the plans are those for erection of two sugar factories, one in the Hamad basin and the other at Azraq in the region of the frontier with Saudi Arabia.

Japanese non-sucrose sweetener usage[3]

Japan's increasing use of artificial sweeteners such as aspartame will depress usage of HFS rather than sugar in the short term, according to industry sources. The most important sector for substitution is that of soft drinks, where HFS represents about 80% of the total sweeteners used. HFS consumption between October 1983 and September 1984 reached 542,000 tonnes, while domestic production and imports of sugar totalled some 2.7 million tonnes, raw value. HFS prices were around half the level of domestic sugar prices, partly owing to high levies on imported raws to provide subsidies to the domestic producers. Despite its predominance in soft drinks, HFS has failed to penetrate markets for other sugar products; in particular, new technology for producing solid HFS has proven too costly.

Puerto Rico sugar production, 1984[4]

The Puerto Rican sugar cane harvest was completed in late May with an output of 94,000 short tons of raw sugar by the five factories, against 98,000 tons in 1983. Because of drier weather and an earlier start to the harvest, sugar recovery rose to 7.5% from 7% last year. The Puerto Rico government has guaranteed a net price for 1984 of 25 cents/lb. raw value, up from 21 cents in 1983, and expectations of a favourable support price in 1985 have encouraged growers to plough up existing ratoon cane and plant new cane; this is expected to raise output above 100,000 tons in 1985.

Mexico sugar production, 1983/84[5]

The 1983/84 cane harvest in Mexico yielded 3,050,000 tonnes of sugar, tel quel, up from 2,900,000 tonnes in 1982/83, according to the Director General of the state sugar enterprise Azúcar S.A. Current stocks are sufficient for nine months consumption and Mexico is to boost production to achieve self-sufficiency in the coming season.

1 F. O. Licht, *International Sugar Rpt.*, 1984, **116**, 479.
2 *Zuckerind.*, 1984, **109**, 768.
3 F. O. Licht, *International Sugar Rpt.*, 1984, **116**, 480.
4 *U.S.D.A. Sugar & Sweeteners Outlook & Situation Rpt.*, June 1984, 5.
5 F. O. Licht, *International Sugar Rpt.*, 1984, **116**, 434.

Thames refinery fibre optic system for computer control of process

By John A. Fitzpatrick

(Tate & Lyle Refineries Ltd., London)

Introduction

Thames Refinery is renewing some of its principal process sections. The new plant will include many measurements and controllers, some specialized control equipment and visual displays, all controlled by computers that will communicate with each other. A single transmission system is required that can handle all types of signals generated by the many different instruments linked to the system.

The equipment available on the market was examined and found to be unsatisfactory. Instrument manufacturers supply equipment that does much more than we require. Hence, such equipment is expensive because most of what we buy we do not use. Also, our experience is that maintenance of purchased equipment takes far too long owing to our lack of experience with it. Finally, the standard of performance must be in doubt because manufactured systems perform a large number of checks on the validity of data received.

John A. Fitzpatrick

Tate and Lyle has been developing techniques associated with process control by computer for fifteen years. Two data transmission systems have been designed and installed in Thames Refinery which have performed to our satisfaction, one for six years and the other for three. As these systems were designed and built in-house, the few failures that occurred were quickly corrected.

Because systems available on the market were unsatisfactory, it was decided to design the data transmission system for the new processes.

TLR transmission system components

The transmission system consists of analogue multiplexers, digital multiplexers, fibre optic cables, opto-electronic converters and frequency converters. One analogue multiplexer can connect with up to eight analogue measurements such as flow, temperature, level, etc. One digital multiplexer can connect with up to sixteen digital measurements such as "valve open or shut" or "pump running-not running". The digital multiplexer also operates both analogue and digital type controls. It has sixteen output channels that can be used either singly, to operate digital controls, or in pairs, to operate analogue controls. Fibre optic cables are used instead of copper cables because of the advantages of transmission through glass over copper. The opto-electronic converters put signals into and take signals out of the fibre optic lines. The frequency converters are used to protect analogue measurement signals.

TLR 8-channel analogue multiplexer

The multiplexer is illustrated in Figure 1. In order to achieve maximum immunity from noise, CMOS (complementary metal oxide semi-conductor) components are used in the multiplexer circuit. Also, each input includes an opto-isolator to protect the multiplexer from any electrical disturbances that may occur in the field. The measurement signals input to the multiplexer are 24 volts switched at 20-100 Hz. For example, the input signal from a flowmeter is 20 Hz when the flow is zero, and 100 Hz when the flow is at maximum. All measurements are integrated in the multiplexer; hence, for a flow measurement, the value sent to

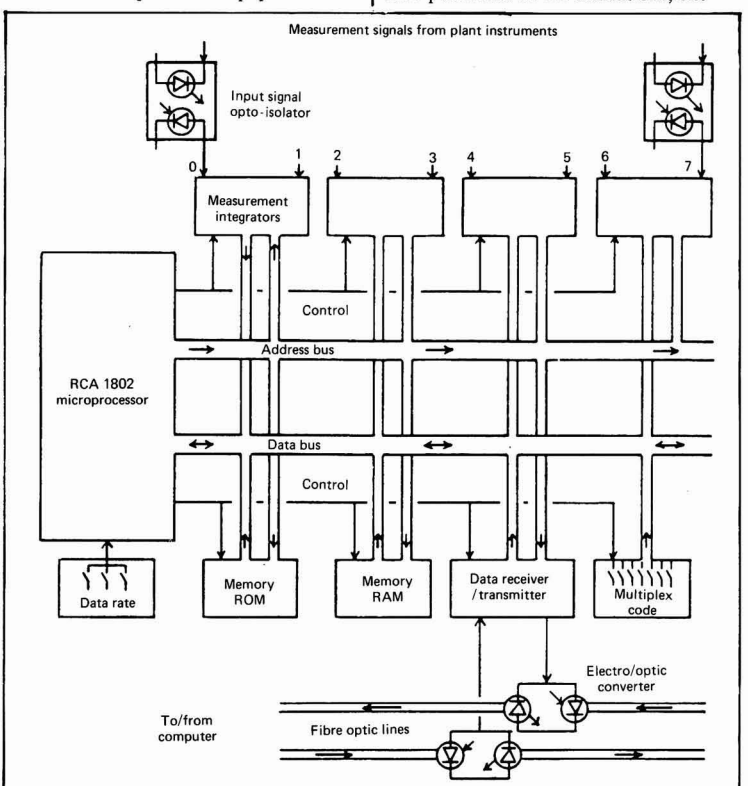

Fig. 1. TLR 8-channel analogue multiplexer

Paper presented to the 43rd Ann. Meeting, Sugar Industry Technologists, 1984.

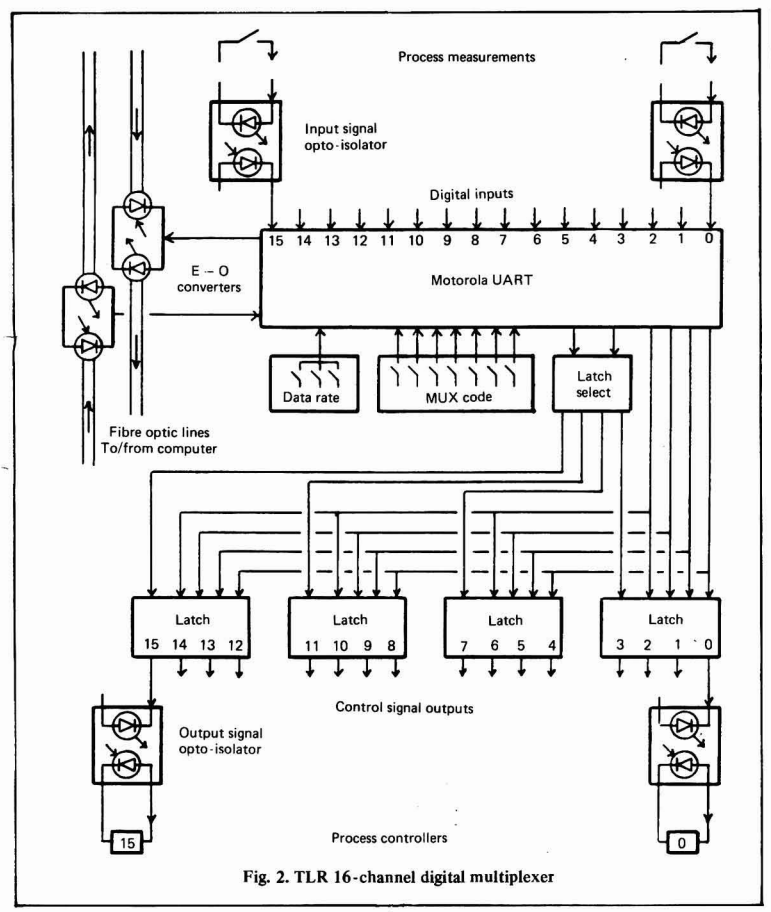

Fig. 2. TLR 16-channel digital multiplexer

the process computer represents the total flow since the previous time, not the current instantaneous flow. For a temperature measurement, the value transmitted represents the average temperature since the previous transmission.

The operation of the multiplexer is controlled by an RCA 1802 microprocessor. It can be seen from the diagram that the microprocessor is connected to a number of units by address and data buses. The program used by the microprocessor to perform its various tasks was written by TLR and is stored in the RAM (random access memory). The ROM (read-only memory) contains a utility program supplied by RCA which is used to load the TLR program into memory. The UART (universal asynchronous receiver transmitter) receives instructions from the computer and passes them to the microprocessor. It also sends data to the computer under control of the microprocessor. Signals to and from the computer travel in fibre optic cables and the electro/optical converters change signals from electricity to light between the UART and the cable.

Every multiplexer has a unique code so that only one multiplexer responds to each computer instruction. This code is a fixed input to the microprocessor and is set on a battery of switches. The speed of transmission of data can be set to 1200, 2400 or 4800 bits per second. Another battery of switches is provided for this selection. The TLR system operates at 2400 bits per second.

Operation of the analogue multiplexer

The process measurements are integrated continuously. When the computer requires measurements it sends one data byte along the fibre optic line. This byte contains the unique code of one of the multiplexers connected to the line. This particular multiplexer responds by transmitting the integrated measurements of all eight channels to the computer. As each measurement is stored in a sixteen bit counter, a single measure is transmitted to the computer as two data bytes. When the stored value is transmitted the integrater is reset to zero.

TLR 16-channel digital multiplexer

This multiplexer is illustrated in Figure 2. As in the analogue multiplexer, the digital multiplexer uses CMOS components and opto-isolators on all inputs and outputs. Also, inputs and outputs are 24 volts DC. The operation of the multiplexer is dependent upon a Motorola UART but communication with the process computer, the unique multiplexer code and speed of transmission are identical with the analogue version. Control signals to the process are maintained at the required level by a series of latch circuits, one for each output channel.

Operation of the digital multiplexer

Process measurements are continuously input to the UART of the multiplexer. When the process computer requires measurement data, it transmits one data byte along the fibre optic line. The byte contains the unique code of one multiplexer connected to the line. This multiplexer responds and it sends two bytes of data to the computer. Each byte contains the states of eight of the sixteen input measurements.

The computer can change the states of the four output channels, of any one of the four latches, in one output sequence.

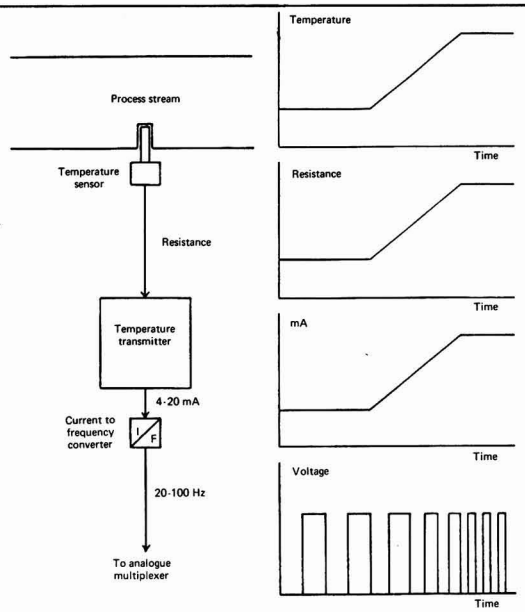

Fig. 3. Temperature measurement

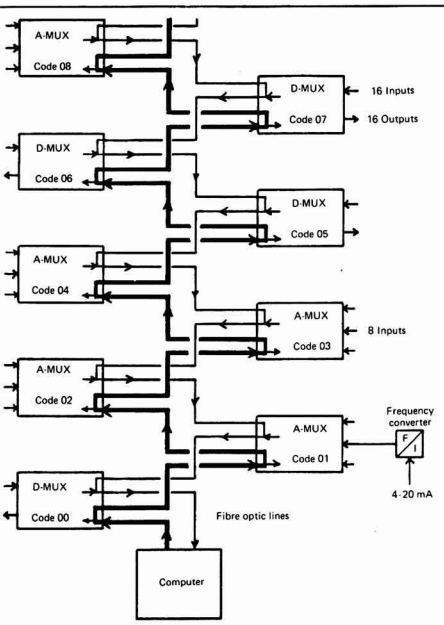

Fig. 4. TLR transmission system

It does so by transmitting two data bytes along the fibre optic line. The first byte contains the unique code of one multiplexer on the line. The second byte identifies the latch and the required states for all channels connected to the latch.

TLR frequency converter

Process instruments are chosen that have 4-20 mA output. This signal is likely to be distorted if transmitted to a multiplexer and it is therefore converted to a frequency signal in the range 20-100 Hz. This method of transmitting the measurement is far less susceptible to noise.

It was necessary to design this converter, as units available on the market have frequency ranges that are too high for our purposes or their response is non-linear.

A typical installation is shown in Figure 3 using a temperature measurement to illustrate the arrangement. The conventional temperature meter produces a 4-20 mA signal which is often used to drive an indicator or recorder. This signal is immediately converted to a pulse train and transmitted to the multiplexer.

TLR transmission system

A typical arrangement is shown in Figure 4. The fibre optic cable, containing two glass fibres, runs from the computer and around the process plant. At suitable locations, it connects with analogue and digital multiplexers. All signals from the computer to multiplexers travel through one of the two glass fibres, while all signals from multiplexers to the computer travel through the other.

One cable can operate any mixture of analogue and digital multiplexers (A-MUX and D-MUX in Figure 4) provided: the total number of multiplexers does not exceed sixty four and each multiplexer has a unique code. If all multiplexers are of the one type, a cable can support 512 analogue or 1024 digital measurements.

Summary

The newly introduced fibre optic system for transmission of control instrument signals in the Thames Refinery

THE KONTI 12-DCH

- With built in sugar melter
- With inner heating system
- With stainless steel curb

- With automatic feed-control
- With automatic Bx-control
- With syrup separation

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ISJ Abstracts

Cane sugar manufacture

Cane preparation measurements in Louisiana – 1981

S. J. Clarke. *J. Amer. Soc. Sugar Cane Tech.*, 1984, **3**, 74-77.

The Cane Preparation Index (CPI), defined as $100 \times \frac{\text{pol extracted by washing}}{\text{pol extracted by disintegration}}$, was measured during the 1981 season at five Louisiana factories, three of which used two knife sets and the other two shredders for preparation. Average values with the knife sets were 57%, 59% and 64%, and with the shredders, 70% and 73%; standard deviation at each factory was about ± 6%. The results compare with 60-65% for knife sets operated conventionally and with 73% for a contra-rotating set, and with values in the high 70's and low 80's possible for shredders. At Raceland factory, reduction from 2 to 1 inch of the clearance between the hammers and the anvil of a Unigrator unit raised the CPI to 79%, but mill feeding problems resulted from such fine preparation. The value of 64% given above was for a new knife set installed with increased power. While an approximate relationship was found between preparation and extraction, whereby an increase in the CPI of about 6% raised the mill extraction by 1%, there are so many other factors affecting extraction that it is considered unreasonable to assume a simple correlation between CPI and extraction. The degree of preparation obtainable with different types of equipment is discussed, and the effect of variety examined. There was some indication that a recently released variety, CP 70-321, could be over-prepared, resulting in mill feeding problems. However, no significant differences were observed between preparation of this variety and CP 65-357 (a standard variety) under identical conditions (30-lb samples of plant, 1st and 2nd ratoon cane passed in 1-ft lengths through a small shredder at Audubon Sugar Institute); proof that the method used can demonstrate varietal differences was obtained in the treatment of two brittle, high-fibre varieties, which provided very high CPI values. The pros and cons of increased preparation are briefly evaluated.

Mill capacity improvement at Leighton – arcing of mill rolls

G. Legendre. *J. Amer. Soc. Sugar Cane Tech.*, 1984, **3**, 78-80.

Details are given of the surface treatment of the cane mill rollers at Leighton sugar factory in Louisiana. Beads were welded on the tips of the grooves of the receiving and bagasse rollers to reduce wear, while a solid bead was applied to the tips of the groove of the top roller and a solid weld applied on each side of the groove; spot welding was also used to recondition the rollers on every "wash-out" day. The presence of finger bars (installed some years previously to replace scraper plates) contributed to the benefits of the surface treatment in terms of minimal wear and increased hourly throughput without any roller changes in 1981.

Boiler efficiency analysis in the Louisiana sugar industry

W. Keenliside. *J. Amer. Soc. Sugar Cane Tech.*, 1984, **3**, 81-86.

The performances of bagasse furnaces in some Louisiana sugar factories are discussed. CO was found in the flue gas of many units, but in most cases at a low level. Where, however, the CO level exceeded 1.0% (corresponding to an efficiency reduction of at least 7%) this was mostly a result of poor bagasse distribution, with some cases of bagasse overloading also being evident. The problems associated with uneven distribution, of particular significance in the case of horseshoe furnaces, are discussed. Another major problem was the high excess air level, and it is pointed out that few factories have facilities for measuring it. While the average efficiency of the furnaces surveyed was about 52%, it is considered that under optimum conditions (65% excess air and an exit flue gas temperature of 425°F) the efficiency could be raised to about 60%, permitting significant cost savings. The importance of air preheating is noted, while other measures contributing to energy saving include reducing the entry of tramp air, particularly via the bagasse chutes and gas burner vents, and increasing the boiler steam pressure.

Top roller variable loading

C. M. Alonso. *J. Amer. Soc. Sugar Cane Tech.*, 1984, **3**, 94 *(Abstract only)*.

A brief comparison between the old dead-weight system and the nitrogen-charged bladder type accumulator is made. A system that combines their advantages to obtain simplicity on a variable loading of the top roller is explained and the results achieved when applied to the first mill, in terms of the improved extraction and steadier flotation, are analysed. The importance of having as much pressure as possible to avoid mill slippages and chokes is discussed, with emphasis on the relationship between the first mill loading and the factory share of the sucrose extraction when the first expressed juice is used as the basis of the cane payment.

New procedure for chemically cleaning water-side surfaces in crystallizers

P. R. Arellano. *J. Amer. Soc. Sugar Cane Tech.*, 1984, **3**, 94 *(Abstract only)*.

The formation of scale films on the heat-exchange surfaces in crystallizers could decrease the coefficient of heat transmission by 50% in only 300-500 days of operation. The water-side chemical cleaning procedure of heat-exchange surfaces in crystillizers discussed allows the recovery of a substantial portion of the coefficient of heat transmission lost to those deposits, thereby increasing productivity and lowering operating costs of such equipment.

Practical hints on bio-control of sugar mills

E. Castro-Mata. *J. Amer. Soc. Sugar Cane Tech.*, 1984, **3**, 94 *(Abstract only)*.

Conditions that highly favour microbial development are found in the cane sugar industry. Microbial activity originates in

both field and factory. The importance of good microbiological control in increasing sugar recovery is very well known in the industry. This paper provides process engineers with useful control data on characteristics of critical micro-organisms, control of the degree of contamination going into and out of the process stages, flow patterns and other important variables within the system, as well as biocide characteristics. These data attempt to provide enough background to support some practical hints that will be helpful in achieving a good biocontrol of sugar factories.

How surfactants function in abnormal quality of low-grade sugar cane molasses

J. C. P. Chen, B. A. Smith, R. V. Romo and J. J. Molina. *J. Amer. Soc. Sugar Cane Tech.*, 1984, **3**, 95 *(Abstract only).*

The authors previously presented a report on the establishment of a uniform boiling system for the evaluation of surfactants in low-grade boilings. The boiling techniques employed were proved to be reproducible. The authors presented a second report on the boiling characteristics of 31 surfactants, using the established uniform boiling system, in normal quality molasses for low-grade boilings. It proved that, even with normal quality molasses, a good surfactant has the characteristics of improving the boiling performance in many, if not all, quality parameters. This report is on the evaluation of 16 chosen surfactants in semi-abnormal and abnormal *B*-molasses. The results show that those which are good for normal quality molasses may not be as good for abnormal quality materials. Furthermore, the boiling characteristics of surfactants in abnormal quality molasses functioned differently and demonstrated patterns other than those in normal low-grade boilings. For semi-abnormal quality molasses, boilings can be carried out without a surfactant, but with a lengthened time of boiling. However, in abnormal quality materials, boilings were simply impossible without a surfactant.

Evaluation of varietal milling characteristics: Audubon Sugar Institute, 1981

S. J. Clarke. *J. Amer. Soc. Sugar Cane Tech.*, 1984, **3**, 95 *(Abstract only).*

Six new varieties, some of which have recently been released and others which may be released, were compared with CP 65-357 as a standard variety. The milling tandem at the Audubon sugar factory was used to grind a few tonnes of each of the varieties. The parameters studied were sucrose % cane, fibre % cane, juice purity, tonnes of sugar available (96°S) per tonne of cane, power requirements, sucrose extraction and grinding rate. Three of the varieties were superior to CP 65-357. The experimental methods and their limitations are described and data for each of the varieties presented.

Air heater *versus* bagasse dryer

J. J. Mecsery. *J. Amer. Soc. Sugar Cane Tech.*, 1984, **3**, 95 *(Abstract only).*

A practical discussion comparing the thermal balances of an air pre-heater *versus* a bagasse dryer (using stack flue gases) to obtain a degree of fuel saving when a large modern boiler without any heat recovery (Case 1) is compared with the same boiler with an air heater (Case 2) and, finally, the original boiler compared with the same unit operating with a bagasse dryer (Case 3). All values used in each case are calculated; where the value is assumed for simplicity, a current everyday average value is used. The boiler and equipment used for this comparison are modern, currently used in the industry. The boiler is a water-tube type, with all water walls and two drums equipped with a spreader stoker. The dryer is a direct-contact, counter-current drum type. Also presented are a table and calculations of the approximate heating values of bagasse at various moisture contents, the total heating value and the relative heat saving of total bagasse.

Microcomputer incorporated in raw juice mass flowmeter

C. Reynaldos. *J. Amer. Soc. Sugar Cane Tech.*, 1984, **3**, 96 *(Abstract only).*

This discussion explains simply how a microcomputer is incorporated into a raw juice mass flowmeter with a density correction. The advantages and flexibility of the microcomputer allow it to receive more input signals. In addition to juice density and flow, the microcomputer receives signals of the maceration water flow as well as a bagasse:cane ratio. The microcomputer can be programmed to calculate many desired unknowns, e.g. the amount of cane ground at any moment of the day or the total in a given period. This is impossible to do with the pneumatic analogue computer used previously.

Belt presses for dewatering and washing of cane mud

M. D. Shields and B. Rodrigues. *J. Amer. Soc. Sugar Cane Tech.*, 1984, **3**, 96 *(Abstract only).*

High cane mud pol losses and cake disposal problems are common in modern, large sugar factories. This paper is a review of the results of pilot tests run at a Florida sugar factory with a new filtering device designed to deliver a cake of lower moisture and pol losses than conventional vacuum filters. The existing vacuum filter's cake was successfully washed and dewatered with Eimco belt-presses. The cake pol losses were reduced from 4.5% to 1.5% and the cake moisture from 80% to 65-70%. Because of improved clarity, the filtrate could be used as dilution in the maceration step or for dissolving lime used in the defecation step. In another set of tests, the clarifier underflow was effectively filtered in the Eimco belt-presses using bagacillo as filter-aid. By comparison with the vacuum filters, the pol losses could be reduced to 2.0-2.5%, compared with the existing 4.5%; the cake moisture decreased to 70% against an existing 80%, and the filtrate purity improved to 78% against 75%. Additional tests were made on washing and dewatering of the clarifer underflow without the use of bagacillo as filter-aid. Under emergency conditions,

the belt-press can operate without bagacillo, but there are slightly higher pol losses than when using it.

Deposits and their control in multiple-effect evaporators

M. L. Pulido. *Sugar y Azúcar,* 1984, **79,** (4), 13, 16-17, 19.

Deposits occurring on the juice side of evaporator tubes are discussed, although the ash composition of steam-side deposit is also given. While the composition of deposits varies with the effect, information is given on some of the main types of scale found. The components include calcium carbonate, silica and/or calcium silicate, calcium sulphate, calcium phosphate (resulting from orthophosphate addition in clarification), magnesium carbonate or silicate, iron (resulting from water of high ferrous bicarbonate content and from corrosion) and calcium oxalate. The solubility of each constituent is discussed. The effect of lime used for clarification and the possibility of reducing the scale problem by replacing lime with magnesium oxide are noted. Among other means of reducing scale formation are the continuous maintenance of greater evaporation rates (cane sugar factories experiencing short and frequent stoppages seem to be troubled by increased scale formation) and maintenance of a juice level which is 10-20% of the tube length. The effect of cane juice composition is also mentioned as well as that of raw water used to complement condensate for imbibition. Apart from using as much condensate as possible instead of raw water for imbibition, and adopting various other methods of reducing the scale problem, the use of anti-scale chemicals is the only practical counter-measure, and some advice is given on how to achieve maximum results.

The potential for generation of public electricity in cane sugar factories

T. Torisson. *Sugar y Azúcar,* 1984, **79,** (4), 21, 26-27, 30-31.

The possibility of producing electricity for supply to the public grid is discussed. Up to 40% of the bagasse available in a factory (assuming a cane fibre content exceeding 12%) could be used for electricity generation if the consumption of process steam could be reduced to 35% (on weight of cane) and the steam generated in modern, high-performance boilers. A co-generation scheme based on increased steam pressure and temperature, with use of the additional steam produced from the excess bagasse in a condensing turbine, is described. The higher admission pressure can be utilized in a turbine located before an existing back-pressure turbine or in a new back-pressure set, while the steam raising can be done by two or three boilers, with only one needed to run the condensing turbine during non-crushing periods. Comparison with an existing scheme shows that, at a fibre content of 18%, 115 kWh per ton of cane can be made available as surplus electricity by increasing boiler efficiency from 50 to 76% and increasing the live steam pressure from 15 to 42 bar. Storage of bagasse during non-crushing periods is discussed. While drying and pelleting would reduce the space requirements and allow for longer storage periods, the use of oil as supplementary fuel is also suggested. The costs of power production at a crushing rate of 180 tch, a bagasse moisture content of 50% and a factory operational period of 5000 crushing hours per year (with 2000 hours during which oil is used as fuel) are calculated.

Need for energy conservation in the sugar industry

P. J. M. Rao. *Indian Sugar,* 1983, **33,** 529-542.

After a brief discussion on energy conservation in the sugar industry generally, the author discusses measures for efficient generation and utilization of steam. Mechanical and thermal methods of bagasse dewatering are surveyed, with references made to bagasse dryers, particularly the Stearns-Roger drum dryer as installed in a Philippines sugar factory. The use of high-pressure boilers is discussed, followed by a brief mention of the value of cane trash as alternative fuel. Reference is made to the high steam utilization efficiencies in beet sugar manufacture and of the benefits of using falling- and rising-film evaporators as well as thermal and mechanical vapour recompression. Replacement of evaporation with reverse osmosis and the use of steam accumulators are discussed, and efficient generation and use of electricity examined.

Mill improvements at Westfield factory – drilled flanges

C. C. Savoie. *Sugar J.,* 1984, **46,** (10), 18-19.

In an attempt to reduce front roller juice flooding, sets of holes were drilled in the roller flanges as extra drainage means on the 1st, 2nd and last cane mills at Westfield. Baffle plates were added to the mill housings to prevent the re-routed juice reaching the bearings, while the cheek plates had to be cut back to allow the holes to remain unblocked. Observations showed that the juice passed through the holes almost continuously, but there was no sign of an expected increase in extraction nor of reduction in bagasse moisture, although data were considered insufficient, and the modifications are expected to contribute to improved performance as well as reduced flooding. Another measure described involving maceration was also tested. A maceration trough placed after each mill had been found to give non-uniform and inadequate penetration of the cane mat, while splashing of the intermediate carrier chains with the imbibition juice contributed to wear and corrosion, and the position of the trough hampered clearance of cane blockages on the carrier. A second maceration trough was therefore placed before each mill in the tandem. The trials were conducted on the front and back troughs operated together and separately; tabulated values of Brix for each mill showed some differences which may not be significant in view of the small number of samples taken. However, because of increased penetration and other advantages, the practice of macerating before the mill is considered justified.

Beet sugar manufacture

Vapour recompression: the novel solution at Guignicourt sugar factory

M. Burtin and J. C. Giorgi. *Sucr. Franç.*, 1984, **125**, 117-121 *(French)*.

The value of mechanical vapour recompression as an aid to reduction of steam and power consumption is discussed, and various possible methods of using a compressor are examined. Restrictions imposed on Guignicourt are mentioned, and the system installed is described. It comprises a falling-film evaporator acting as pre-evaporator, an external entrainment separator and a compressor operating at a maximum rated speed of 5810 rpm and receiving the vapour via the separator, with vapour injection from the multiple-effect evaporator between the separator and compressor; the compressed vapour is returned to the falling-film evaporator. The system has proved very flexible in a series of trials, with the possibility of varying conditions over a wide range and easily stopping and starting operations. Evaporation rates up to 60 tonnes/hr were achieved using 3rd or 4th effect vapour, while use of 1st effect vapour is expected to raise it to 80 tonnes/hr.

Sugar dust and explosion prevention

J. P. Ducatillon and P. Laune. *Sucr. Franç.*, 1984, **125**, 133-136 *(French)*.

Over some 15 years, measurements have been made of dust counts in the air and on the floor of areas of a sugar factory and refinery considered to be the worst affected. Results are tabulated and briefly discussed. All dust samples were found, on the basis of their particle size range of 50-100 μm, to be potentially explosive. A dust bomb developed at a sugar factory was modified and used to determine the explosive potential of dust samples, which were placed in a cone at the closed bottom of the 1800 mm high tube (of 190 mm diameter) and made to form a cloud by a jet of compressed air; at a height of about 300 mm, a spark between two electrodes was applied to the dust, whereupon (provided the dust content was adequate) there was the typical sound of an explosion and a flame was emitted at the open top of the tube. Trials were also conducted on the use of inert dusts to reduce the intensity of dust explosions; results showed that, with increase in the particle size range of a 10-g sample of sugar dust (covering 40 to 80 μm), the amount of calcium carbonate (having an average particle size of 1-2 μm) or of gypsum (of 80 μm particle size) needed to prevent an explosion fell. Gypsum proved the more effective medium; gypsum of 150 μm particle size seemed to be even more effective than the finer material. Larger-scale experiments are needed to confirm these results.

The question of optimum non-sugars concentration in rationalization of molasses exhaustion

K. Wagnerowski. *Gaz. Cukr.*, 1983, **91**, 217-222 *(Polish)*.

The question of optimum non-sugars concentration in low-grade massecuite relative to molasses exhaustion is examined on the basis of statistical analysis of three typical Polish molasses of given initial purity and effective non-sugars concentration subjected to cooling to a given temperature from 80°C. The results are given in the form of graphs showing purity *vs.* temperature, rate of cooling *vs.* temperature and initial non-sugars concentration, relative cooling time *vs.* initial and effective non-sugars concentration, relative crystal yield per unit cooling time and crystallizer unit volume *vs.* initial and effective non-sugars concentration, and relative time and crystallizer capacity requirement per unit crystallized sucrose *vs.* initial and effective non-sugars concentration. A table also shows the effect of variation in non-sugars concentration on crystallization parameters. From examination of the data it is concluded that a molasses exhaustion scheme based on a high initial non-sugars concentration and gradual dilution of the massecuite with water in line with the fall in temperature is not optimum, whereas a system in which the effective non-sugars concentration is maintained at a constant level throughout the cooling period is regarded as optimum.

A new type of beet knife

J. Grabka. *Gaz. Cukr.*, 1983, **91**, 223-224 *(Polish)*.

Details are given of a beet knife of Polish design which has proved comparable in performance to an East German type used hitherto by the Polish sugar industry. The power consumption of a beet slicer equipped with the new knife and operating under identical conditions was considerably lower than with the other knife.

Tests on the effectiveness of chemical preparations for inhibition of rotting in beet piles

N. Jarowaja. *Gaz. Cukr.*, 1983, **91**, 235-236 *(Polish)*.

Laboratory tests on inhibition of the activity of *Botrytis cinerea* in beet piles using various chemical preparations are reported. Funaben T, a Polish fungicide, proved most effective in preliminary tests and was then used in further trials. It is emphasized that the results are of an informative nature only, and that confirmation must await trials on a larger scale.

New applications for reverse osmosis

C. Freschi and G. Bottoni. *Ind. Sacc. Ital.*, 1984, **77**, 13-14 *(Italian)*.

Work on the use of reverse osmosis (RO) to concentrate thin juice as a pre-evaporation stage and to concentrate vinasse is reported by two representatives of the Paterson Candy organization. In the case of pilot-plant trials on thin juice treatment, efficient concentration to 26°Bx was achieved (this is considered the practical maximum) at a permeate COD always lower than 500 ppm, with a solids retention greater than 99%. Using a ZF99 membrane, the juice can be treated at 75-80°C and a pressure of 55-60 bar. The costs of treatment are indicated. Advantages of RO processing of vinasse include a reduction in energy consumption as a result of the absence of thermal

treatment (only a circulation pump being required) and a high quality of waste water.

Study of a sugar factory with vapour compression

T. Baloh. *Zuckerind.*, 1984, **109**, 285-294 *(German).*

See *I.S.J.*, 1983, **85**, 378.

Concentration plant for run-off from *B*-raw sugar

E. Hess and H. van Malland. *Zuckerind.*, 1984, **109**, 295-300 *(German).*

At Ochsenfurt sugar factory, the run-off from *B*-raw sugar is adjusted to 64°Bx for treatment by the Quentin process; since the rated daily throughput of the factory is 12,500 tonnes of beet and the quantity of run-off in question is 78 tonnes/hr, this dilution represents an extra 15 tonnes of water/hr to be evaporated. A scheme is described which uses pan vapour to concentrate the run-off to 71°Bx in a falling-film evaporator; on its route from the tank to the evaporator, the run-off passes through a plate-type heat exchanger where it is cooled from approx. 85°C to 50°C by means of run-off that has already been evaporated. The temperature of the run-off in the evaporator is further reduced to 36°C, but passage through the heat exchanger raises it to 76-78°C before it is pumped to a feed tank. A tapering 90° pipe bend connected to the bottom of the evaporator acts as pre-separator for the vapour and liquid phases and simultaneously accelerates the flow of the vapour to a required level at which it enters a tangential separator, which comprises a vertical cylindrical tank having a bottom discharge port for the run-off. The vapour flows from the top of the separator to a water-jet condenser. Experiences with the system over three campaigns are discussed.

Sugar fractionation — space-saving and adaptable

H. P. Kerlin and H. P. Degelmann. *Zuckerind.*, 1984, **109**, 310-303 *(German).*

Details are given of the vibratory Mogensen Sizer, a sugar screening system that is described as more flexible than existing systems while occupying less floor space. It comprises six screen decks sloping at different angles, one beneath the other; the top deck is at the shallowest angle to the horizontal and has the largest mesh size, and the angle of slope becomes steeper as the mesh becomes finer. At the lower end of each deck the sugar that fails to pass through the perforations falls down a chute to the appropriate collector. One of these units has been installed as a complementary system for sizing of 10 tonnes of white sugar per hour in a West German factory.

A study on the formation factors of crystal size distribution in industrial sucrose crystallizers

A. Pot, L. J. Kuijvenhoven, L. H. de Nie and E. J. de Jong. *Zuckerind.*, 1984, **109**, 305-313.

See *I.S.J.*, 1983, **85**, 376.

Thick juice storage against the background of the1982/83 campaign at Ropczyce sugar factory

J. Cieslak. *Gaz. Cukr.*, 1983, **91**, 244-246 *(Polish).*

An account is given of the scheme used in 1982/83 for thick juice concentration, storage and processing to white sugar. The juice, totalling 24,573 tonnes, was stored in three tanks until December 18, and then processed during the subsequent 33 days. A total of 13,222 tonnes of sugar was produced from the juice at average losses of 0.15%. Modifications made to the thick juice scheme used in the previous year, when it was introduced, are indicated.

Optimization of the diffusion process in continuous trough-type diffusers. II

E. Walerianczyk, A. Butwilowicz and A. Tomaszewska. *Gaz. Cukr.*, 1983, **91**, 263-264 *(Polish).*

Investigations of the behaviour of non-sugars in beet and diffusion and determination of their quantities and of sugar losses in diffusion are reported. The activity of pectinoesterase with regard to the beet pectins was found to fall progressively as the beet ripened; if unripe beet are processed, the enzyme in the cell juice will cause a large part of the pectins to be dissolved, while the amount of colloidal material passing into the raw juice will also be higher than when ripe beet are processed. The pectinoesterase activity in raw juice will be typically about 80% of that in the cossettes; this will be primarily a result of cell wall material entering the juice. Determination of pectinoesterase activity provides a guide to the colloid content in raw juice, while combined determination of invertase and pectinoesterase activities will give an indication of the quality of the beet to be processed. Pectinoesterase activity was lower in wilted beet but higher in rotten beet. Examination of the α-amino acid and amide contents showed that both groups of non-sugars increased in the raw juice relative to their contents in the beet, the greatest rise (150%) occurring with alkaline water; tyrosine found in the cossettes did not occur in raw juice, whereas the highest individual increase was of glutamine (aprox. 180%).

Heat transfer during boiling of fluids in annular channels

I. I. Sagan', I. S. Cherkunova and V. A. Yarmolenko. *Izv. Vuzov, Pishch. Tekh.*, 1984, (1), 97-102 *(Russian).*

Studies were made of forced-convection boiling of water and 30°Bx sugar solution where the vapour content was high and flow took place in an annular region (the liquid phase being situated at the tube wall), so that the effect of heat flux on the heat transfer coefficient was reduced, while that of forced convective flow increased. An equation was developed for calculation of heat transfer from the wall to the liquid. Results indicated the value for increasing heat transfer of annular vapour-generating channels in which liquid flow takes place as a rising thin film under the effect of the vapour.

Sugar refining

What the UK refineries do with our sugar

J. C. Abram. *Fiji Sugar,* 1983, **8**, (4), 27-29.

The author, Divisional Technical Director of Tate & Lyle Refineries Ltd., describes the processes used in refining, and tabulates data showing average raw and refined sugar analyses and indicating the performances of the different process stations. The wide variability of raw sugar quality is also demonstrated.

Clean-up plants for sugar users

P. Laakso. *Sugar y Azúcar,* 1984, **79**, (2), 17, 20.

Liquor purification by ion exchange resin in refineries manufacturing liquid sugar is described by a representative of the Finnish Sugar Co. Ltd., pioneers of the technique. Mention is made of various plants, including Miwani Sugar Mills Ltd. in Kenya, which uses a clean-up system supplied by Finnsugar Engineering to produce a high-quality granulated refined sugar (having a colour content of <35 ICUMSA units and an ash content of >0.02%) that is particularly suitable for soft drink manufacture; the refinery plans to manufacture liquid sugar at some time in the future. Apart from small-scale clean-up factories operating in the soft drinks industry and handling 1-5 tonnes of liquid sugar per hour, there could be the need for low-capacity plants to treat unrefined white sugar in developing countries. The use of a small amount of active carbon is recommended for minimizing possible odour problems.

Sugar refining in Thailand

Y. Fujimoto. *Zuckerind.,* 1984, **109**, 238-239 *(German).*

An outline is presented of sugar refining in Thailand, which started in 1972 at Supanburi cane sugar factory and was planned to be extended to more than one-third of the 43 factories by 1983/84. The capacity of the refinery sections is limited by the amount of excess bagasse available, since this is the only fuel used; in some cases, bagasse is imported from other factories. Generally, about half of the raw sugar is refined. Seven factories out of nine refining in 1982/83 used the CARE system developed by the author in collaboration with Thailand technologists for remelt treatment, while the seven planning to start refining in 1983/84 will also adopt the scheme, which is a combination of carbonatation and ion exchange. The affined sugar melt is adjusted to pH 10.3 with milk-of-lime, followed by carbonatation (for which boiler flue gas is used), filtration and adjustment to pH 8.0. Polish filtration or treatment with a strongly basic resin in Cl^- form precedes 3-massecuite boiling to provide one or two consumption white sugars; the low-grade sugar is mingled with the affination sugar, while the raw syrup is processed in the sugar factory. Data for two factories indicate a white sugar colour of 38 and 36 ICUMSA units. Despite high invert contents in Thailand cane, the process gives lower inversion losses than does the sulphitation process, and lower molasses yield than the carbonatation process, thus lowering production costs. The favourable economics and ease of operation have induced two refineries using the Talofloc process to adopt the CARE system.

The refining qualities of raw sugar with special emphasis on ash, colour and dextran problems

J. C. P. Chen. *Sugarland,* 1983, **20**, (4/5), 6-10.

See *I.S.J.,* 1984, **86**, 54.

Investigations of the corrosive properties of (ion exchanger) regeneration effluents in sugar refining

G. M. Solovets and A. A. Kirilenko. *Sakhar. Prom.,* 1984, (4), 28-30 *(Russian).*

The nature and rate of corrosion of carbon steel partially immersed in a 10:0.2 NaCl:NaOH regenerant solution and in effluent from a regenerated anion and cation exchange resin were determined, and the results compared with those from immersion in tap and distilled water. It was found that the effluent from the cation exchange resin had the worst effect on the steel, followed by the unused regenerant, whereas the effluent from the anion exchanger had somewhat less adverse effect than water. It is concluded that colorants in the effluent from the anion exchanger had an inhibiting effect on corrosion. Evaporation of this effluent reduced the corrosive properties only slightly, and then only provided the temperature was not allowed to rise too much; boiling caused considerable corrosion.

Adsorbent decolorizing systems — the pros and cons

L. A. Zemanek. *Paper presented at 43rd Ann. Meeting Sugar Ind. Technologists,* 1984, 7 pp.

Results of a plant-scale test and subsequent experience with the use of a Canesorb carbon/bone char system at California and Hawaiian Sugar Co. similar to that at Atlantic Sugar Ltd.[1] are reported. Advantages of the new system include a considerable reduction in the amount of char burnt (% on melt) and in the energy consumption for char regeneration. The amount of new char injected has also been drastically cut, while the increase in decolorizing capacity (to give the same No. 1 liquor effluent colour as before) has permitted combination of Nos. 1 and 2 houses, releasing char filters for standby as replacements in the event of damage to any of the working filters (thus avoiding costly repairs) and enabling the Herreshoff regeneration furnace to work more closely to its design capacity and thus more efficiently. A number of problems have been encountered with the system, including reductions in flow rates, higher losses than expected in the furnace, the presence of large quantities of dust, and inadequate separation and measurement of the Canesorb fraction in adsorbent mixtures. The combined system at Aiea refinery in Hawaii is also mentioned.

1 Barton & Knebel: *I.S.J.,* 1983, **85**, 14-18, 38-42, 72-76.

Starch based sweeteners

Production of high fructose corn syrup in the USA

P. H. Blanchard and E. O. Geiger. *Sugar Tech. Rev.*, 1984, **11**, 1-94.

An account, with 271 references to the literature, is presented of developments in the manufacture of HFS in the USA, covering the background to the development of the industry, its commercial justification, the potential for further expansion, quality standards for 42%, 55% and 90% syrups, methods of analysis and physical properties. The wide range of applications for HFS is noted, with particular mention of the soft drinks industry. The importance of developments in enzyme technology is discussed; the use of enzymatic liquefaction of starch and refinements in the saccharification technique have permitted the production of syrup having the very high levels of glucose required for isomerization, while the development of immobilization techniques has made the commercial use of glucose isomerase economically viable. The chemistry of the starch-processing enzymes is outlined. A typical process sequence for HFS production is described, based largely on the recommendations of Novo Industri A/S. Process operations and equipment of special relevance are reviewed separately in greater detail, with particular attention devoted to the isomerization stage. Special requirements for fructose syrup purification are indicated. Also covered is the technique of fructose enrichment by large-scale chromatography and work on alternative experimental techniques for the manufacture of 55% fructose syrups.

Current and potential uses of immobilized enzymes

H. O. Hultin. *Food Technol.*, 1983, **37**, (10), 66, 68, 72, 74, 76-78, 80, 82, 176; through *S.I.A.*, 1984, **46**, Abs. 84-398.

Current technology of enzyme immobilization is outlined and current commercial applications are surveyed. The most important of these is the conversion of glucose to fructose by glucose isomerase; the process used is described, and ways of increasing the fructose concentration are indicated.

Development of immobilized enzymes for production of high-fructose corn syrup

W. Carasik and J. O. Carroll. *Food Technol.*, 1983, **37**, (10), 85-91; through *S.I.A.*, 1984, **46**, Abs. 84-399.

Novo Laboratories Inc. made immobilized glucose isomerase (for HFS production from starch hydrolysates) commercially available in 1974. The form of the enzyme first introduced (type A) was suitable only for batch-reuse systems. Later types (E and H) could be used in continuous-flow systems, but the pressure drop increased rapidly. Improved types (S and Q) were obtained by homogenizing the cells prior to cross-linking and by including additives (MgO and dextrose).

Isomerization of glucose to fructose. I. The stability of a whole cell immobilized glucose isomerase catalyst. II. Optimization of reaction conditions in the production of high-fructose syrup by isomerization of glucose catalysed by a whole cell immobilized glucose isomerase catalyst

J. Straatsma, K. Vellange, H. G. J. de Wilt and G. E. H. Joosten. *Ind. Eng. Chem., Proc. Design and Dev.*, 1983, **22**, 349-356, 356-361; through *S.I.A.*, 1984, **46**, Abs. 84-401, 84-402.

I. The enzyme system investigated was a conglomerate of *Arthrobacter* cells containing immobilized intracellular glucose isomerase. Its rate of deactivation was measured as a function of several parameters. The deactivation was most sensitive to pH and temperature, while other possible parameters, such as oxygen concentrations, by-product concentration and impurities present in a synthetic feed stream, appeared to have only minor influence. Deactivation is probably caused by denaturation of the enzyme, and not by mechanisms such as proteolysis, change of the membrane structure of an *Arthrobacter* cell, or pore plugging.
II. Results of previous studies were used to calculate the economically optimal reaction conditions in the production of HFS by isomerization over an immobilized catalyst in a packed-bed reactor. The optimum pH of the feed was found to be 7.65. The sensitivity of total operating costs to small variations in pH (0.1 unit) was small. The temperature should preferably be 50-55°C, if microbial growth can be avoided at this temperature. The catalyst particles should be so small that their effectiveness factor is unity; if this cannot be reached for practical reasons, the particle should be as small as the pressure drop over the reactor allows.

A new process combining adsorption and enzyme reaction for producing higher-fructose syrup

K. Hashimoto, S. Adachi, H. Noujima and Y. Ueda. *Biotechnol. Bioeng.*, 1983, **25**, 2371-2393; through *S.I.A.*, 1984, **46**, Abs. 84-404.

A process for producing a syrup containing more than 50% fructose was developed. It involved a new system combining selective adsorption of fructose and an immobilized glucose isomerase reaction. Continuous counter-current contact of the liquid stream with the solid adsorbent was simulated by advancing adsorption columns against the fixed inlets and outlet of liquid streams, without actual movement of the solid adsorbent, while the immobilized enzyme reactors were stationary. Two mathematical models, an intermittent moving-bed and a continuous moving-bed model, are presented for calculating the concentration profiles of glucose and fructose in the system; the validity of these models was experimentally confirmed. A criterion for good production in the system is given. The system requires less desorbent than a process using a fixed-bed adsorber + a simulated moving-bed process to produce a syrup containing 45-65% fructose, the level desired in food manufacture.

Laboratory studies

Analyses

J. P. Ducatillon and J. Roger. *Sucr. Franç.*, 1984, **125**, 123-126 *(French)*.

Some 20 factories used an enzymatic method to determine sucrose in raw juice, molasses and sometimes syrups during 1983. Results showed that polarimetry gave a value that was on average 1.1% (absolute) greater than that given by the enzymatic method for raw juice – this compares with a difference of 0.5% in 1982 and one of 1.35% in 1981. In the case of syrups, there was practically no difference between the two sets of results, whereas there was a progressive increase in the pol-sucrose difference for molasses throughout the campaign, starting from −3% and ending at +3%. Differences found between the various factories in respect of molasses exhaustion are discussed, and it is concluded that exhaustion should be expressed in terms of sucrose rather than pol. Details are given of measurements of evaporator corrosion in terms of the iron content in feed and discharge juice, and of monitoring of evaporator scale formation as expressed by juice calcium and silicon contents (determined by atomic absorption) before and after evaporation. The findings are discussed.

Analysis of saccharides in low-dextrose equivalent starch hydrolysates using high-performance liquid chromatography

J. J. Warthesen. *Cereal Chem.*, 1984, **61**, 194-195.

HPLC determination of sugars in corn syrup solids and maltodextrins (DE greater and less than 20, respectively) using an HPX-42A prepacked resin column (Bio-Rad Laboratories) with distilled water as mobile phase was investigated. External glucose, maltose and maltotriose standards (DP 1, 2 and 3) were used to establish the area response for the sugars. Results showed that the sugar profiles of the two products could be determined up to and including 10 degrees of polymerization (DP) within 21 minutes, although problems could arise in attempts to use area normalization for samples of low DE; however, the use of the standards for DP 1, 2 and 3 will contribute to an improvement in sugar measurement.

Isolation and fractionation of sugar colorants by rapid chromatographic methods

H. T. Cheng and C. R. Wang. *Taiwan Sugar*, 1984, **31**, 8-12.

See *I.S.J.*, 1983, **85**, 380.

Acetic acid, a major volatile constituent of brown sugar: its origin and measurement

M. A. Godshall and A. J. DeLucca. *J. Agric. Food Chem.*, 1984, **32**, 390-393.

Acetic acid was identified as the major volatile constituent of brown sugars from refineries in four countries. Earlier investigations[1] had shown that the volatile components contributed to the odour and flavour characteristic of refinery brown sugars. The acetic acid levels ranged from 31 to 827 ppm; the source of the acid was found to be bacterial action in recycled sweet-waters containing low sucrose concentrations. Other volatile constituents caused by bacterial action were methanol, ethanol, acetaldehyde and diacetyl. The major micro-organism responsible for the acetic acid was *Enterobacter aerogenes*, while *Serratia marcescens* produced much less acid. The gas chromatographic method used for analysis, with modification of the injection port of a Hewlett-Packard 5750 unit to contain a Dupuy inlet for direct examination of the volatiles, was rapid and gave semi-quantitative results.

New procedure for sulphite ion determination in boiler water treatment in the sugar industry

K. A. Gratton, L. H. Steimel and P. R. Arellano. *J. Amer. Soc. Sugar Cane Tech.*, 1984, **3**, 58-60.

A turbidimetric method is described in which residual SO_3^{--} in boiler water (i.e. remaining after addition of sulphite as corrosion inhibitor) is determined as sulphate. The new method is in two stages: (1) determination of sulphate emanating from natural sources and the small amount formed by sulphite reaction with oxygen, followed by addition of H_2O_2 to oxidize any remaining sulphite, and (2) determination of the total sulphate. Subtraction gives the sulphate resulting from the residual sulphite. For the creation of a white turbidity in the presence of sulphate, a reagent (SulfaVer IV) is used; this is obtainable from the Hach Chemical Co., P.O. Box 389, Loveland, CO 80539, USA. A chart is given for ease of determining the sulphite from the difference in the sulphate readings. The method has the advantage over the potassium iodide/iodate titration method of being unaffected by organic material.

A modern approach to an old problem – analysing abnormal conditions in a sugar mill quality control laboratory

M. Bensinger and R. A. Leon. *J. Amer. Soc. Sugar Cane Tech.*, 1984, **3**, 94 *(Abstract only)*.

The analysis of carbohydrates derived from sugar cane has historically been a measure of the collective physical properties of the sample. The ability to track accurately the efficiency of the various processes in the factory is becoming increasingly important in today's economy. When abnormal events such as field freezes occur, the operation of the factory becomes harder or impossible to predict using conventional assay methodology. This is because compounds other than sucrose may be present in the cane juice. The ability of the factory to determine rapidly and accurately these compounds is going to improve greatly the overall operating efficiency. The use of high-performance liquid chromatography to assay samples commonly encountered in the sugar factory is shown. The simplicity of the method is stressed. The use of this technique to determine abnormal conditions such as polymeric sugars (dextrans) is also discussed.

1 Godshall & Roberts: *I.S.J.*, 1982, **84**, 154.

By-products

Study on mineral supplementation of vinasse in sugar cane fertilization with high-axle tractor

J. A. Magro, J. C. F. da Silva, E. Zambello and J. Orlando. *Saccharum STAB* (Brazil), 1981, **4**, (14), 28-30; through *S.I.A.*, 1984, **46**, Abs. 84-486.

The fertilizer values of vinasse from musts based on molasses, cane juice and a mixture are expressed in terms of urea, KCl and triple superphosphate. Trials are reported in which cane ratoons in (clay and sandy) dark red latosol soils were supplied with vinasse from mixed must, at 60 m^3/ha, alone or with liquid or solid supplements. Cane yields and pol were not significantly affected by the supplements, apart from urea on clay soil at the high dose of 200 kg/ha (90 kg N/ha).

An investigation of optimum conditions for continuous alcoholic fermentation of molasses for maximum productivity

H. I. Cengiz and N. Taygun. *Seker*, 1984, **30**, (114), 13-20 *(Turkish)*.

Laboratory experiments are reported in which optimum molasses fermentation conditions for continuous 2- and 4-stage systems using *Saccharomyces cerevisiae* were investigated. At a temperature of 36°C and pH 5.0 (apart from a fall in both values for a short period when nutrients were added), 2-stage fermentation lasting 1½ hours gave an alcohol yield which, at 11.75 g/litre/hr, was 4.3 times greater than with a batch process under comparable conditions. In the case of the 4-stage system, the alcohol yield from 5 hours' fermentation (a total cycle time of 17 hours, including 12 hours for fermenter emptying and cleaning) was 2.6 times greater than with a batch system, falling to 10.0, 7.7 and 5.9 g/litre/hr in stages 2, 3 and 4; all the sugar was consumed, and final alcohol concentration was 38 g/litre.

Invert syrup from blackstrap molasses

J. A. Polack and E. L. Aguirre. *J. Amer. Soc. Sugar Cane Tech.*, 1984, **3**, 95 *(Abstract only)*.

Separation of sugars from non-sugars in molasses by ion exclusion is the basis for a process announced by Finnsugar Engineering. Ion exclusion, first introduced by Dow, separates ionic from non-ionic solutes over a bed of resin. Enhanced sugar recovery and/or the production of invert syrups are possible benefits of the the process. The present research has two main parts: study of the cane molasses pretreatment required to use ion exclusion, and measurement of the effects of operating variables on the sugar/non-sugar separation efficiency. Many operating variables, such as temperature, flow rates, resin particle size and concentration, were studied. This paper summarizes the results of these studies and shows, in broad terms, what would be required for commercial application of the process.

Deodorizing by denitrification. Application to anaerobically treated vinasse

J. P. Lescure and P. Bourlet. *Sucr. Franç.*, 1984, **125**, 149-151 *(French)*.

Experiments were conducted on deodorizing vinasse by denitrification using a bacterial substrate (from a previous test) fixed on PVC packing. The 600-ml cylindrical reaction vessel received a continuous stream of anaerobically treated effluent at the rate of 480 ml/day plus 43 ml/day of effluent (containing about 350 mg/litre of nitrate) from a preceding nitrification vessel. Recirculation of the denitrification tank contents was also practised so as to improve the contact with the substrate, while 9% of the treated effluent was recycled to nitrification, in which compressed air was used for oxygenation. Results over a 7-week period showed an almost complete disappearance of the foul odour without any significant reduction in the concentration of organic matter or of total N. However, preliminary pilot-plant tests revealed some problems connected with (1) anaerobic mud leakage into the effluent from the preceding fermentation stage (adversely affecting biofilter operation) and (2) variations in the composition of the effluent to be treated, which had a negative effect on control.

Alcoholic fermentation of sugar factory by-products

M. de Miniac. *Ind. Alim. Agric.*, 1984, **101**, 123-135 *(French)*.

Wide fluctuation in yeast growth rate and alcohol yield, in fermentation tests on beet molasses from eight sugar factories conducted over two campaigns, was attributed to differences in the non-sugars compositions brought about in part by variation of factory processing. The effect of non-sugars composition on fermentation was further studied with four boiling house materials: feed syrup, raw syrup from 1st and 2nd massecuite curing, and molasses. Results showed that rise in purity from molasses to feed syrup caused a reduction in yeast growth rate; at constant purity, the non-sugars fractions gave comparable fermentation curves regardless of their origins in the boiling house (molasses or run-off), while heat treatment seemed to cause no chemical change in the yeast nutrients. However, it has been found elsewhere that the non-sugars content and its origin can have marked effects on yeast growth, SO_2 used in sulphitation probably having a major effect. Concentrated vinasse was added to 2nd strike raw syrup together with water and yeasts, and fermentation carried out; the results, tabulated in terms of assimilation of the sugar and non-sugar constituents, are discussed. Recycled vinasse without any yeast extracted proved a better nutrient material than molasses; some of the organic constituents in the original beet were transformed by preliminary fermentation into proteins, amino-acids, enzymes, etc. which make up the yeast structure, so that in this form they were more readily assimilated than in their original form, giving an accelerated yeast growth rate and a higher yeast yield by comparison with molasses of comparable purity.

Patents

UNITED STATES

Isomerization of glucose to fructose

S. E. Foley, P. J. Oriel and C. C. Epstein, *assrs.* Dow Chemical Co., of Midland, MI, USA. **4,308,349**. March 9, 1978; December 29, 1981.

The glucose in aqueous solution is heated at pH 6-8.5 and at 45°-85°C with (1 lb per 50-5000 lb of glucose of) an isomerase enzyme (immobilized on a water-insoluble support) produced by an *Ampullariella* micro-organism [*A. digitata (A.* sp. 3876, *A.* sp. 3877, *A.* sp. 3965, *A.* sp. 3966, *A. lobata, A. campanulata, A. regularis* or a mutant of any of these] in the presence of a thermal stabilizing agent (a Co, Mg or Mn cation) (and 0.1-10% of xylose) whereby the product contains 40-50% fructose on hexoses present.

Extraction of sucrose from molasses

A. M. Landis, of Carpentersville, IL, USA, *assr.* UOP Inc. **4,312,678**. September 3, 1980; January 26, 1982.

A source of sucrose and at least one other sugar (molasses) is brought into contact (in the liquid phase) under adsorption conditions (at 20°-200°C and at atmospheric to 500 psig pressure) with an adsorbent comprising a shaped replication of inorganic support particle aggregates, the adsorbent consisting of a carbonaceous pyropolymer possessing recurring units containing at least C and H atoms, thereby adsorbing the sucrose on it and thereafter recovering the sucrose by desorption (with water) (at 20°-200°C and atmospheric to 500 psig pressure).

Filtration and deionization flocs prepared from cationic and anionic emulsion ion exchange resins

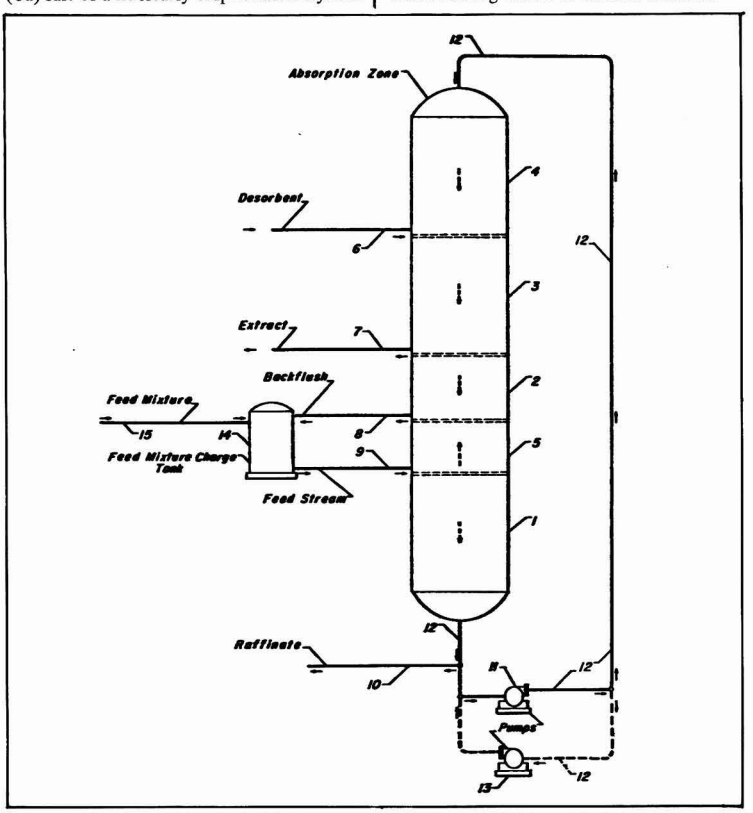
B. P. Chong, E. G. Isacoff and J. W. Neely, *assrs.* Rohm & Haas Co., of Philadelphia, PA, USA. **4,312,956**. June 18, 1979; January 26, 1982.

Flocs prepared by mixing cationic and anionic emulsion ion exchange resins may be used to decolorize raw sugar solutions. Flocs prepared from weakly acidic and weakly basic emulsion resins may be regenerated thermally, i.e. with an aqueous liquid at relatively high temperatures.

Simulated countercurrent sorption process employing ion exchange resins with backflushing

A. M. Landis, D. B. Broughton and G. Fickel, *assrs.* UOP Inc., of Des Plaines, IL, U.S.A. **4,293,346**. November 5, 1979; October 6, 1981.

A simulated moving bed system for separating an extract component (fructose) from a fluid feed mixture with a raffinate component (glucose) employs a stationary adsorbent consisting essentially of an ion exchange resin [an alkali or alkaline earth (Ca) salt of a nuclearly sulphonated styrene cation exchanger (in particles between 20- and 40-mesh) containing (about 4% of) a cross-linking agent (divinylbenzene)] having a greater selectivity for the extract component than for the raffinate component. The resin is contained in a column which includes an adsorption zone 1, a purification zone 2, a desorption zone 3 and a back-flushing zone 5. The adsorption zone is located between the upstream feed input 9 and the downstream raffinate output 10. The purification zone 2 is maintained as the nearest separation zone upstream from zone 1 and is defined between the upstream extract output 7 and the downstream back-flush output 8. The desorption zone 3 is immediately upstream from zone 2 and is defined between the upstream desorbent (water) input 6 and the downstream extract output 7. The back-flushing zone 5 is defined between



the feed input 9 and the back-flush output 8; its function is to counter the compaction of the resin particles which takes place during operation of the column and flow within zone 5 is in a reverse direction to that of the remainder of the column. A buffer zone 4 may also be included between the desorption zone 3 and adsorption zone 1 when feed is used for back-washing; if water is used, the buffer zone becomes essential.

Feed mixture is applied to the column and, owing to the greater selectivity of the resin, the extract is retained and a raffinate stream is withdrawn through output 10. Not necessarily at the same flow rate or time, desorbent is applied to zone 3 through input 6 and an extract fraction withdrawn through output 7. Similarly back-flush material is supplied to zone 5 and withdrawn through output 8. After an appropriate time, the feeds into the various zones are changed in a downstream direction so that the zones then change their function, with zone 3 becoming zone 2, zone 2 becoming zone 5, etc., this simulating a counter-current process.

Treatment of waste water

H. H. Benjes, V. N. Wahbeh and J. R. Stukenberg, *assrs.* Bacardi Corporation, of San Juan, Puerto Rico. **4,311,593.** September 15, 1980; January 10, 1982.

A stream of waste water (vinasse from a molasses fermentation) is distributed within the upper part of an anaerobic digester containing methane-producing micro-organisms in a medium of high surface area. The waste water (of pH 6.5-7) flows downwardly through the medium to the lower part of the digester from which a substantial part is recirculated to the top of the digester, the upward flow being 1-10 (5) times that of the influent waste stream. An effluent portion of the waste water, which has had its oxygen demand substantially reduced by the micro-organisms, is separated and part of the methane produced is removed from the top of the digester (while another part is returned to the lower part of the digester so that it bubbles upwardly through the medium). Nutrients are added to the waste so as to maximize the growth of the micro-organisms and the digester is maintained at 95-130°F (125-130°F).

Method for the treatment of cellulosic substances with hydrogen peroxide

M. Takagi, of Toda, Japan, *assr.* Bio Research Center Co. Ltd. **4,314,854.** March 5, 1981; February 9, 1982.

An aqueous (1-50% w/w) suspension of cellulosic material to be converted enzymatically to sugars, e.g. bagasse, is brought into contact with 0.1-10% w/w of H_2O_2 in the presence of 0.001-0.01 mole of a Mn^{++}-producing material ($MnSO_4$) (at ambient to boiling temperature for 0.5-24 hr).

Process for the production of fructose polymers and high fructose syrups

R. E. Heady, of Park Forest, IL, USA, *assr.* CPC International Inc. **4,317,880.** June 3, 1980; March 2, 1982.

A sucrose-containing substrate (sucrose and a fructose-bearing syrup) is subjected (continuously) to the concurrent action of effective amounts of fructosyl transferase and glucose isomerase enzymes (the former derived from *Pullularia pullulans* ATCC No. 9348) for a time and under conditions effective to form fructose polymers, glucose and fructose (50-60°C and pH 6.3-6.7). By hydrolysing the polymers (separated from the glucose) is yielded a syrup containing principally fructose.

Method for obtaining glucose isomerase

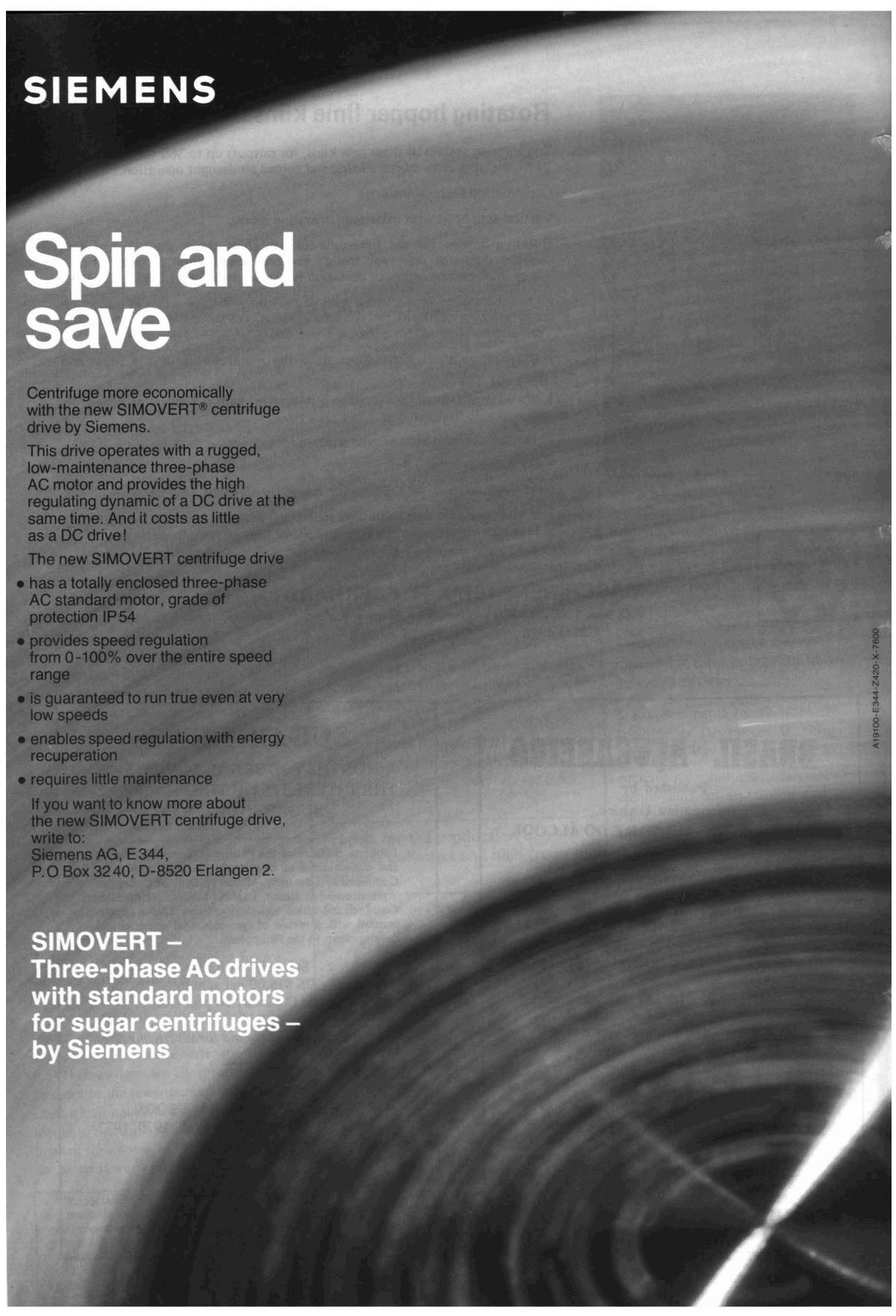
M. S. Popov, G. M. Djedjeva, I. O. Todorov and N. S. Stoeva, of Sofia, Bulgaria, *assrs.* Institut po Microbiologia. **4,317,883.** December 3, 1980; March 2, 1982.

The enzyme-producing strain *Streptomyces* sp. 1339, registration N.144 Bulgarian State Institute for Drug Control, is cultivated for 36-72 hours in a culture medium with xylose as an indicator, at a temperature of 24-36°C, the initial pH being 6.5-9.0, in the presence of 0.0001M $CoCl_2,6H_2O$ and 0.01M $MgSO_4,7H_2O$ in 0.1-3M of the substrate.

Technique to reduce the zeolite molecular sieve solubility in an aqueous system

S. Kulprathipanta and R. W. Neuzil, *assrs.* UOP Inc., of Des Plaines, IL, USA. **4,319,928.** May 2, 1980; March 16, 1982.

An aqueous solution of a mixture of components [sugars (glucose and fructose)] is brought into contact with an absorbent comprising a clay bound crystalline aluminosilicate (an X- or Y-zeolite) (having alkali metal or alkaline earth cations at exchangeable cationic sites) dispersed in an inorganic matrix (silica, alumina, titania or natural clay) whereby one component is selectively adsorbed and subsequently recovered by desorption with water. The adsorbent has been used previously at least once for such component separation and possesses a silicon constituent which tends to dissolve in the aqueous solution, resulting in disintegration of the adsorbent; to reduce this the used adsorbent is coated with (1-4% w/w of) a water-permeable organic [cellulose ester (cellulose nitrate)] polymer.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control scheme is described.

Système à fibres optiques adopté à la Thames Refinery pour le contrôle du processus par ordinateur

On décrit le système récemment introduit à la Thames Refinery pour la transmission par fibres optiques des signaux provenant des instruments de contrôle.

Das Glasfasersystem der Thames-Raffinerie für die Prozeßsteuerung durch Computer

Das neu eingeführte Glasfasersystem für die Übertragung der Regelinstrumentsignale in der Thames-Raffinerie wird beschrieben.

El sistema de fibras ópticas para control por computador del proceso

Se describe el sistema introducido recientemente en la refinería Thames para la transmisión por fibras ópticas de señales provenantes de instrumentos de control.

SIG sugar packaging in Louisiana

By Bernard Krayer, Dipl.-Ing. (ETH)

(Swiss Industrial Company, Neuhausen Rhine Falls, Switzerland)

In the American sugar industry, household sugar is an important sector of sales. Nearly all sugar refineries market household packets of 2 lb, 5 lb, 10 lb, and even 25 lb. Owing to the current situation in the American sugar industry, the market for household sugar is fiercely contested. Retail prices are depressed and all refineries are therefore forced to refine, pack and distribute the sugar as cheaply as possible.

A substantial factor in costs is dependence on a highly reliable and economical output of the packaging plant. At the same time, the packaging machines should be able to handle inexpensive wrapping material from reel.

For these reasons, Godchaux-Henderson Sugar Co. Inc. in Reserve, Louisiana, decided in 1981 to purchase new packaging machinery. The management of Godchaux-

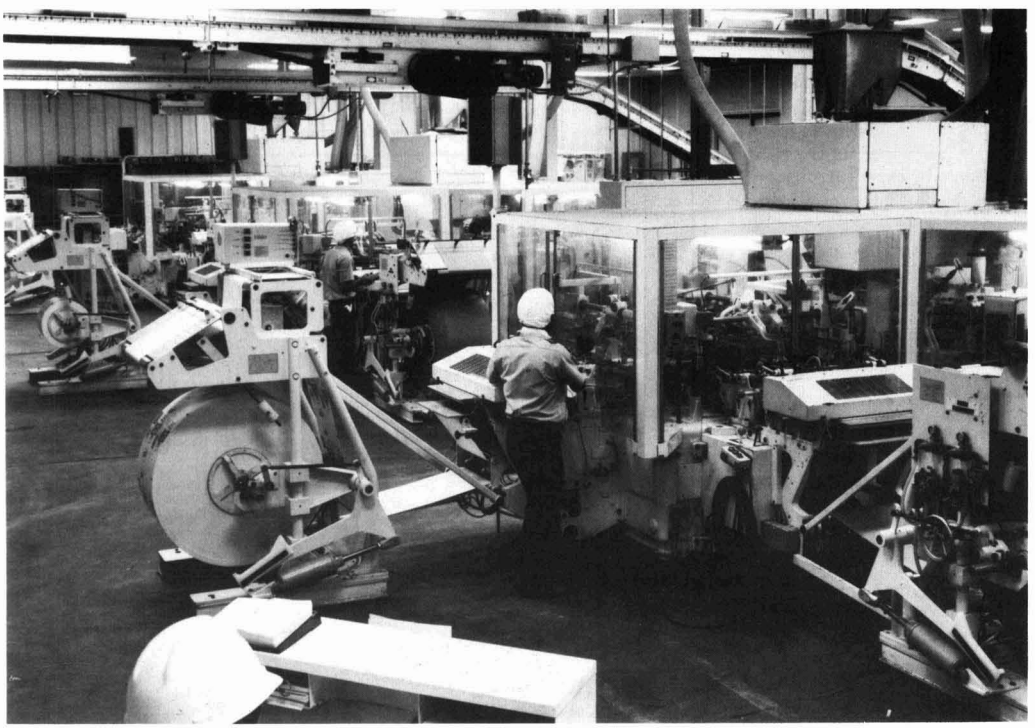


Fig. 1. Three PLD lines at Godchaux-Henderson

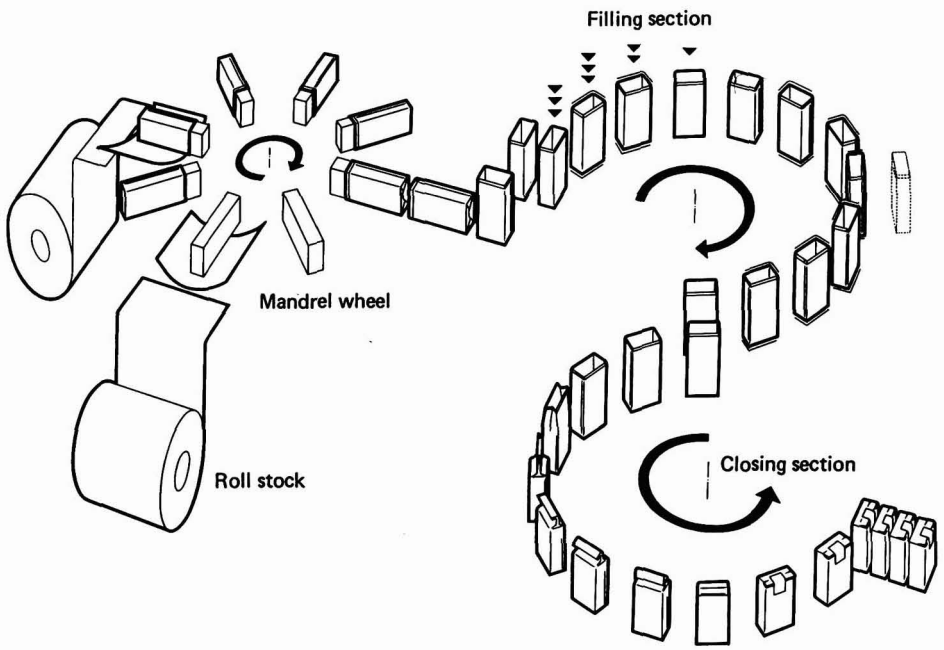


Fig. 2. Working principle of the SIG Type PLD sugar bagging machine

Henderson knew by experience that only the most reliable and robust packaging machines would meet established requirements and attain outstanding results. The multishift production and the production figures demanded do not allow long breaks for service and maintenance of the machines. Nor must any unforeseen stoppages in production occur, in order to guarantee the delivery times for the packaged sugar.

After intensive enquiries, a decision was made in favour of three packaging machines of the type PLD from SIG Swiss Industrial Company. In addition, three parcelers of type TV were ordered, giving thus three complete packaging lines which are now in operation at Godchaux-Henderson (Fig. 1).

The three lines operate totally independently of each other and yield an hourly output of 100 5-lb packets each. Godchaux-Henderson considered this project very important and spared

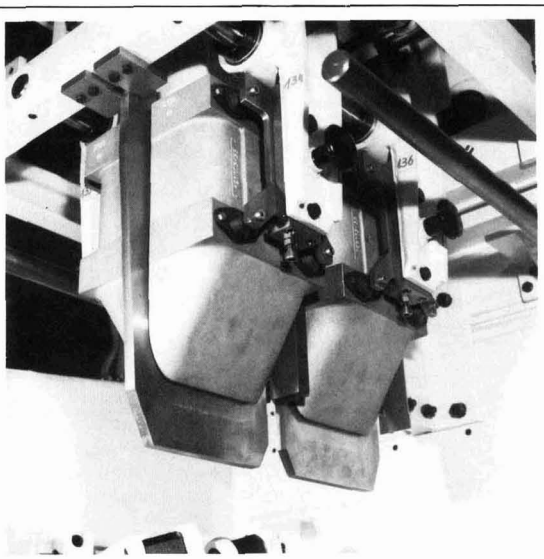


Fig. 3. SIG Tipfiller

themselves no trouble to install the plant completely afresh. The packaging hall was newly built in another part of the factory grounds and new product feed systems installed.

The SIG packaging machine

The packaging machine essentially comprises 3 wheels or turrets (Fig. 2), which are driven by intermittently-acting gear units. The first wheel is an 8-part mandrel wheel on which the double bags are formed, the wrapping material being pulled off the reel, glued and folded. After the forming section, the bag enters the 16-part filling and vibrating section. The sugar is filled from a volumetric tip-filler unit (Fig. 3). After filling, the bag is weighed on an electronic checkweigher. The weigher emits a signal, which controls the topping-up unit, so that the exact weight is attained (Fig. 4).

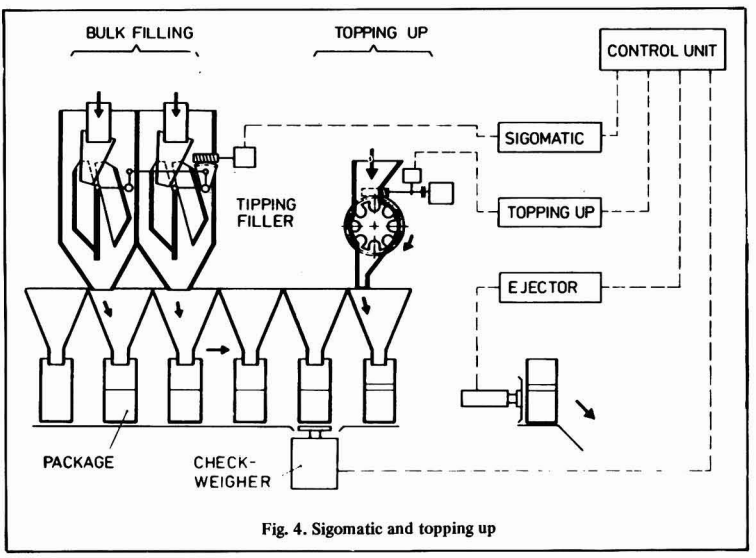


Fig. 4. Sigomatic and topping up

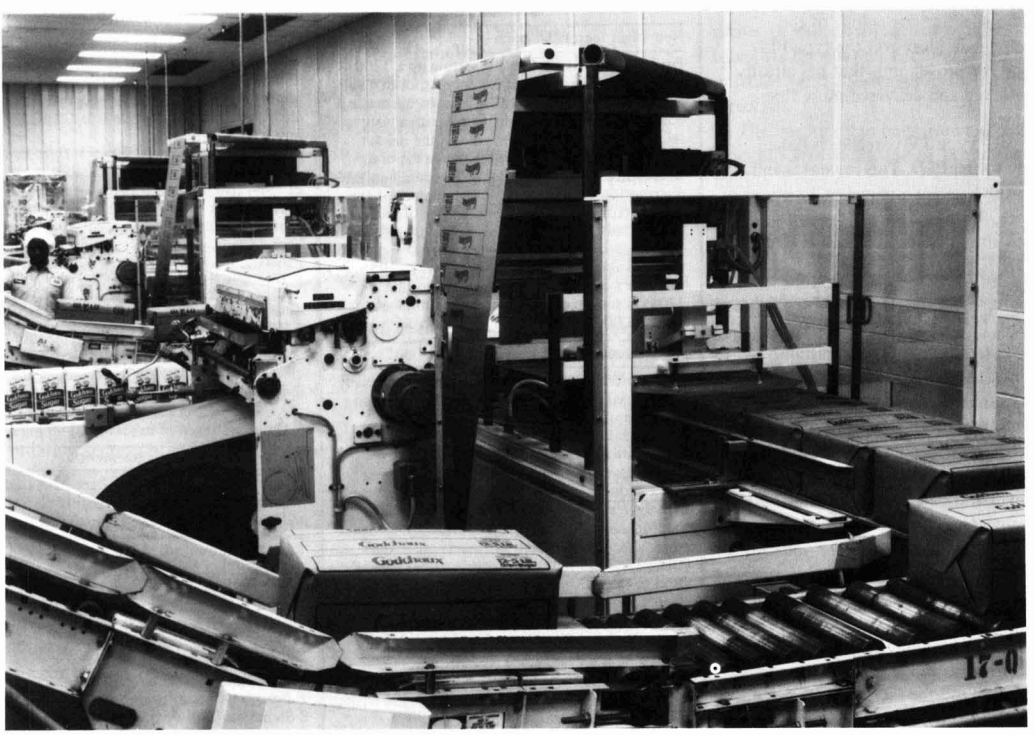


Fig. 5. SIG Type TV parceller

SIG sugar packaging in Louisiana

The entire filling unit is very robust and reliable, and is composed of only a few mechanical parts. This uniquely simple and straightforward filling system attains a high weight accuracy. The customer could be given a guarantee of a standard deviation of 1.5 g on 5 lb of granulated sugar.

Having been subject to intense vibration, the filled bag is pushed into the closing wheel, where the top closure fold is formed, glued and flattened down.

The SIG type PLD was selected by the customer because this machine has decisive advantages over conventional packaging machines. The driving parts are fully protected; the abrasive sugar does not come into contact with chains, shafts, gears, etc. Thus the extent of wear exclusion and the operational reliability attained are unique. Unpredictable maintenance work is obviated.

The compact design of the type PLD permits a space-saving layout of the packaging hall. Moreover the type PLD machine is a proven unit that has already been ordered and delivered more than 100 times.

An SIG Type TV parceller is linked directly to the PLD. This separates and groups the bags for a parcel of 12 pieces of 5 lb each. The kraft paper is run off the reel and glue fed from a closed system (Fig. 5).

The Reserve installation

Thanks to the good cooperation between customer and supplier it was possible to put the packaging lines quickly into production. This was only possible, however, because operators and maintenance staff were given intensive training. All participants were selected carefully by the management of Godchaux-Henderson and prepared for their duties. Electronics specialists, fitters and machine operators were instructed and trained on the jobs by SIG engineers.

When all three lines had been installed, they were subjected to an acceptance test. The test was run for several hours in accordance with VDI 2674 and disclosed an average plant efficiency of 98%.

The customer's managers are aware that good results are ultimately only to be attained through sound training of the operating personnel and dependable support by the machine supplier.

The comprehensive service manuals of the packaging machine allow any problems arising to be rapidly analysed and properly rectified. In the meantime the customer was able to convince himself that the SIG replacements service is solidly reliable and that SIG engineers are quickly to hand.

Today, about 3 years after going into production, the performance of all machines is still outstanding.

The robust design, proven elements, personnel training and dependable support by SIG have made these results possible.

Godchaux-Henderson is convinced that it purchased the right packaging machines and is in a position to offer granulated sugar at low cost and a high capacity of delivery.

Brevities and statistics

West Indies sugar production, 1983[1]

	1983	1982
	tonnes, raw value	
Barbados	85,837	88,378
Guyana	265,481	304,863
Jamaica	202,295	198,050
St. Kitts	28,611	37,127
Trinidad	79,020	78,685
	661,244	707,103

New sugar factory in India[2]

Ponni Sugars & Chemicals is setting up a 1200 t.c.d. sugar factory in the Salem district of Tamil Nadu state in India. It will be unusual in that a coal-fired boiler is being installed with a view to releasing all the bagasse for sale to the neighbouring paper factory of Seshasayee Paper & Boards Ltd. at a price which will ensure equitable distribution between the two companies of the gains accruing from the manufacture of bagasse paper. The factory was due to start operations in 1984 and to crush 80-100,000 tonnes of cane to produce about 9000 tonnes of sugar. In 1985, a full year's operations will involve crushing 220,000 tonnes of cane which would release some 65,000 tonnes of bagasse for paper making.

Mexico sugar industry investment[3]

The Mexican state-owned sugar company Azúcar S.A. has said it will invest some 10,000 million pesos (approximately $53 million) in the modernization of the sugar industry. While some immediate repairs may be made, a complete overhaul will be a long-term affair. Modernization of the industry will mainly be concentrated on the 16 sugar factories in Vera Cruz. It is hoped that Mexico will be able to export sugar within two years, as production prospects are good. Official sources said that imports in 1983 came close to 900,000 tonnes while this year total imports will not exceed 300,000 tonnes owing to a sugar output in 1983/84 higher by 150,000 tonnes than in 1982/83 and reaching 3,050,000 tonnes, tel quel[4]. Whether Mexico will be able to export sugar in a few years remains to be seen, however, as the modernization of the industry has been announced often during the past and factories are still operating with obsolete equipment.

Bolivia sugar exports, 1983[5]

	1983	1982
	tonnes, raw value	
Argentina	22,663	0
Chile	5,738	6,760
Peru	6,093	0
USA	10,814	35,850
	45,308	42,610

Ghana alcohol manufacture[6]

Imports of alcohol into Ghana are no longer to be allowed, according to an official report; instead, Ghana Sugar Estates Ltd. (Ghasel) will import molasses in bulk to be converted into alcohol. Ghasel will be the sole Ghanaian importer of molasses.

Chinese sugar expansion[7]

In 1984 five new sugar factories are to start operations in Yunan, one of the cane sugar producing areas of China. The province will then have 48 factories with a capacity of more than 2300 t.c.d. and will produce more than 300,000 tonnes of sugar a year.

Zimbabwe sugar and alcohol manufacture study[8]

The US Trade Development organization has granted the Industrial Development Corporation of Zimbabwe $400,000 to determine the feasibility of building a sugar and ethanol plant in the Lowveld. The total cost of the plant is expected to reach in excess of $150 million.

Cuba – Angola trade agreement[9]

Under the terms of a trade agreement signed recently, Cuba is to supply Angola with sugar and medicines in exchange for timber.

1 C. Czarnikow Ltd., *Sugar Review*, 1984, (1707), 120.
2 *Indian Sugar*, 1984, **33**, 853.
3 F. O. Licht, *International Sugar Rpt.*, 1984, **116**, 496.
4 *Reuter Sugar Newsletter*, August 6, 1984.
5 *I.S.O. Stat. Bull.*, 1984, **43**, (5), 5.
6 *Reuter Sugar Newsletter*, July 4, 1984.
7 *Amerop-Westway Newsletter*, 1984, (129), 10.
8 *Standard Chartered Review*, August 1984, 13.
9 C. Czarnikow Ltd., *Sugar Review*, 1984, (1718), 170.

Materials handling in the sugar industry

British Ropeway Engineering Co. Ltd. (BRECO), of Sevenoaks, Kent, England, have been associated with the sugar industry for many years, having supplied equipment to handle sugar cane, bagasse, raw sugar and refined sugar in both bulk and bagged form.

Typical of these installations is one for Las Majaguas in Venezuela where BRECO supplied the complete conveying and other handling equipment for the sugar processing plant.

The main cane carrier, a belt conveyor 2.40 m wide, receives chopped cane at a maximum rate of 420 tonnes/hr and delivers it to the mill. A self-cleaning overband type of magnetic separator is mounted over this conveyor to remove the tramp iron from the cane and protect the mills.

At the other end of the mill house the bagasse is received by a belt conveyor which elevates it to the boiler feed conveyor running the full length of the boiler house, with outlets at each of the boiler positions. Any bagasse exceeding the boiler's requirements is carried forward and fed on to the tail end of a belt conveyor running the full length of the bagasse store at high level. This in turn discharges by means of a tripper onto a scraper conveyor suspended on two electric hoists beneath a gantry arranged to traverse the full length of the store.

When reclaiming, a scraper conveyor suspended beneath the travelling gantry is lowered on to the storage pile and the bagasse is scraped across the pile, falling by gravity on to the reclaim belt conveyor in an open tunnel along one side of the storage building. This then discharges, at the rate of 75 tonnes/hr, onto a scraper conveyor which elevates it back onto the boiler feed conveyor for feeding to the boilers.

A scraper conveyor in the process house receives the cake from vacuum filters and elevates it to the top of a pair of hoppers into which it is fed by a spreader-type screw conveyor.

A belt conveyor in an enclosed gantry was furnished by BRECO to carry the raw sugar at the rate of 60 tonnes/hr from the process house to the raw sugar storage building where it discharges to a sugar scale and distribution hopper. The discharge from this is received onto the tail end of a belt conveyor which rises and runs through the apex of the storage building. A hydraulically-powered tripper, complete with sprinkler device, operates over the horizontal section of this conveyor and discharges the raw sugar into the storage area. It is reclaimed by a front-end loader onto a belt conveyor which feeds to a chain-and-bucket elevator, and via a screw conveyor into either of two truck loading hoppers.

Also in the storage building is another screw conveyor which feeds a dryer, this being followed by a belt conveyor and chain-and-bucket elevator to transfer the dried sugar to the buffer hopper and bagging machines.

BRECO equipment has been installed at the Bukidnon refinery in the Philippines to handle raw and refined sugar. For the raw sugar handling system BRECO supplied a truck intake hopper, feeder and conveyors, all rated at 80 tonnes/hr, to feed existing store conveyors modified to cater for an increased capacity of 100 tonnes/hr – made up of material from the existing raw sugar plant and material brought in by truck from other plants in the area. A pneumatically-operated plough was installed on the existing store conveyor to divert the raw sugar at the rate of 30 tonnes/hr to the conveyors and elevator which feed the raw sugar hopper in the new refinery building. The balance of material goes into the store, for reclaiming via an existing system when required during the off-crop season.

In the refinery, a conveyor, elevators and screw conveyors receive refined sugar from the dryer and transfer it, again at 30 tonnes/hr, to four 50-tonnes capacity blending bins and the weigher supply hopper, these and their supporting structures being included in BRECO's contract.

A flat-belt conveyor with a hand-propelled tripper with side discharge conveys 50-kg bags of sugar from the bagging machines into the bagged sugar store.

Bagged sugar handling

BRECO's experience in the design and supply of handling systems for bagged sugar range from the relatively simple conveying system and static vertical chutes with manual stacking of the bags to the automated high capacity installation. In the latter instance a single machine serves two purposes, one to receive bags, and transfer them to stockpiles and the other to retrieve from stockpiles for transfer to other areas. When stockpiling, the sacks are diverted from the gantry conveyor by means of a retractable motorized plough onto a turntable and then onto the telescopic boom conveyor. The tip of the boom conveyor is positioned by precise control adjacent to the point at which the bags are to be deposited. On recovery from the stockpile the direction of conveyors, turntable and ploughs is reversed. Bags are placed onto the boom conveyor end, positioned as required, and travel via the counter rotating turntable onto the gantry conveyor in the required direction.

The machine can be moved along the stockpile area at a speed of 17 metres per minute. Exact positioning of the machine at a given stockpile can be achieved by the lower speed drive, variable up to 7.5 m/min.

Control of the boom telescopic and slewing motions is also achieved by variable speed drives enabling the boom tip to follow closely the work pattern. Luffing of the boom is by means of a single speed drive.

The boom conveyor is reversible, enabling sacks to flow in either direction as instructed by the operator. It is interlocked with the static conveyor system, the turntable and with the motorized ploughs. The direction of turntable rotation is automatically selected dependent on the direction of belt travel and on the radial position of the boom conveyor, which ensures correct feed to and from the turntable.

The transfer of bags onto and from the turntable is under the control of reversible motorized ploughs, their direction of travel automatically selected to correspond with

the conveyor belt direction. The ploughs are automatically repositioned to match the turntable rotation. A similar motorized plough is located at the position of the transfer to and from the gantry conveyor. This plough has the added feature of being retractable when it is necessary for bags to by-pass the stacker. Movement of this plough is under the control of the operator. Limit switches fitted to the slewing table prevent over-travel. Normal 30° maximum lowered position and maximum up is controlled by a screw limit switch fitted by the luffing winch. Probe switches at the tip of the boom prevent further movement in the event of the boom coming into contact with an obstruction and a slack rope switch is also included. End-of-travel limits prevent over-travel of the telescopic boom. End-of-travel limit is provided to stop the machine at each extremity of its rail tracks.

The conveyor and turntable system have speed-sensing switches which form part of sequence control and initiate the plant shutdown in the event of a malfunction. The bridge conveyor and turntable may be operated independently under manual control. The boom conveyor is pivoted from a slewing cradle which also supports the luffing rope system and machinery together with the operator's cab. This is supported, via a slewing ring, by the base structure comprising portal frame legs connected by the gantry spanning a stockpile and supporting the bridge conveyor.

The whole machine is mounted on a pair of motorized two-wheel bogies beneath the slewing table and two single driven wheels at the other end of the machine. The machine travels on a pair of flat bottom rails fitted to sole plates placed on prepared foundations. Power to the machine and interlocking control is through motorized reeling drums' coiling cables fed from a supply point midway along the length of travel.

Typical list of BRECO installations in the sugar industry

Mauritius	Sugar	Elevators, ground, overhead and gravity conveyors, chutes and weighers
	Raw sugar	Belt conveyors and pug mill
	Sugar bags	Belt conveying system, weighers, chutes and elevators
Zambia	Bagasse	Storage and reclaiming system
West Indies	Bagasse	Storage and reclaiming system
Venezuela	Sugar & bagasse	Complete storage, reclaiming and conveying system
Philippines	Sugar	Conveying and elevating system
India	Sugar cane	Aerial ropeway

Bulk sugar handling

In the case of bulk sugar BRECO have engineered installations incorporating underfloor reclaim systems and can supply mechanical scraper units where the overall economics favour an installation to reclaim sugar from feeding out to a jetty for shiploading.

Shiploading

The simplest and lowest cost conveyor shiploader is an inclined conveyor with the head pulley supported by a trestle adjacent to the dock edge. This permits material to discharge either directly or through a chute into the hold of a ship. More sophistication can be introduced to permit ships with wide beams to be loaded by extending the conveyor over a hinged or retractable boom. Additional flexibility can be introduced by mounting the trestle support on wheels, either with pneumatic tyres or running on rails, so the conveyor can be moved back from the dock to permit the ship to move.

Undoubtedly the most accepted bulk conveyor loading device is the travelling shiploader. It can be simple in design, economical and adaptable to almost any kind of dock or jetty. This type is in essence a conveyor tripper with an added boom conveyor. The travelling shiploader capability is dependent on the bulk material feed rate, original design parameters of the belt conveyor system, length of travel of the loader, loading boom outreach and boom clearance above water level. The design possibilities for travelling shiploaders are numerous. Their boom can be fixed, hinged, luffing, slewing, shuttling or a combination of any of these movements. Apart from being able to load on both sides of a pier, the shuttling and slewing booms have perhaps greater flexibility in loading ships with wide ranges of boom sizes and hatch openings. The luffing boom has the advantage of being able to discharge at or below the hatch-coaming as the ship settles in the water, thereby reducing dust.

Radial shiploaders or, as they are sometimes referred to, slewing or quadrant loaders, are basically shuttle conveyors running on structural steel bridges that are pivoted on the shore or feed end and either cantilevered out from the pivot or supported to the discharge end by flanged wheels. These run on a rail or track which has a radius to coincide with the fixed span of the bridge between the pivot point and the track. The shuttle belt conveyor is fed by a stationary main feed conveyor through a chute over the pivot point. The shuttle conveyor can traverse to accommodate the hatch of a loading ship. The longitudinal range is restricted by the arc of the bridge movement and the extension of the shuttle boom.

The radial loader has several advantages over the travel machine, mainly in its

economical and simple supporting foundation. The conveyor system for feeding the shuttle loading conveyor is not as extensive as the longitudinal dock conveyor of the travelling machine.

In essence the only major difference in the design of the shiploader for bagged or bulk sugar is that the former has either a spiral chute or sandwich belt to transfer from the boom to the ship while the latter has a vertical chute.

Solid fuel handling

Within a sugar plant, which consumes large quantities of process steam and electrical energy, a boiler plant is frequently installed utilizing as a fuel the waste product of sugar production – bagasse. Very often a second fuel is utilised and BRECO have supplied installations handling both bagasse and coal for firing the boiler.

Aerial ropeways

BRECO have had some sixty years' experience in the design of materials handling conveyor systems, but their experience in the field of aerial ropeways goes back even further, to the 1890's. The aerial ropeway has found application in the sugar industry in providing an economical means of transporting cane from the fields to the plant.

Brevities and statistcs

Chile sugar imports, 1983[1]

	1983	1982	1981
	tonnes, raw value		
Argentina	152,207	58,226	47,649
Bolivia	8,338	6,760	0
Brazil	32,759	72,968	8,120
Colombia	0	0	5,163
EEC	22,087	58,674	5,989
Paraguay	2,160	0	0
USA	8,640	10	19,081
	152,207	58,226	47,649

Distillery project for Hawaii[2]

Hilo Coast Processing Co. have plans to build a $15 million plant to produce 5 million gallons/year of ethanol with construction to start by the end of 1984. Negotiations are continuing with major oil companies for marketing the ethanol as a 1:9 blend with petrol.

Canadian sugar refinery sale[3]

Natalik Inc., owners of St. Lawrence sugar refinery in Montreal, has recently been purchased by Atlantic Sugar Ltd., another Canadian sugar refiner. St. Lawrence will be operated as a wholly owned subsidiary of Atlantic Sugar and current operations, management and personnel are expected to remain substantially unchanged.

The London futures market[5]

The committee of the United Terminal Sugar Market Association Ltd. has reviewed aspects of the structure of the association and adopted a resolution that from October 1, 1984, its name would be changed to The London Sugar Futures Market Ltd.

New Yugoslavian sugar factories[5]

Two new sugar factories will begin operating in Serbia in the 1984/85 campaign; they will have a daily beet processing capacity of 4000 tonnes each. The 23 factories in Yugoslavia are expected to process 6 million tonnes of sugar beet in 1984/85 and produce 750,000 tonnes of white sugar. In the 1983/84 campaign, 5,600,000 tonnes of beet were processed while sugar production reached 710,000 tonnes.

China sugar imports, 1983[6]

	1983	1982	1981
	tonnes, raw value		
Argentina	0	18,249	0
Australia	324,474	402,281	367,239
Brazil	0	146,938	12,883
Colombia	0	49,800	0
Cuba	771,717	915,311	573,246
EEC	420,336	117,478	26,422
Fiji	44,082	43,708	0
Hong Kong	5,163	1,667	67
India	0	92,809	0
Japan	11,885	0	0
Malaysia	0	1	1
Philippines	0	198,776	92,719
Poland	109,061	0	0
Swaziland	0	26,657	0
Thailand	90,020	549,243	112,956
	1,776,738	2,562,918	1,185,533

India sugar industry expansion plans[7]

The Indian planning commission has proposed an increase in the sugar industry's annual licensed capacity to 13.26 million tonnes during the five-year national development plan starting April 1, 1985. The commission expects parliament to approve the plan with only marginal changes. The 1990 total compares with licensed capacity of 8.5 million tonnes in February and 9.62 million tonnes planned for the end of the plan period to March 31, 1985. The planned expansion in 1985/90 should enable India to export 1 million tonnes of white sugar per year with the balance used for domestic consumption and building of stocks.

A/S De Danske Sukkerfabrikker annual report, 1983/84

The very wet spring of 1983 delayed sowing and was followed by near-drought in the summer. The start of the campaign was delayed for two weeks but the crop was still reduced by 16% from normal, reaching 2,008,000 tonnes. Total sugar production was 293,000 tonnes against 457,000 tonnes in 1982/83. The investment program continued during the year with a view to increasing efficiency and cutting production costs by reducing fuel consumption and losses. A new power unit was installed at Assens, and the Copenhagen packing and storage facilities moved to new premises. The pulp drying plant at Sakskobing is to be replaced with a new one three times as big. The DDS-Engineering division started up a beet sugar factory in China which it had converted and expanded, while a cane sugar factory supplied to Vietnam was completed and put into operation. In addition, many individual plants, machines and automatic controls have been supplied to beet and cane sugar factories throughout the world.

Brazil alcohol production, 1983[8]

In 1983 production of fuel alcohol reached 7900 million litres, of which 2500 million litres were anhydrous alcohol, and this year's output is forecast at 8100 million litres by Brazil's Sugar and Alcohol Institute. Future growth will be in hydrated alcohol the market for which is growing at 30% per annum; by contrast, the anhydrous alcohol market is declining by 12% per annum.

Philippines sugar production, 1983/84[9]

Philippine sugar production fell to 2.3 million tonnes, tel quel, in the 1983/84 crop year (September/August) from 2.45 million tonnes in 1982/83, according to the Philippine Sugar Commission. Three factories in Negros had yet to submit production reports for the last week in August but this will not significantly affect the estimate. Lower production is a result of the drought which started in late 1982; the 1983/84 sugar crop was not affected by the recent typhoon but damage to the 1984/85 crop is being assessed and the earlier forecast of 1.89 million tonnes will have to be revised.

1 *I.S.O. Stat. Bull.*, 1984, **43**, (7), iv.
2 *Sugar y Azúcar*, 1984, **79**, (8), 14.
3 F. O. Licht, *International Sugar Rpt.*, 1984, **116**, 516.
4 C. Czarnikow Ltd., *Sugar Review*, 1984, (1720), 178.
5 F. O. Licht, *International Sugar Rpt.*, 1984, **116**, 493.
6 *I.S.O. Stat. Bull.*, 1984, **43**, (7), v.
7 F. O. Licht, *International Sugar Rpt.*, 1984, **116**, 534.
8 *World Sugar J.*, 1984, **7**, (2), 31.
9 F. O. Licht, *International Sugar Rpt.*, 1984, **116**, 518.

Trade notices

Continuous level control

The 30-98 Co. Ltd., Victoria Road, Burgess Hill, West Sussex RH15 9JZ, England.

Bin-Dex continuous level controls are ideal for applications with bulk solids and range from simple indication to integration into plant control systems. So as to minimize any delay following the unlikely event of a malfunction in the system, a self-monitoring and warning system can be provided, whereby a signal is generated to initiate visual or audible warnings and actuate control circuits should a checking cycle not be completed.

The Model MDR-7 refractometer

Anacon (Instruments) Ltd., St. Peters Road, Maidenhead, Berks. SL6 7QA, England.

The Model MDR-7 refractometer provides instantaneous, direct read-out in refractive index or °Bx; it is controlled by microprocessor, is compact, easy to operate and gives rapid results. There is no need for sample preparation, while variation in operator technique is eliminated. Because of this, high repeatability and accuracy are ensured.

PUBLICATIONS RECEIVED

P96M microprocessor-based digital display controllers

Kent Industrial Measurements Ltd., Howard Road, Eaton Socon, St. Neots, Cambs. PE19 3EU, England.

An entirely new range of microprocessor-based digital display controllers, the P96M, has been launched by Kent Industrial Measurements. Programmable for virtually any application, the controllers are featured in Leaflet P96M/0384/1 which is available from the above address.

Simtec NPL polarimeter

Thorn EMI Simtec Ltd., Sellers Wood Drive, Bulwell, Nottingham NG6 8UX, England.

The automatic digital Type 243 saccharimeter is an electronically controlled, self-balancing, photoelectric instrument having a range of ± 35°S in intervals of 0.001°S with a 10- or 20-mm cell, a range of ± 110°S in intervals of 0.02°S with a 3.4-mm cell, while a 40-mm cell can be used to determine the sugar content in waste water in intervals of 10 ppm. Its speed of response is such that a value of within 0.003° arc of the final reading is given within 10 sec, while sensitivity is of the order of 0.0001° arc. The sample can be introduced into the cell by e.g. continuous feeding or batch filling using a syringe. A 4-page brochure describes the instrument.

Pumps

Goulds Pumps Inc., 240 Fall Street, Seneca Falls, NY 13148, USA.

A 12-page brochure from Goulds Pumps gives details of the company's range of pumps available for a wide range of applications.

Reverse jet filters

Carter-Midac, Carter Industrial Products Ltd., Bedford Road, Birmingham B11 1AY, England.

Leaflet No. 1301e gives details of the R-Type insertable reverse jet filters for dust separation. The units can be inserted in silos, hoppers, bunkers or any enclosure where dust is a problem. Manufactured by Carter-Midac (the environmental engineering division of Carter Industrial Products), the units consist of a number of tubular felted filter elements supported on an internal open-mesh cage sealed onto a robust spigot plate.

Seals for rotating shafts

Crane Packing Ltd., Crossbow House, Liverpool Road, Slough SL1 4QX, England.

A 4-page, full-colour guide (Ref. BI 300A) from Crane Packing features mechanical seals for reciprocating pumps and mixer vessels, and gland packing products; both the Type 80 mechanical seal and Style 715 gland packing are suitable for use in the food industry.

Conveying chains

Rexnord Inc., Mechanical Power Division, P.O. Box 2022, Milwaukee, WI 53201, USA.

Bulletin 84-1265 provides information on Rex MatTop chains in the 4800 Series for light-, medium- and heavy-duty, low-cost conveying which have been officially cleared for use in the food industry.

Tube cleaning equipment

Goodway Tools Ltd., Unit 3, The Cordwainers, Temple Farm Industrial Estate, Southend-on-Sea SS2 4BR, England.

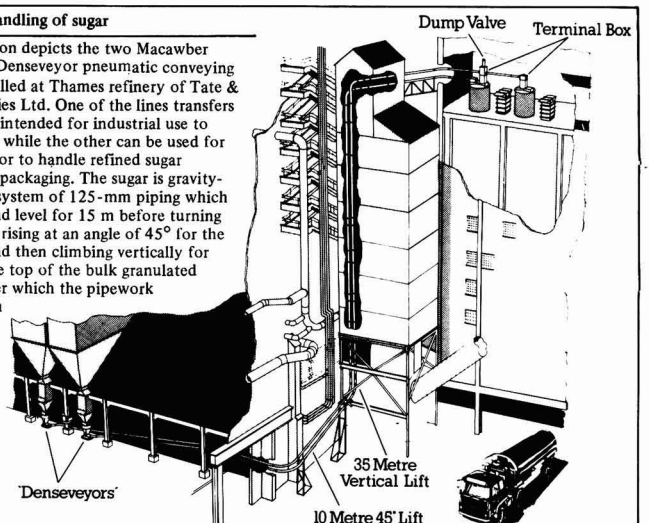
Goodway Tools Ltd. specialize in tube cleaning equipment and offer a complete line of efficient, time-saving electric or pneumatic machines with simultaneous vacuum or water flushing, designed for ease of operation with all types of tubular equipment, including fire- and water-tube boilers, condensers, heat exchangers, etc. Catalogue No. 1083A is a 28-page booklet giving details of the equipment.

High-pressure water jetting order

Jetin Industrial Ltd., specialists in high-pressure water jetting, have recently won a £140,000 order to supply five units to Cuban sugar factories, bringing the total number of Jetin machines in the Cuban sugar industry to more than 20. The system is of use for cleaning heat exchangers, filters, screens, valves, pipelines and many other items of plant, and requires no chemicals. Jetin units are used in a number of sugar industries for removal of scale and deposits. The units for Cuba are powered by 100 kW motors; a Jetin 2000 triplex pump delivers water at 68 litres/min at a pressure of 620 bar.

Pneumatic handling of sugar

The illustration depicts the two Macawber Engineering Denseveyor pneumatic conveying systems installed at Thames refinery of Tate & Lyle Refineries Ltd. One of the lines transfers crystal sugar intended for industrial use to bulk storage, while the other can be used for this purpose or to handle refined sugar intended for packaging. The sugar is gravity-fed into the system of 125-mm piping which runs at ground level for 15 m before turning through 90°, rising at an angle of 45° for the next 10 m and then climbing vertically for 35.5 m to the top of the bulk granulated building, after which the pipework turns through 90° and ends at the two large sugar storage hoppers. The system has worked continuously for more than a year.



New books

Surveys in industrial wastewater treatment. Vol. I. Food and allied industries

Eds. D. Barnes, C. F. Forster and S. E. Hrudey. 376 pp; 15.5 x 23.4 cm. (Pitman Publishing Ltd., 128 Long Acre, London WC2E 9AN, England.) 1984. Price: £36.00.

This is the first of three volumes dealing with effluent treatment in various groups of industries (the other two cover the petroleum and organic chemicals industries and manufacturing and chemical industries, respectively). It carries material on waste water treatment in various food industries, but it is the first section, of 68 pages, which will be of interest to our readers; this is written by K. E. McNeil, of the Sugar Research Institute, Mackay, Australia, and concerns the origins of waste waters in the beet and cane sugar factory and methods used for their treatment, as well as treatment and disposal of vinasse from distilleries manufacturing alcohol from cane juice or molasses. Effluent from cane raw sugar refining is also included. The material is in the form of a general account of the manufacturing processes used in beet and cane sugar manufacture and refining (covering both crystal and liquid sugar production), followed by descriptions of the types of waste water and the treatments used, including relatively recent work on anaerobic fermentation of beet sugar factory effluent. Thus, this part of the book constitutes a review of the work done and results achieved within the sugar industry generally; it is valuable as a source of references, and gives a clear, concise picture of the situation. However, it would have been better as a monograph rather than as merely one-sixth of a book, the remainder of which will probably not be of interest to our readers. This is a pity, since the contents are well arranged and the printing very clear.

Enough is enough

Anon. 25 pp; 21 x 14.8 cm. (Consumers in the European Community Group, 24 Tufton Street, London SW1P 3RB, England.) 1984.

This pamphlet is an attack on the Common Agricultural Policy of the EEC by the umbrella body for UK organizations concerned with the Community's consumer issues. It sets out the principles of the CAP and indicates how it works, but then describes the way that reality differs from the aims of the policy. The Group considers that the CAP now benefits just the big farmers instead of consumers and all farmers, as it was supposed to. It discusses each sector separately and also provides a few notes on some of the nonsenses which arise under the CAP – for EEC purposes, goats are classified as sheep, for instance, and hyacinth bulbs as vegetables.

Unfortunately for this purpose, its arguments in the case of sugar do not inspire confidence; it compares production in 1973 and 1983 without acknowledging that the latter year was one of extraordinary yields from a beet area which had been reduced. Also it compares EEC prices with world market prices as though the latter were the norm instead of a residual market price which is usually well below the cost of production of even the most efficient sugar manufacturers. These faults are a pity since there is a good case to be made for reducing sugar production in the EEC, with a smaller percentage for the B-quota and higher levies on surplus C-sugar to discourage its production and to provide a greater contribution to the subsidies on export sales.

Elsevier's sugar dictionary

L. Y. Chaballe. xiv + 322 pp; 16.8 x 24.7 cm. (Elsevier Science Publishers, Science & Technology Division, P.O. Box 300, 1000 AH Amsterdam, Holland. 1984. Price: 215 florins.

Dictionaries are like watches: the worst is better than nothing, while the best is never completely right. As a consequence, it is very easy for a reviewer to fill his space with criticisms which may thereby give a false picture of the utility of the dictionary. The present example is undoubtedly going to be of use to many people – but it could have been so much better.

It gives 2741 terms in English/American, French, German, Spanish and Dutch, also including Latin names of some pests and diseases. The English/American entries are lised alphabetically in bold type with their equivalents in the other languages below. Alphabetical lists for each of the other languages are then provided with references to the number of the entry in the main body of the work. Certain of the English/American terms are followed by a short definition and/or a qualifying label in English indicating the field in which they are used.

The compiler is described as a conference interpreter and technical translator resident in Belgium; he clearly has a good knowledge of the languages involved but one gains the impression that he is not involved in the sugar industry. The main fault of the dictionary is that it has attempted to cover too wide a range of subjects – cane and beet agriculture, processing, by-products, sugar marketing, etc. – and thus has not treated them as thoroughly as they could be. For instance, the preface indicates that sugar cane agronomy is covered, yet such basic terms as "lodging", "ratoon" and "sett" are omitted. "Chopper harvester" and "whole-stalk harvester" are included but not "Cane harvester" or "Green cane harvester". Among by-products, "acetone", "furfuryl alcohol" and "isopropyl alcohol" are included but not "alcohol", "distillery" or "ethanol", while "vinasse" is to be found under "Molasses vinasses".

A number of marketing terms are included, such as "futures contract", "quota system", "forward price" but not "arbitrage", "broker", "terminal market" or abreviations such as "C.I.F.", "F.O.B.", etc. "Safety factor" is indicated as an old Australian term meaning "moisture % non-pol" but "safety factor of sugar" is included separately to indicate % moisture/(100-pol). There are some mis-spellings and odd English usage, for example terms "consumption sugar" and "lower-grade sugar" translated identically for all but

French, but different translations are given for "plantation white sugar" and "mill white sugar" does not appear.

The reviewer concludes that, either the book needs to be larger if it is to cover the whole range of subjects in a comprehensive way, or the scope should be more limited in a second edition in order to allow a fuller coverage of terms employed in the subjects remaining. One obvious example for omission would be agriculture; Elsevier have already produced a "Sugar beet glossary" and a similar "Sugar cane glossary" could be a useful addition.

For readers in the USA and Canada, the book is available from Elsevier Science Publishing Co. Inc., P.O. Box 1663, Grand Central Station, New York, NY 10163, USA, at a cost of $82.75.

Hawaiian sugar manual

Anon. 16 pp; 15.1 x 22.7 cm (Hawaiian Sugar Planters' Association, P.O. Box 1057, Aiea, HI 96701, USA.) 1984.

The latest edition of this paper-backed booklet gives details of the Hawaiian sugar industry, with a directory of sugar companies; details of the cane area owned by each, the area harvested in 1983 and the total sugar production per company as well as sugar yields per acre; cane sugar production in Hawaii from 1908 to 1983; an account of the role of sugar in Hawaii's economy, of the 1983 crop results, of the history and activities of the HSPA, of C & H Sugar Co.: and of raw sugar prices, wages, hours and working conditions within the industry. Also included is an analysis of US sugar supply and use, sugar imports into mainland USA from 1980 to 1983 inclusive, mainland US sugar consumption and US sugar prices. A short glossary of sugar terms is appended.

Industrial crystallization

S. J. Jancic and P. A. M. Grootscholten. xvi + 434 pp; 16.8 x 24.7 cm. (D. Reidel Publishing Co., P.O. Box 17, 3300 AA Dordrecht, Holland.) 1984. Price: 165 florins.

Written when the authors were at Delft University of Technology, the material in this book is described in the preface as essentially based on the advanced course taken by 5th year students of chemical and mechanical engineering at the University. It is intended for advanced engineering students requiring a wider appreciation of crystallization phenomena and a better understanding of industrial crystallizer design, operation and performance; scientists, designers and plant engineers who have had no basic training in crystallization; and research workers looking for a useful reference book. It is divided into two parts: (1) Fundamentals of crystallization from solution, and (2) Crystallizer design. Apended to the text is a list of symbols with their definitions, references to the literature and a subject index. The English is generally very good, with just a few cases where what is meant is not completely clear, but unfortunately for our readers only 3 pages are devoted to sugar crystallization. However, specialists in the classifications above will find the book of considerable value.

Sugar year book, 1983

Anon. 338 pp.; 9.7 x 13.4 cm. (International Sugar Organization, 28 Haymarket, London SW1Y 4SP, England.) 1984. Price: £10.00.

The continued cooperation of countries, both Members and non-Members of the International Sugar Agreement, has permitted the preparation of this edition of the Sugar year book, the 37th in succession. As in the other publications of the ISO, quantities are reported in tonnes and, in most cases, raw value, with tables of production, imports, exports, consumption, etc., for calendar years 1983 and back to 1976 or 1977. Statistics have been provided by the government concerned for most countries; in other cases they have been extracted from statistical publications or estimated. The tables cover 126 countries, the EEC being counted as one, while a number of general tables are given of world statistics, including production, etc., as above, and also net imports and exports, stocks in selected countries, per caput consumption, prices on the world market and also wholesale and retail prices. The size, clear type and authoritative figures make this small book one of the most convenient and essential aids for the sugar statistician.

Situación y perspectivas de la industria azucarera en América Latina y el Caribe

J. A. Cerro, H. Tokeshi, J. Sánchez D., J. Lodos F., I. Díaz A. and H. Noa S. 158 pp; 15 x 22.3 cm. (GEPLACEA, Ejército Nacional 373 – 1° piso, 11520 Mexico, D.F., Mexico.) 1983.

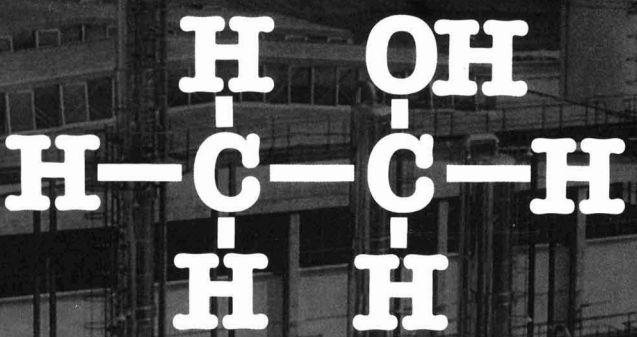
During the 18th Congress of the International Society of Sugar Cane Technologists, in Havana, Cuba, in February 1983, a group of participating technologists met for an interchange of information under the auspices of GEPLACEA. Papers were presented by the authors indicated above, in Spanish, and texts are reproduced in this booklet. In translation, the titles of the papers are, respectively: "Economic aspects of world sugar activity", "Sugar cane varieties in the year 2000", "Agricultural frontier and cane agricultural mechanization: prospects", "The sugar industry and the challenge of development", "Prospects of the sugar industry: energy aspects", and "Economic prospects for sugar cane by-products in Latin America".

El mercado internacional del azúcar

J. A. Cerro. 79 pp: 13.7 x 20.6 cm. (GEPLACEA, Ejército Nacional 373 – 1° piso, 11520 Mexico, D.F., Mexico.) 1984.

This booklet, in Spanish, is a survey of the structure and development of the world sugar market, with discussions on the effect of alternative sweeteners and of protectionism on the world market. Characteristics and functioning of the 1977 International Sugar Agreement are examined and the proposals for a new Agreement made by the group's President at the September 1983 negotiations, are summarized. It is recorded that these negotiations were unable to produce more than an Administrative agreement.

ETHANOL



Sugared or amylaceous raw material
(fruits, beet, cane, molasses, grains, etc...)

Batch or continuous fermentation

Recuperation of CO_2, yeast

Distillation, rectification, deshydratation
High yields - low energy consumption

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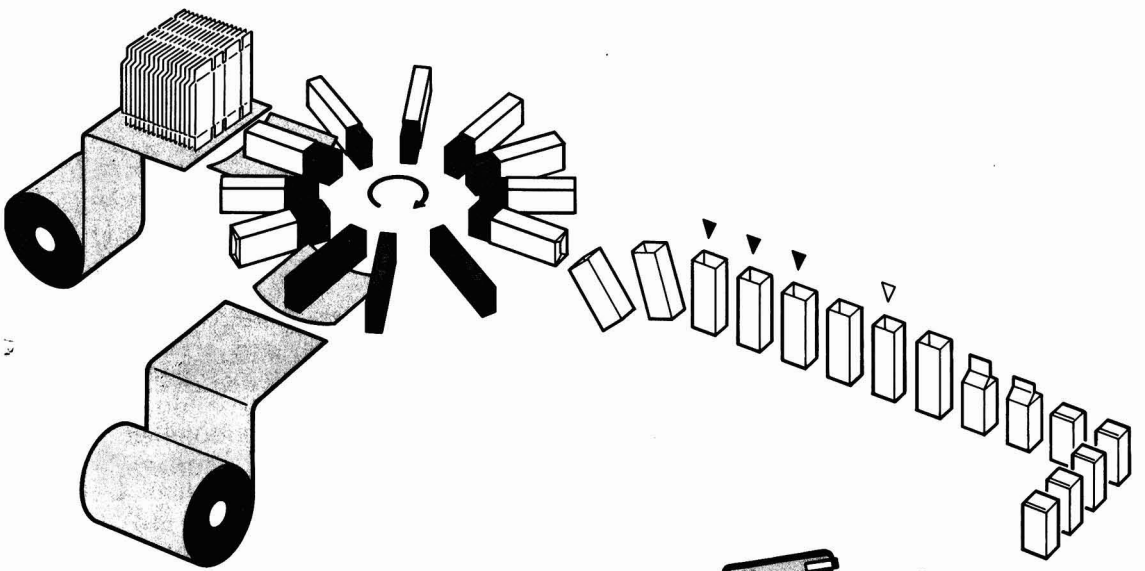
I.S.J. BOUND VOLUMES

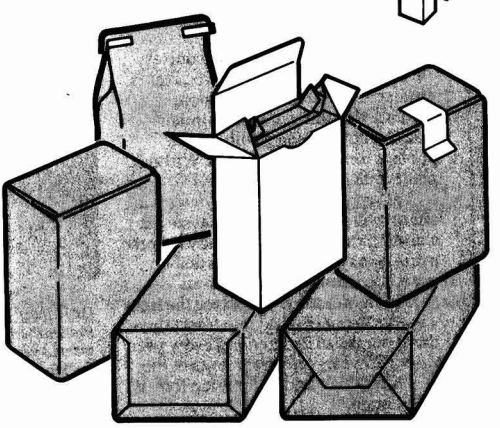
for 1983 are available at a price of £45.00. Volumes for 1982 are available at £40.00 while those for 1970-81 and certain previous years are also available at a price of £35.00, which includes 2nd class surface postage.

1st class surface or airmail postage costs will be charged extra if they are required.

SIG sets new standards

for the efficient and reliable packaging of sugar





With the packaging plant type PRD, SIG sets new standards by combining a modern concept with well-proven features. The result is a highly efficient and very reliable packaging line.
Its main characteristics are the in-line design and modular construction, all drive elements in a completely enclosed oil bath housing, and highest weight accuracy achieved by tipping fillers and topping-up controlled by checkweigher.

- high output of up to 130 packs/min
- closed glue circuit
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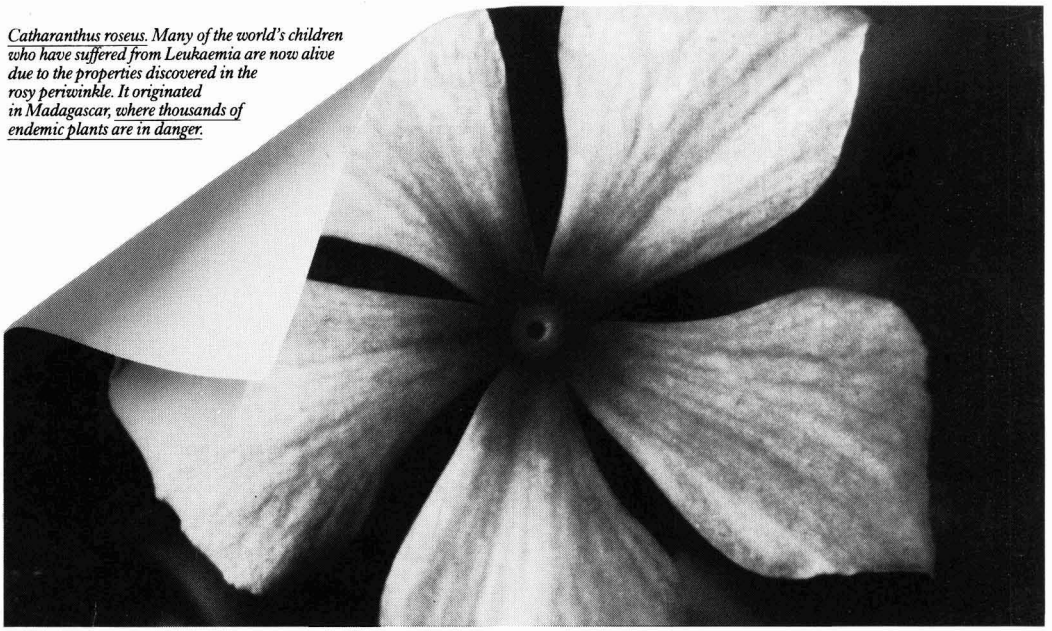

Catharanthus roseus. Many of the world's children who have suffered from Leukaemia are now alive due to the properties discovered in the rosy periwinkle. It originated in Madagascar, where thousands of endemic plants are in danger.

Plants have fed the world and cured its ills since life began. Now we're destroying their principal habitat at the rate of 50 acres every minute.

We live on this planet by courtesy of the earth's green cover. Plants protect fragile soils from erosion, regulate the atmosphere, maintain water supplies for agriculture and prevent formation of deserts. Without plants man could not survive.

Yet, knowing this, we are destroying our own life-support system at such an alarming rate that it has already become a crisis – a crisis for ourselves and an even bigger one for our children.

The figures alone should tell the story – we destroy a tropical rain forest three times the size of Switzerland every year; within 25 years only fragments of the vast Malaysian and Indonesian forests will remain.

What we are destroying

Much of the food, medicines and materials we use every day of our lives is derived from the wild species which grow in the tropics. Yet only a tiny fraction of the world's flowering plants have been studied for possible use. Horrifyingly, some 25,000 of all flowering species are on the verge of extinction.

Once the plants go, they are gone forever. Once the forests go only wastelands remain.

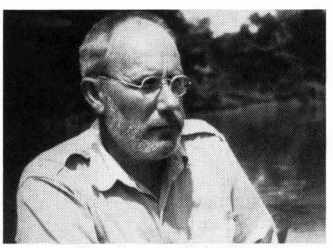

Photo: Courtesy of Richard Evans Schultes

Dr. Richard Evans Schultes, director of the Botanical Museum at Harvard University, has spent 13 years in the Amazon jungle collecting the 'magic' plants of myth and legend and making them available to Western medicine and science. "The drugs of the future," he says, grow in the primeval jungle."

Who is the villain?

There is no villain – except ignorance and short-sightedness. The desperately poor people who live in the forests have to clear areas for crops and fuel, but they are doing this in such a way that they are destroying their very livelihood.

Add to this the way in which the heart is being ripped out of the forests to meet the demand for tropical timbers and we have a recipe for disaster.

What can be done about it?

The problem seems so vast that there is a tendency to shrug and say "What can I do?" But there is an answer.

The WWF Plant Conservation Programme

The World Conservation Strategy, published in 1980, is a programme for conserving the world's natural resources whilst managing them for human needs. A practical, international plant conservation programme has been prepared based on WCS principles and is now well under way all around the world.

You can become part of it

The WWF Plant Conservation Programme is a plan for survival which you can help make a reality. Join the World Wildlife Fund now. We need your voice and your financial support.

Get in touch with your local WWF office for membership details, or send your contribution direct to the World Wildlife Fund at: WWF International, Membership Secretary, World Conservation Centre, 1196 Gland, Switzerland.

Save the plants that save us.

WWF FOR WORLD CONSERVATION

WWF acknowleges the donation of this space by International Sugar Journal. Advertisement prepared as a public service by Ogilvy & Mather.

SUGAR BOOKS

Prices given below include insurance, packing and surface mail postage. They are approximate and subject to alteration without notice owing to fluctuations in currency exchange rates. Air mail postage extra will be quoted on request. Terms are strictly cash in advance.

Check your personal library against the list of basic books given below:

NOEL DEERR: CLASSIC PAPERS OF A SUGAR CANE TECHNOLOGIST: *Ed. Payne*	(1983)	**£80.10**
BEET SUGAR TECHNOLOGY (3rd ed.): *McGinnis*	(1982)	**£34.70**
UNIT OPERATIONS IN CANE SUGAR PRODUCTIONS: *Payne*	(1982)	**£32.05**
MANUFACTURE AND REFINING OF RAW CANE SUGAR (2nd ed.): *Baikow*	(1982)	**£98.30**
AUSTRALIAN SUGAR YEARBOOK 1984	(1984)	**£21.00**
F. O. LICHT'S INTERNATIONAL SUGAR YEARBOOK AND DIRECTORY	(1984)	**£37.30**
BY-PRODUCTS OF THE CANE SUGAR INDUSTRY (3rd ed.): *Paturau*	(1981)	**£46.75**
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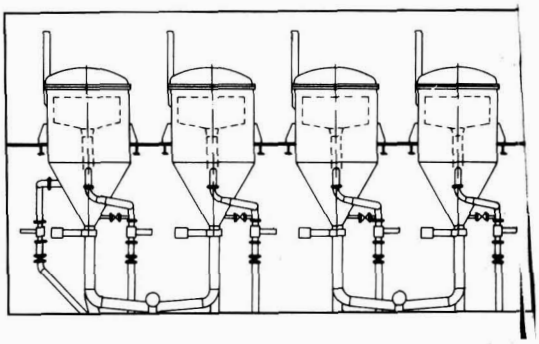

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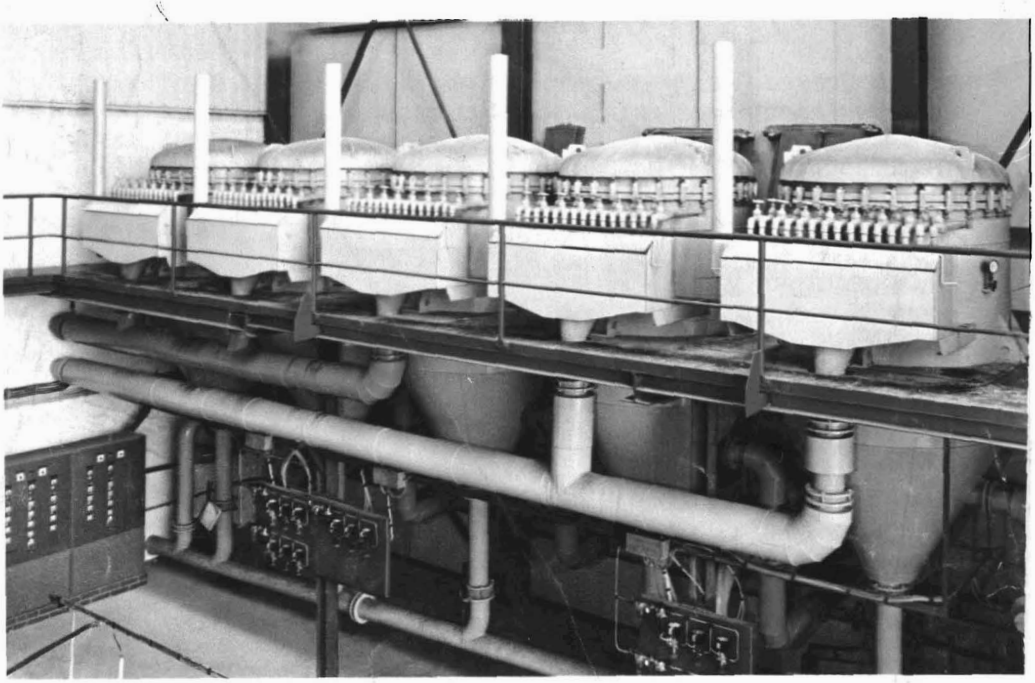

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