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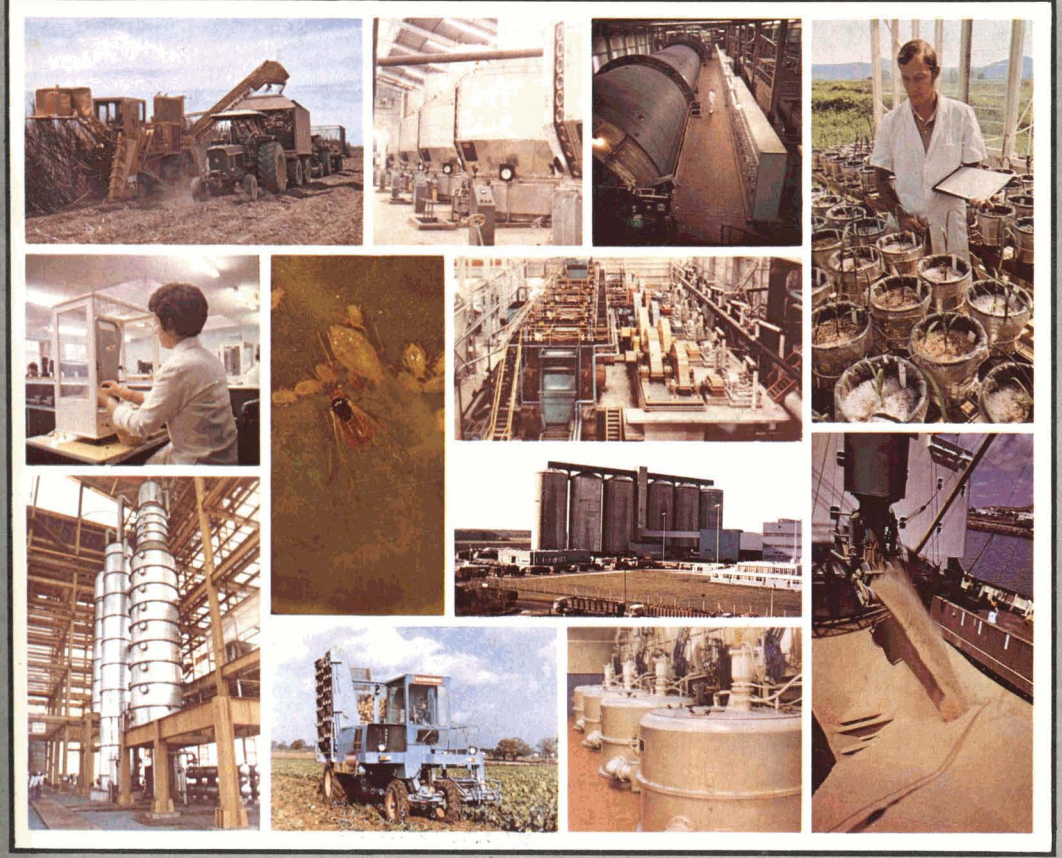

MARCH 1981

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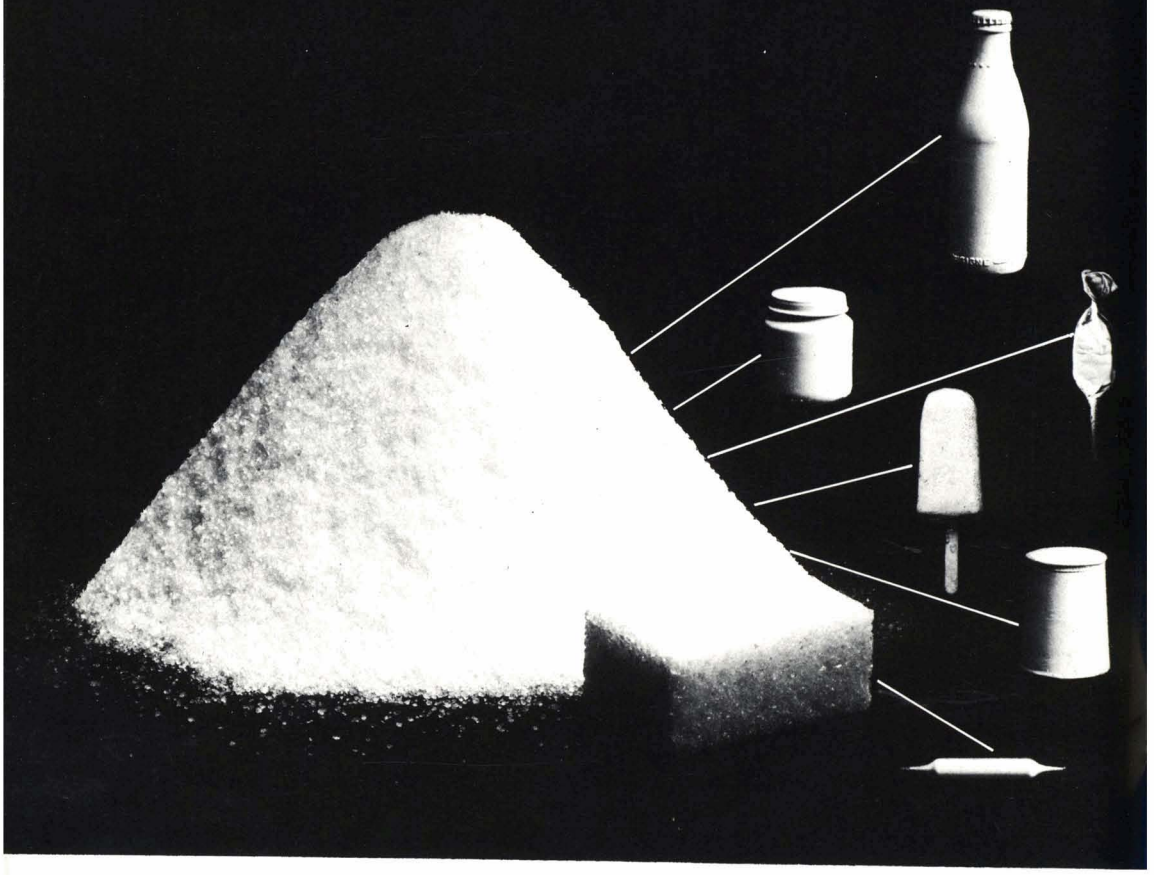

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NOTES AND COMMENTS

World sugar prices

From a value of £290 per tonne at the beginning of January, the LDP rose to £315 on January 6 and fell to £280 a week later, returning to £290 on January 15. During the next week it fell to £245, recovering to £275 on January 27 but ending the month at £242 per tonne. The LDP(W) followed a similar course, starting the month at £318 per tonne, reaching a peak of £343 on January 6, falling to £279 on January 19, recovering partially but ending at £278 on January 30.

This erratic course followed no clearly discernible sequence of cause and effect but it is believed that lowering of political tension with the release of the US hostages by Iran contributed to easing of prices as did the reports of consumer resistance. Buyers were securing supplies in single cargoes, apparently expecting prices to fall. Later in the month there were reports of the possibility of Iran and the USSR returning to the market, which strengthened prices but lack of confirmation, plentiful availability of new-crop Thai sugar and reduction of Japanese requirements, with cancellation of supply contracts, brought about the weakness at the end of the month.

Mauritius sugar crop, 1980[1]

The 1980 cane harvest began on June 17, 1980 and ended on November 29. The 21 factories crushed 4,564,400 tonnes of cane, 1,837,877 tonnes or 28.7% less than the record cane production of the year 1976. Average cane yield was 57.6 tonnes per hectare as against the record figure of 79.2 in 1979. The average sugar extraction rate was 10.42% on cane and sugar production was 475,494 tonnes tel quel (504,214 tonnes, raw value), a fall of 30.9% on the 1979 production of 688,383 tonnes, tel quel (730,169 tonnes, raw value). The disastrous results of the 1980 crop were due to one intense cyclone (with wind speeds up to 160 m.p.h.) which passed over the island and three others which passed close by, as well as to excessive rainfall and lack of sunshine during the growing period.

British Sugar Corporation Ltd. Annual Report, 1980

In 1979/80 a record amount of sugar, 1,154,000 tonnes, was produced with record levels of efficiency. The total harvested area was 213,000 hectares and growers were paid more than £216 million. After late drilling because of harsh conditions, germination and early growth were rapid, with good plant populations established in all areas. Early autumn weather was almost ideal, leading to an exceptionally high sugar content of 17.04%. The Silver Spoon range of sugars has been expanded by the launch of new speciality sugars and sales were over £200 million at retail prices. Production of dried molassed beet pulp as animal feed reached over 661,000 tonnes and sales totalled more than £60 million.

A further £29 million was spent on capital investment during the year, and £13 million on ancillary plant and buildings to complete work at the reconstructed factories at Bury, Cantley, Peterborough and Wissington. About £2.7 million was spent on environmental protection and safety installations.

Beet Sugar Developments Ltd., the Corporation's consultancy subsidiary, has worked on a beet sugar project in Egypt and on projects to assess the potential for alcohol production from sugar beet in New Zealand and Tasmania. BSC experts were also concerned in the commissioning of cane sugar factories in Nigeria, the Philippines and the Sudan.

Corporation profits rose from £31.5 million to £34.2 million on a historical cost accounting basis, or from £16.0 million to £18.9 million on the recently-introduced current cost accounting basis.

US sugar production forecast

The US Dept. of Agriculture published in December its estimate of US sugar production which it expects to total nearly 5.7 million short tons, raw value, in the crop year 1980/81, equivalent to 5.2 million tonnes, raw value. The 1980/81 beet sugar crop is expected to reach 3,000,000 tons (2.7 million tonnes), up 4% from 1979/80, while cane sugar production in the Mainland and Hawaii is set at 2.7 million tons (2,400,000 tonnes), about the same as 1979/80. Puerto Rico is not included in the forecast. The US sugar industry does not now have the capacity to produce much more than 6 million short tons (5 million tonnes) and only moderate output increases could be expected in 1981/82 despite currently high beet and cane prices.

Deliveries to domestic sugar users, including Hawaii, in calendar 1980 are expected to total around 10.4 million tons (9,400,000 tonnes, raw value), down 3% from 1979. Per caput consumption is thus around 87 pounds (39 kg), 4% lower than 1979. Deliveries and per caput consumption are expected to decline further in 1981, associated with continued increases in the use of HFCS as well as indicated consumer and industrial user resistance to higher sugar prices.

US sugar imports in 1980 are thought to have totalled some 4.6 million tons (4.2 million tonnes, raw value), 10% less than in 1979. Because of an estimated near 20% fall in US stocks last year, however, imports to fill these and meet consumption needs could rise in 1981 to 5.0 million tons (4.5 million tonnes). Corn sweetener shipments may rise to over 5 million tons, dry basis (4.5 million tonnes) in 1981 to represent a third of total caloric sweetener use, of which HFCS would represent half, or nearly 20% up on 1980.

EEC export licence procedure changes

Under EEC regulations for the granting of sugar export licences, traders have had to pay an initial deposit which could be considered an earnest of good intentions. There were complaints during 1980, when the price fell steeply from one week to the next, that traders had allowed their licences to lapse, even though this meant forfeiting their deposit. At the beginning of last year the deposit was only 3 e.c.u. per tonne and after the earlier complaints, it was raised in April 1980 to 9 e.c.u. per tonne, and became payable by the day preceding the subsequent tender.

Towards the end of 1980 the falls in sugar prices between tenders exceeded this amount and so it still paid traders to forfeit the deposit, let the licence lapse and build into succeeding bids the deposit element accepted earlier. As a consequence, the EEC authorities have again

[1] *Mauritius Sugar News Bull.*, 1980, (11).

amended their regulations so that, where licences are not taken up, the trader will forfeit either 9 e.c.u. per tonne or the difference between the initial award and that ruling when the licence expires, whichever is the greater.

European sugar production 1980/81[2]

The outlook for the European beet sugar crop was extremely good until the weather turned sharply colder in both East and West European countries. Temperatures well below freezing were then thought to have damaged the crop and it was anticipated that sugar production would turn out well below earlier forecasts. The cold spell was short-lived, however, and, in West Europe at least, little damage was caused. Disappointing results have been experienced in Turkey, Greece and Yugoslavia although Spain will not have to import sugar as expected earlier. The third estimates by F. O. Licht GmbH for the campaign are reproduced below, with corresponding figures for the previous two campaigns.

	1980/81	1979/80	1978/79
		tonnes, raw value	
West Europe			
Belgium/Luxembourg	870,000	993,000	902,000
Denmark	462,000	492,000	442,000
France	4,240,000	4,325,000	4,063,000
Germany, West	2,904,000	3,088,000	2,997,000
Holland	924,000	927,000	1,034,000
Ireland	185,000	190,000	204,000
Italy	1,892,000	1,698,000	1,630,000
UK	1,195,000	1,255,000	1,109,000
Total EEC	*12,672,000*	*12,968,000*	*12,381,000*
Austria	440,000	410,000	357,000
Finland	123,000	100,000	104,000
Greece	190,000	319,000	354,000
Spain	945,000	714,000	1,128,000
Sweden	348,000	350,000	339,000
Switzerland	100,000	118,000	107,000
Turkey	935,000	1,068,000	1,096,000
Yugoslavia	760,000	852,000	780,000
Total West Europe	*16,513,000*	*16,899,000*	*16,646,000*
East Europe			
Albania	40,000	40,000	20,000
Bulgaria	230,000	240,000	180,000
Czechoslovakia	800,000	920,000	885,000
Germany, East	700,000	720,000	780,000
Hungary	467,000	511,000	553,000
Poland	1,200,000	1,580,000	1,763,000
Rumania	570,000	570,000	603,000
USSR	7,400,000	7,500,000	9,000,000
Total East Europe	*11,407,000*	*12,081,000*	*13,784,000*
Total Europe	27,920,000	28,980,000	30,430,000

UK refinery closure

Tate & Lyle Ltd. announced on January 22 that they were to close the Liverpool refinery as soon as possible. The 300,000 tonnes/year facility has been in existence for 112 years and required extensive investment in modernization which was not economically justifiable. Losses of £10 million were attributable to the Liverpool operation in 1980.

There were immediate protests from the unions employed and from representatives of the ACP countries which have sent most of their sugar to the UK for refining. Tate & Lyle have said, however, that they would make greater use of their remaining refineries in London and Greenock, although it could be that not all of the former tonnage can be handled. The problem is a Community one, moreover, and not exclusively British, since it is the EEC which guarantees access of ACP sugar under the Lomé convention. The market for refined cane sugar in the UK has been shrinking, as has the quantity exported, so that Tate & Lyle has had a marketing problem in disposing of their refined sugar, particularly since their profit margin is only about one-fifth of that afforded to beet sugar producers under the EEC sugar regime.

In early February the company agreed that the refinery would continue to operate until at least April 3 to permit the union representatives to make representations to the British government in the hope of preserving the 1600 jobs at stake. The UK Minister of Agriculture stated later[3], however, that the problem was a question of declining UK consumption and surplus production in the EEC. He reported that he had offered to accept a reduction of 200,000 tonnes in the British beet sugar production quota if it were matched by similar cuts for the other member countries. This could involve closure of beet sugar factories in the UK, and he hoped that Tate & Lyle and the British Sugar Corporation could consider a joint venture to export the refined cane and white beet sugar for which there was no market in Britain. Consumption has fallen from 2.7 to 2.3 million tonnes in the past five years, part having been lost to HFCS.

Japanese sweetener consumption

Sugar consumption in Japan in the period October 1979/September 1980 is estimated at slightly more than 3.1 million tonnes, raw value, or 2% less than the previous 12 months. In 1980/81 consumption is expected to fall to 2.96 million tonnes, a further decline of 5%, and some observers think it could decline by 7%. F.O. Licht GmbH have published a trend projection[4] showing a further decline to 2,984,000 tonnes in 1981/82 and to as low as 2,810,000 tonnes in 1985/86.

By contrast, high fructose corn syrup consumption has grown from 216,158 tonnes in 1976/77 to an estimated 348,976 tonnes in 1979/80 (an average annual increase of 17.3%) and could exceed 600,000 tonnes by 1989/90, according to industry sources, which would be the result of an average annual increase of 5.6%. Licht notes: "As in the United States, the main motor propelling the HFCS advance in Japan has been the price differential in relation to sucrose. Since 1977, HFCS on a dry basis has generally sold in Tokyo at a discount of more than 20% from the refined sugar price. The price differential, however, is partly due to the fact that there is no tax on HFCS while sugar is subject to an import duty, an excise tax and also a surcharge.

"The situation could become really precarious if there should be further technological breakthroughs. When a technique to separate levulose from HFCS, or to isomerise dextrose completely to levulose, is established, and solid levulose comes on the market at a far lower cost than under the present method of production, the influence on sugar consumption will be immense, since this sweetener could replace sucrose in uses where a sweetener in solid form is preferred. However, even without any further technological breakthroughs sugar imports are likely to decline in the years to come."

Steam turbine order for Trinidad. — Peter Brotherhood Ltd. have been awarded a contract for a 1000 kW steam turbine to drive an alternator for generation of electric power at the Brechin Castle sugar factory in Trinidad.

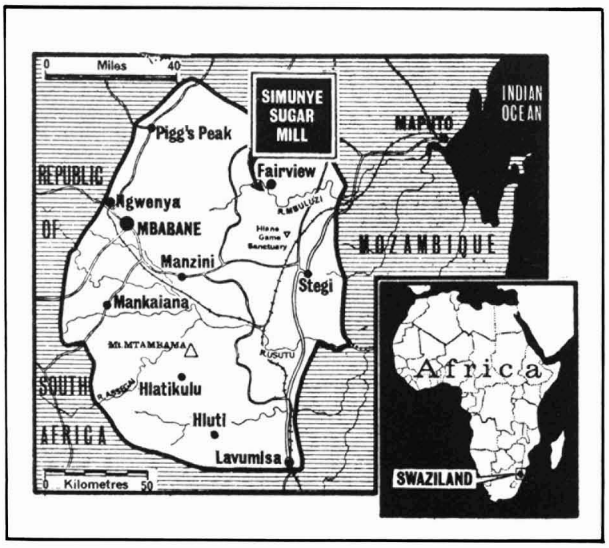
[2] F.O. Licht, *International Sugar Rpt.*, 1980, **112**, 719 - 721.
[3] *The Times*, February 12, 1981.
[4] *International Sugar Rpt.*, 1981, **113**, 1.

Simunye - Swaziland's third sugar project

The fundamental improvement in world sugar markets in the early seventies provided the springboard which led by the end of the decade to the eventual establishment of the Royal Swaziland Sugar Corporation (RSSC). Brighter long-term prospects for sugar, a useful quota under the Commonwealth Sugar Agreement and two sugar mills already operating profitably in the country, prompted the Swaziland Government to grasp the opportunity of realizing one of its long-held development ambitions – a sugar project owned and controlled by the Swazi Nation itself.

It was only natural that the Government should turn to the Commonwealth Development Corporation for advice in such a major endeavour, for CDC had been intimately associated with the very beginnings of irrigated agriculture and cane growing in the Swazi lowveld two decades previously. It had initiated the development of the Swaziland Irrigation Scheme, followed a few years later by the Mhlume (Swaziland) Sugar Company, both highly successful ventures. So the Government commissioned CDC to study the alternative possibilities, and a survey, financed by British Government technical aid funds, was begun.

A study of the Umbuluzi River Basin by engineering consultants had confirmed that a dam on the river could provide all the water needed to irrigate a large area of hitherto unused but cultivable land for such crops as might be suited to the local soils. The problem was whether it could grow sufficient cane efficiently and cheaply enough to support a mill and increase the country's sugar output by half as much again. At the same time it had to be shown that the sugar could be sold at prices which would make the venture a viable one.



Within a year CDC had completed a thorough investigation of all aspects of the most likely possibilities, and had identified all the major components which would be required for such a scheme. The study concluded with detailed outlines of two alternative plans, both of them almost equally attractive. These were: either to expand one or both of the existing sugar mills by the necessary capacity, or to set up an entirely new third mill on its own estate.

In the event the Government opted for a separate mill, largely on the grounds that, although it might have been thought safer to expand existing mills, an entirely new and self-contained venture could well prove more attractive to financial backers and overseas aid institutions, some of whom were new to Swaziland.

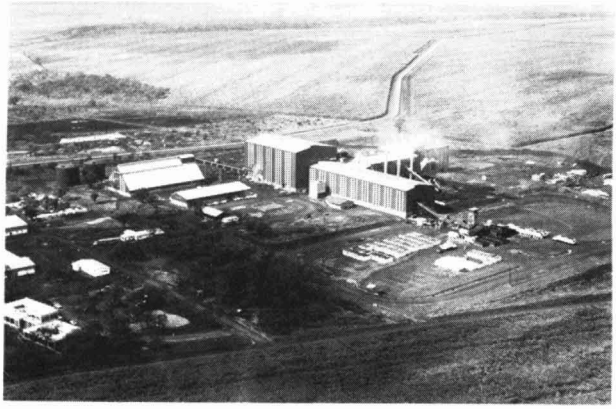


Fig. 1. The Simunye sugar factory

By 1974 the Government had set up a Steering Committee responsible for the implementation of the new project. Tate & Lyle were appointed to draw up detailed engineering plans for an irrigated sugar estate and mill and to organize this complex project. The Committee was to explore sources of finance to bring the project into being. The dam to provide the water for the cane area was to be a separate operation since it would have benefits that would not be confined to the sugar estate. In the event this was built and financed with the aid of German capital aid through Kreditanstalt für Wiederaufbau (KfW).

With its long experience of sugar in Swaziland CDC was invited to join the Steering Committee, and was represented by the General Manager of Swaziland Irrigation Scheme, whose lands were close to the areas pinpointed for the new venture. CDC's projects also provided physical facilities for the consultants in the early stages.

There followed a period of discussion and negotiation between the Swazi Government and Nation and potential investors and financing institutions. On December 9, 1977, final approval for the £75 million project was granted. Financing arrangements were successfully

concluded, the largest providers of equity and loan capital being, of course, the Swazi Government and Nation. A dozen other investors include Tate & Lyle, the Government of Nigeria, Coca-Cola Export Corporation, Mitsui & Co. Ltd., the Commonwealth Development Corporation, Barclays Bank Ltd. and other banks and investment houses.

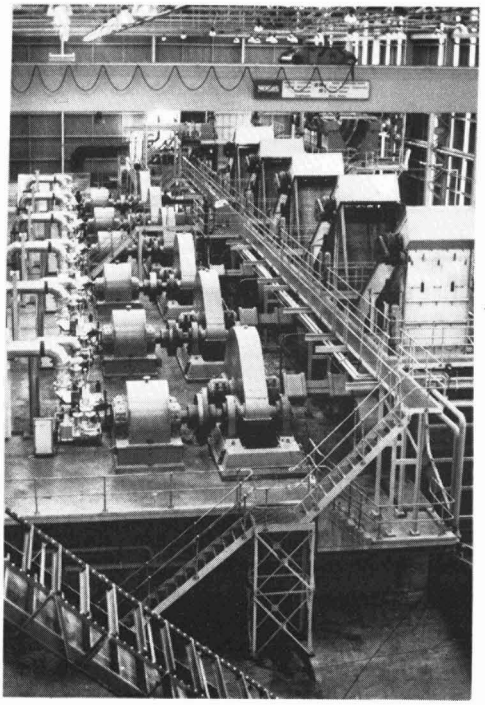


Fig. 2. The Simunye milling tandem

From December 1977, implementation of the project proceeded rapidly and without interruption. Tate & Lyle's site team arrived in January 1978 and by mid-year work was well advanced on the Lusoti township, pump stations, canals, roads and land development, all in the Mlaula area. A start was made on foundations for the mill and on detailed design and specification work. In October 1978 King Sobhuza II of Swaziland dedicated a memorial stone at the project, naming it Simunye – "We are one". Supplies of irrigation water started flowing in November 1978 to areas of cane newly planted by RSSC.

Smith Mirrlees of Glasgow were appointed as the main contractor for factory equipment and associated services. The tandem of six 42 x 84 inch mills (Fig. 2) is designed for a peak throughput of 6000 tonnes of cane per day. The clarification station and boiling house are of conventional design but there is an unusual cane yard, with all cane stored in bins which are unloaded onto inclined feed tables (Figs. 3, 4). VHP sugar is produced by a 3-boiling system as employed at the other two Swaziland sugar factories.

The mills are individually driven by Peter Brotherhood single-stage axial-flow 900 kW steam turbines with 5520/1000 r.p.m. gearing, operating initially on steam at 2.24 $N.mm^{-2}$ and 338°C, exhausting at 0.14 $N.mm^{-2}$. The tandem also includes a shredder driven by a single-stage Brotherhood turbine developing 1500 kW and operating under the same steam conditions but with gearing for reduction from 6044 to 1200 r.p.m.

Fig. 3. Cane reception at Simunye. View from above

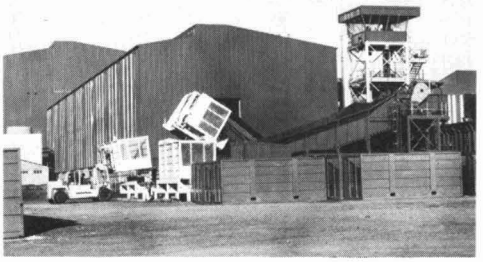


Fig. 4. Cane reception at Simunye. View from below

Some £1000,000 worth of weighbridges and automatic weighers have been provided by W & T Avery Ltd. of Birmingham, England, for weighing cane haulage traffic and sugar, etc. The machines include a large 100-tonnes capacity road/rail weighbridge, two 50-tonne capacity road weighbridges and three specialist hopper weighers for measuring throughputs of juice, raw sugar and molasses. All were installed by Avery's South African associate company which is also contracted to carry out routine servicing.

John Thompson Africa (Pty) Limited, a member of the NEI Africa Group, designed, manufactured, erected and commissioned the three bagasse/coal-fired water-tube boilers that form the energy heart of the Simunye factory.

Each of these fully automatically controlled units has an output of 55,000 kg/hr of steam at a pressure of 3100 kPa and temperature of 400°C. The boilers are bottom-supported; they are fitted with partly water-cooled combustion chambers, cross-flow drainable superheaters, three-pass convection banks and two-pass parallel flow air heaters. Cyclone separators in the steam drum maintain steam purity.

The combustion equipment has been specifically developed to burn both bagasse and coal efficiently in the same furnace. Three drum bagasse feeders, fed by long chutes, meter the bagasse to the pneumatic spreaders. Coal is accurately metered by rotary self-cleaning type feeders which have been specifically designed to handle South African coals. Coal flingers, in water cooled housings, distribute the coal into the furnace.

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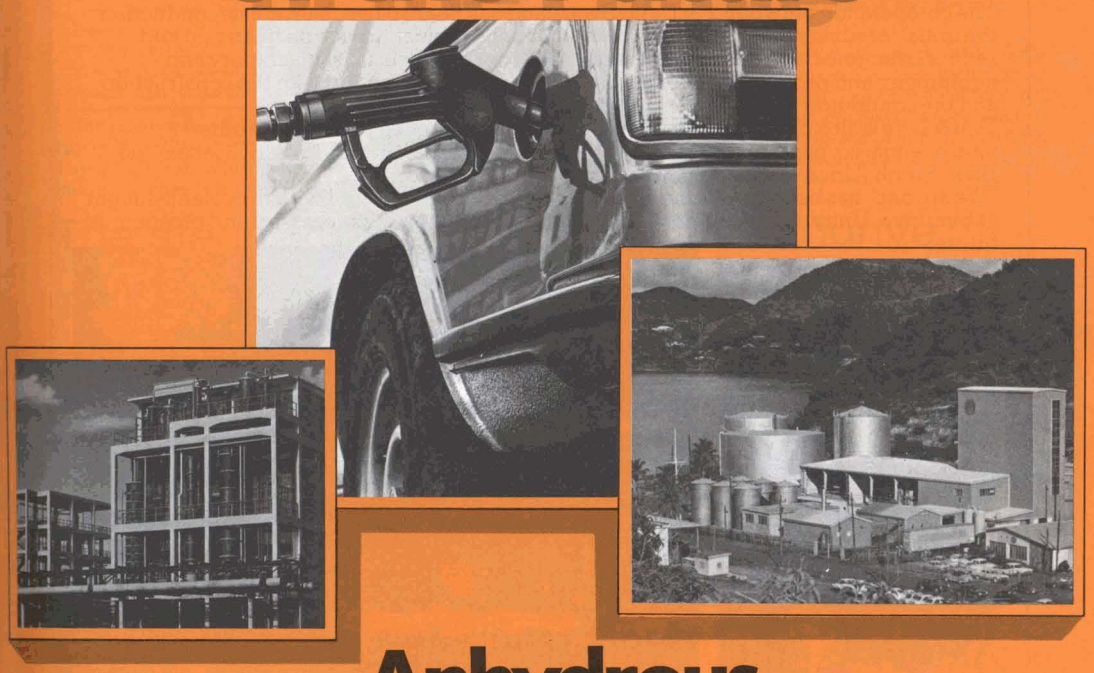

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By hydraulically sluicing the boiler discards, a clean working environment is maintained in the boiler-house.

In addition to the boiler plant, John Thompson Africa also supplied a deaerator, water softener, chemical dosing equipment and ash and smut handling plant.

Design parameters for Simunye

Parameter	Range	Average
Cane: Sucrose %	11.5 – 15.0	13.4
Fibre %	12.5 – 16.0	14.3
Annual crush, tonnes		1,050,000
Season length, days	190 – 240	230
Crushing capacity, t.c.h.		250
Mill extraction, %		95
Raw sugar pol	96.0 – 99.0	98.5
Boiling house recovery %, basis 84.5% mixed juice purity		88.5
Overall recovery, %		84
T.C.T.S. (98.5% pol)		8.8
Time efficiency overall, %		75
Annual sugar production, tonnes		120,000

The estate was officially opened by King Sobhuza on August 26, 1980. The establishment of the sugar cane estate and its raw sugar factory had been completed on time and within budget. Some 3000 job opportunities have been created and largely filled. On the estate, 5500 of the planned total of 8500 hectares has been planted to cane. Production is building up at the mill and will reach the planned maximum of approximately 120,000 tonnes of sugar per year by the end of 1982. Most of the Estate's sugar production will be for export to the world market.

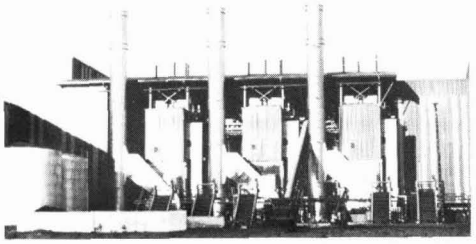
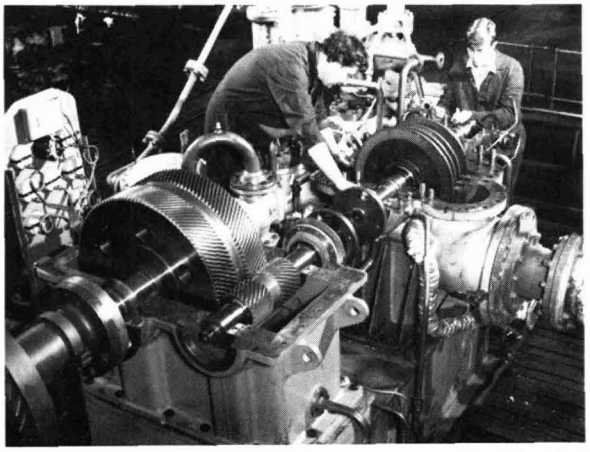


Fig. 5. The boiler house of Simunye sugar factory

The steam turbo-alternators at Simunye

Factories processing sugar cane consume large quantities of low-pressure process steam and electrical power. By generating the required quantity of steam in a high pressure boiler and expanding it to the process pressure through a steam turbine driving an alternator, it is possible to generate much of the power requirements of the factory as a by-product. The value of the electrical power so produced considerably outweighs the cost of additional boiler fuel used for generating steam at a pressure higher than that required for the process.



One of the two 3500kW Allen type SLC18 steam turbines for Simunye during construction at Bedford. The drive from the turbine to the alternator is taken through Allen parallel-shaft reduction gearing seen in the foreground.

At the Simunye factory of the Royal Swaziland Sugar Corporation two turbo-alternator sets, supplied by APE-Allen Ltd. of Bedford, England, are used for steam pressure reducing and power generation. They comprise two 3 500kW type SLC18 multi-stage steam turbines from the manufacturer's standard range, each driving through parallel-shaft speed-reduction gears a 3300 volt, 1500 rpm Parsons Peebles brushless alternator. The closed-air-circuit water-cooled alternator is cooled by water from the nearby Umbuluzi river.

Steam enters each turbine from the boiler plant, at a pressure of 2.24 $N.mm^{-2}$ and a temperature of 338°C, through two automatically-controlled regulating valves and is expanded through the machine to exhaust to the process steam main at a pressure of 0.14 $N.mm^{-2}$.

The turbine shaft is connected via a flexible coupling to a speed-reduction gear of the double-helical single-reduction totally-enclosed type. Turbine and gear are mounted on a baseplate which incorporates reservoirs for lubricating oil and control oil for the set. Oil coolers, filters, and the electrically driven auxiliary oil pump are combined in a console positioned adjacent to the turbine/gear baseplate.

The low-speed output shaft of the gearbox is rigidly coupled to the alternator rotor, the composite rotor being supported by the gearbox bearings and, at the exciter end of the alternator, by a single pedestal bearing.

The turbo-alternator sets were installed by engineers from another Amalgamated Power Engineering company, APE Africa Ltd., and, with the assistance of an engineer from APE-Allen, were commissioned on schedule during April 1980. APE-Allen also assisted Tate & Lyle Engineering Ltd., consultants for the Simunye project, in determining the design of high-pressure steam supply pipework to the turbo-alternator sets.

The automatic vacuum pan systems at Simunye

By K. SULLIVAN (Taylor Instrument Ltd., Stevenage, Herts, England)

Vacuum pan control systems are almost as varied as the pans themselves. They vary because of the type of sugar being boiled, i.e. A, B, C and refined sugar, plus all the combinations used to suit local requirements. Add to these the various measurement systems which may depend upon conductivity, mobility, temperature, consistency and supersaturation. Then couple these with the move to electronic instrumentation including micro-processor technology, and the combination of control options now adds a further choice of equipment from pneumatics, electronic analogue digital electronic control systems, and of course, the micro-processor based P.L.C. systems.

Faced with this panorama of alternatives the would-be purchaser is faced with a difficult problem when specifying the type of system he would like to have operating in his factories - so maybe his first choice is the latest technology.

In the best location, under the control and supervision of qualified people, this is arguably the best decision. However, when the factory is to be built in a developing country where high technology is not generally practised, in a factory which is essentially run by a mixture of expatriate and local trainee personnel, high technology is not recommended in any of its forms when there are so many successful, well-tried and tested control systems that can be applied.

Such was the decision facing the supplier of the pan systems for the third Swaziland Sugar Project now known as Simunye.

The decision to use pneumatic instrumentation throughout the factory was made early in the life of the project which was finally approved on December 9, 1977 and by the time the main contractor, Tate & Lyle Technical Services Ltd., London, approached the instrument vendors for detailed equipment specifications most of the initial thoughts on the types of pan systems had been discussed in principle.

The decision to use pneumatics on the pans was based on a number of factors, from the technical level of the operatives to the requirement to standardize on the instrumentation and spares used throughout the rest of the factory. Once the instrumentation and sugar to be boiled was defined, the choice of measurements, level of automation and factors regarding standardization had to be considered.

The choice of measurements on this occasion was a simple one, as the use of consistency and, more recently, a combination of consistency and supersaturation have become a standard with T & L since the first installation of a trial system at one of their refineries over ten years ago. Since that time, T & L Technical Services Ltd. and Taylor Instrument Ltd. have worked together to design "standard" systems for the different categories of sugar boiling. These systems are designed to use simple standard modular control instrumentation reduce operator intervention to a desired minimum,

K. Sullivan

Fig. 1

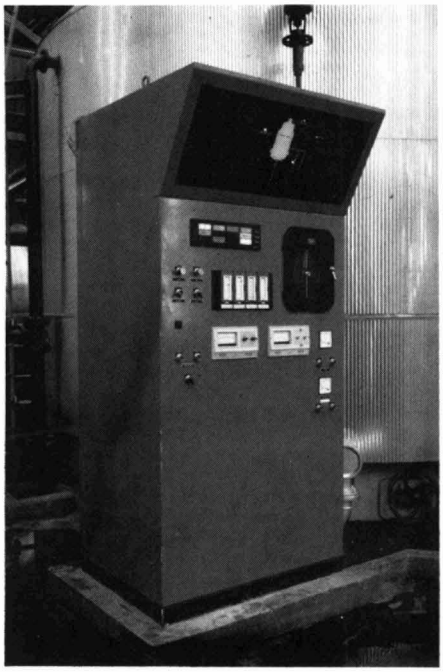


Fig. 2

reduce on-line maintenance by component replacement, increase operator efficiency in the manual mode if control components fail and provide a "universal" system to be used in less developed countries which can be easily adapted for most grades of sugar without costly modifications.

Such a system was installed at Simunye which is illustrated in Figures 1 and 2.

The controllers were standard "off the shelf" 1400 Series pneumatics, similar to all the others installed throughout the factory from the mills to the boilers through to juice clarification and concentration. This enabled the maintenance staff to replace any controller which failed during the seven month grinding season with a replacement plug-in unit within minutes.

The schematic diagram illustrated in Figure 3 briefly shows the main components of the system employed

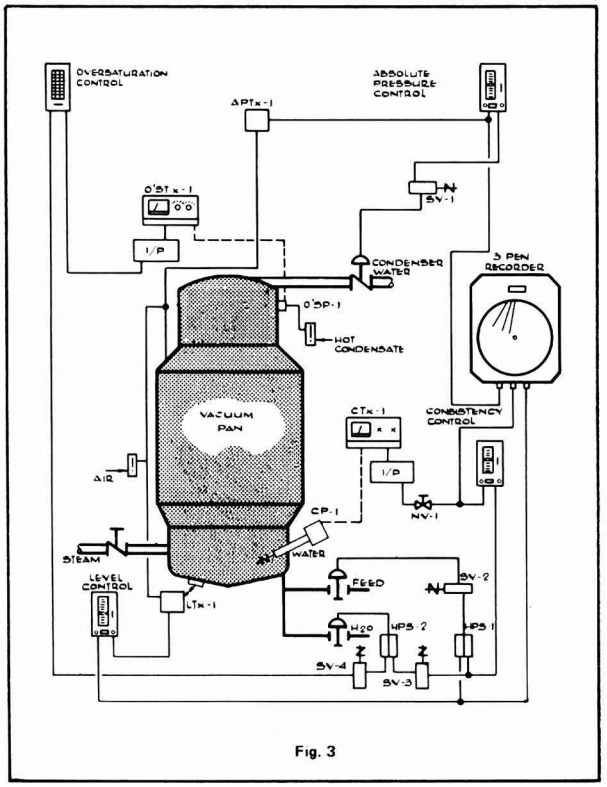


Fig. 3

which is identical for all grades of sugar being boiled at the factory and the reason for this "universal" approach is mentioned above. The types of sugar to be boiled were therefore C-pan from seed on A-molasses and cut, C-pan from footing on B-molasses and dropped, B-pan from seed on A-molasses and cut, B-pan from footing on A-molasses and cut A-pan from footing on syrup and cut or dropped, A-pan from syrup and magma and cut.

So it can be seen from this comprehensive boiling program with wide purity variations and boiling times, that the methods of measurement had to accommodate the extremes of these parameters without complicated modification or recalibrations from pan to pan.

Level and absolute pressure

The level measurement uses a standard differential flush-mounted level transmitter fitted with a compensating or balance leg line on the "low" side of the transmitter piped to the absolute pressure connexion in the pan dome. This line is also an integral part of the connexion to the absolute pressure transmitter which is constantly air-purged to stop the ingress of condensate into either transmitter. Both the level and absolute pressure transmitters are pre-calibrated, installed and commissioned in the normal way. These transmitters also have a universal pneumatic secondary which is interchangeable with all the pressure transmitters on site, another worthy feature.

Consistency

The consistency measurement is made by using a Ziegler & Associates consistency probe and transmitter. This versatile instrument, used for measuring viscosity in melters, mixers, evaporators and minglers, was primarily designed for use in vacuum pans, where the consistency of the boiling syrup is measured in terms of viscosity. This, of course, depends on its concentration and temperature but, surprisingly enough, at the saturation limit, the viscosity is almost constant.

However, the overall consistency of a given syrup increases with the presence of sugar crystals in suspension, so the objective of the consistency control is to maintain the pan consistency within certain limits by feeding fresh syrup or molasses into the pan during the boiling cycle. One could say that this measurement is the most important one in the pan and in fact if it were applied to the perfect pan with constant syrup Brix, purity and heat input, then no other additional measurement would be required. This not being the case means that an overall measurement becomes necessary with the varying conditions encountered in pan regulation but without a doubt the consistency control is the work-horse of the pan system.

Oversaturation

There is no doubt that the most important variable in sugar boiling is the degree of syrup saturation in the pan, as the crystal growth rate is proportional to this variable. We also know through the work done by Yamane & Kamoda[1] that conglomerate grain formation is also proportional to the level of saturation, particularly during the first few minutes after seeding takes place. This, of course, is not such a big problem in a raw sugar mill as in a refinery because of the reduced syrup purities. However, supersaturation, or oversaturation as it has become known, plays such an important part during the pan cycle that all but low purity recovery house pans benefit from this measurement.

The method used for measuring oversaturation in terms of the boiling point elevation has been practised for many years. However, until Ziegler & Associates introduced their oversaturation monitor, the many

[1] *Proc. Research Soc. Japan Sugar Ref. Technol.*, 1959, **8**, 123-130.

problems associated with making this measurement using boiling pots made it unpopular because of the maintenance of the overall system. The oversaturation monitor does not suffer with any of the problems associated with the old B.P.E. methods as the temperature probe assembly holding both the vapour and wet bulbs is inserted directly into the pan head or vapour line without the requirement of other fabrications to make it work. The probe assembly is fed with hot condensate from the pan's own condensate system via a small valve to provide the "wet" bulb with the required amount of flash to produce the temperature differential. The difference between the two temperature sensors is fed into the electronic circuitry of the monitor which produces an output signal proportional to 0-100% oversaturation (1.0 to 2.0 supersaturation). Purity dials on the monitor allow the operator to set the feed syrup purity thus providing an overall reading of oversaturation for any syrup being boiled[2]. This method of measurement is now being used successfully on all types of pan system from refineries to raw sugar factories.

The positioning of the oversaturation probe is important; it must be at a point of maximum vapour velocity and away from the boiling massecuite where entrainment droplets could desuperheat the vapour bulb. Once the point of measurement has been determined the measurement is assured with perhaps only a small zero adjustment to set the output precisely to the pan being controlled at commissioning.

Additional features of the Simunye system not shown in Figure 3 allow the pan-man to switch the pan from a seed to a non-seeded strike, thereby cancelling seed alarms and allowing the arbitrary levels of cut-over pans to be accommodated whether from footing or a mixture of syrup and magma. Plant condition lamps which come on at each of the critical points in the pan cycle show the pan-man continuously the state of the pan throughout the strike. A water-syrup switch also enables the pan-man to "hold" the pan at any time, for any length of time, during the strike for operational reasons without having to resort to the adjustment of any other controls or set-pointers in the systems. The availability of the set pointer adjustments on the absolute pressure and consistency controllers provide the ultimate in flexibility of the system to the pan-man who can make small adjustments to compensate for other parameters outside his control which affect the boiling of the pan. The consistency setpointer also allows for "personal" variations in tightness during the boiling up to the "pan full" point when the pan is brought automatically to dropping consistency.

Figure 4 illustrates two typical A-strikes performed during the commissioning phase. The first was from a magma and syrup mixture showing an initial "clean-up" period where unwanted fines were washed out. The second strike was from footing, boiled and dropped in less than two hours. The lower "thick" line at the 13% point is absolute pressure control record. The level measurement record starts in the 45-50% region and finishes at 87-88%, and the consistency control record runs in the 66% region. The final commissioning of the correctly installed system usually takes two or three strikes to fine-tune the controllers, after which time only the normal manual operations are required on each strike. The pans at Simunye have manual discharge valves operated from the panel and manual vacuum breaker and steam valves operated remotely. All the other valves manipulations may be done automatically as part of the system. The system for automatic seeding was installed into the control panel but was not tied into the pan for the first season's boiling.

Part of the final commissioning phase also included operator training to familiarize the pan-men with the equipment and the effect each adjustment had on the pan being boiled. The instrument maintenance section also attended on a daily basis to familiarize themselves with the general operation of the equipment during the pan cycle to enable them to recognise more quickly potential problems or instrument malfunctions.

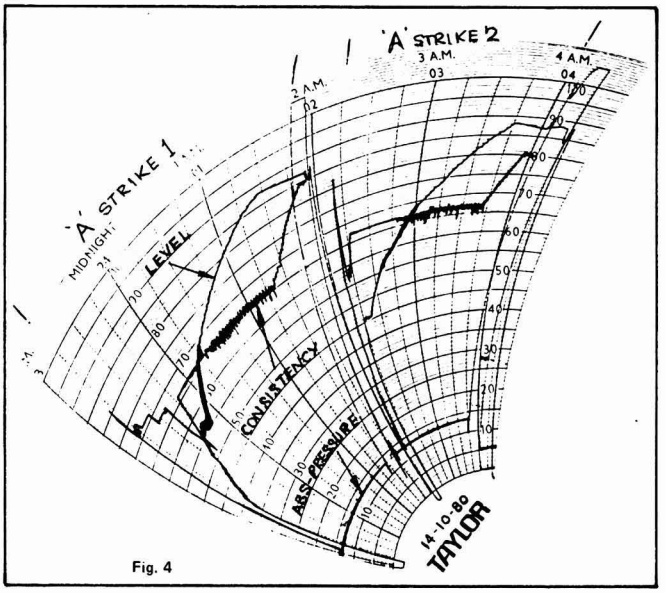


Fig. 4

The commissioning and training period for the six pans took ten days which is one of the quickest we have achieved, thanks mostly to the care taken during precommissioning by both Taylor Instrument Pty. Ltd. (South Africa) and the Instrument Department of the Royal Swaziland Sugar Corporation.

French sugar statistical memo. – Mémo Statistique 1980 is the title of a folded sheet which provides a summary of statistics concerning the French sugar industry for the period October 1, 1979 – September 30, 1980, with corresponding data in many cases for previous years. These show the changing patterns of production and the industry's structure as well as utilization of sugar; in 1955/56 beets were grown on 341,000 ha at a yield of 29.2 tonnes.ha^{-1} and were processed by 109 factories to yield 1,487,574 tonnes of white sugar. In 1979/80 the crop was grown on 520,000 ha, yielding 47.5 tonnes.ha^{-1} and processed by 60 factories to give 3,978,662 tonnes of white sugar. The memo is produced by CEDUS, 30 rue de Lubeck, 75116 Paris.

[2] Ziegler: *Sugar J.* 1979, **41**, (12), 11-14; **42**, (1), 27-31.

Cane growing on the Simunye sugar estate

It was decided at the outset that the Simunye estate would be organized on a plantation basis at least during the period of major development, after which it would be possible for small farmers to join the project. The estate is divided into two parts each close to the Ehlane Game Reserve. Bush clearing and land preparation proceeded with little difficulty apart from stones and rock bars in Mlaula, although scrub removal was less easy in Ngomane and erosion has meant that some soils require special handling. The soil is not particularly good but the climate, combined with adequate supplies of water, ensures high yields of sugar from the cane, which is harvested from May to November.

Most of the rain in Swaziland falls in the highlands around the capital, Mbabane, but it runs down into the Lowveld where Simunye is located. The Mnjoli Dam was built on the Black Umbuluzi River and has formed a lake with a storage capacity of 132 million cubic metres, 35 km from Simunye. Water is distributed through a 59-km network of canals (Fig. 1) and applied to 20% of the cane area by surface furrows and to the remainder by a semi-solid set sprinkler system on a 22-hour day, 6-day cycle (Fig. 2). Good surface drainage has been achieved mostly by land grading, but sub-surface drainage was needed for a small part of the cane area.

To counter the threat of smut, seed cane from the Malkerns Research Station in the Highveld is grown in an intermediate nursery area before planting out. The major variety used is N:Co 376 with minor areas planted to N 52/219 and J 59/3.

Because of the dearth of unskilled labour for cane cutting, the Estate was committed to mechanical harvesting and chopper machines were adopted. The cane is burnt and cut, the billets are loaded into 10-tonne bins (Fig. 3) and these hauled to the factory by road for processing. Some compatibility of equipment has been achieved with the neighbouring Mhlume Sugar Estate.

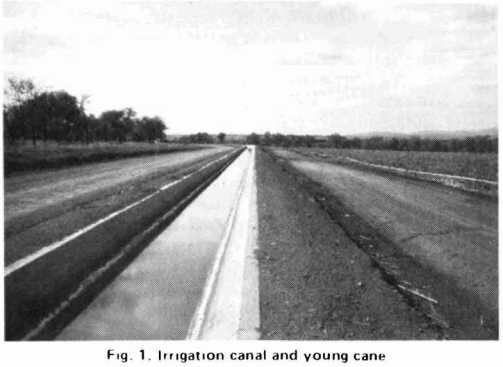


Fig. 1. Irrigation canal and young cane

Fig. 2. Spray irrigation

Fig. 3. Cane harvesting at Simunye

We acknowledge with thanks the help of A.P.E.-Allen Ltd., W. & T. Avery Ltd., Peter Brotherhood Ltd., Commonwealth Development Corporation, the *Financial Times*, and Tate & Lyle Ltd. in the preparation of these articles. Certain of the information was obtained from the paper by Simon J. Winn, presented to the South African Sugar Technologists Association in 1979, to whom we also offer our thanks. We are also most grateful to Mr. Ken Sullivan of Taylor Instrument Ltd. for the opportunity to reproduce some of his photographs.

Indonesia sugar expansion plans[1]. – Indonesia may have to import as much as 600,000 tonnes of sugar in 1981 to meet normal requirements, according to foreign industry sources in Jakarta. They estimate total 1980 imports at 495,000 tonnes and domestic production at 1.25 million tonnes against the revised 1979 estimate of 492,000 tonnes of imports and local production of 1.2 million tonnes. Production in Indonesia in 1981 could reach 1,325,000 tonnes but consumption is seen rising to 1,925,000 tonnes. In the years ahead the gap between demand and supply looks like widening. The government has announced plans to build 18 new cane sugar factories with a capacity of 4000 t.c.d. each and aims to spread cane growing outside Java. However, to operate efficiently, such plantations would need substantial infrastructural investment.

[1] *Public Ledger*, December 31, 1980.

Raw sugar dextran flow through a cane sugar refinery

By M.J. FOWLER

(Amstar Corporation, Chalmette Refinery, Louisiana, USA)

Introduction

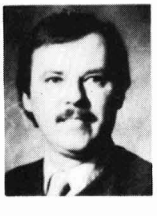
There exists in sugar technology journals a fair amount of literature describing processing problems associated with dextran, a polysaccharide by-product of the bacterium *Leuconostoc mesenteroides*[1,2,3]. The purpose of this paper is to document the flow of dextran through a cane sugar refinery.

Background

Prior to 1978 there were periods when certain process streams of Amstar's Chalmette cane sugar refinery exhibited the classic symptoms of a heavy dextran incursion: elongated crystal morphology, viscous syrups, gummy and unpackagable soft sugars, and elevated blackstrap molasses purities. It was assumed at the time that the dextran originated in the refinery and corrective measures taken then involved cleaning and sanitizing syrup storage tanks and increasing the pH and temperature of sweetwater streams. The remelt problems generally disappeared shortly thereafter. Whether or not this was a direct result of the staff's efforts or just coincidence was never determined.

Beginning in 1978 the above remelt maladies returned; however this time no amount of cleaning or pH adjustment relieved the symptoms. Every effort was made to bring blackstrap purities back to standard levels but, if anything, each action taken seemed to make the situation worse. Towards the end of the year Amstar's Philadelphia refinery reported raw sugar receipts of South American origin high in dextran that completely eliminated its capability to produce sugar for use in alcoholic beverages[4]. An analysis of retained samples of Chalmette's raw sugar receipts was made after this fact became known. The results showed that the refinery raw sugar input had averaged approximately 750 ppm dextran during this period.

A search through the literature for information on dextran flow through a cane sugar refinery, and how to deal with it, did not uncover much information useful to Chalmette. Most of the prior work had been done at raw sugar mills. Roberts *et al.* performed an analysis on polysaccharide flow through two cane refineries; however, this survey was not extended beyond white sugar boiling[5]. The Chalmette refinery was suffering from polysacchaide effects beyond this. To generate this information a dextran balance was made by the refinery staff.



M. J. Fowler

A detailed material balance of the refinery was calculated in July 1971, shortly after carbonatation replaced diatomaceous earth filtration. Another confirmatory materials balance was made in July, 1977. Accurate determinations of materials flow were therefore available.

Dextran analysis

For a comprehensive review of polysaccharide analyses the reader is referred to the work of Imrie & Tilbury[1]. A conclusive analysis for dextran involved exhaustive methylation, hydrolysis, and identification of the methlyated saccharide units[6]. This complex, time-consuming procedure was not suitable for the task at hand since large numbers of samples needed to be analysed. The modifications of Coll, Clarke & Roberts to the haze-development method as detailed in the *Cane Sugar Handbook, 10th Edition*, was therefore adopted[7,8]. The following modifications were made by the writer to adapt the analysis to a wider range of samples:

(a) *Dilution*. Most remelt syrups had to be diluted, especially those heavily laden with dextran. These samples were quantitatively diluted with a 40° Bx syrup made from dextran-free beet sugar prior to pretreatment. In this way solids/alcohol relationships remained constant, and the beet sugar did not contribute any dextran. It is interesting to note that some reagent-grade cane sugar proved to contain more than 100 ppm dextran.

(b) *pH adjustment*. Diluted samples were adjusted to 5.5 – 6.0 pH, the optimum pH for the amylase used (Mycolase – G.B. Fermentation Industries). High alkalinity in some process streams will deactivate the enzyme unless the pH is adjusted. Failure to do so leads to a plus bias as some starch is read as dextran.

(c) *Haze development*. The total volume of the alcohol/prepared sample mixture was doubled from 25 to 50 cm^3. This enabled the use of cuvette sizes up to 10 cm for low dextran levels and ensured that absorbencies were within the accuracy limits of the spectrophotometer. Haze development time was 60 minutes.

(d) *Calibration*. Carpenter, Clark & Roberts of the Cane Sugar Refining Research Project recommended the use of dextran of M. W. 40,000 for calibration. They felt the lower molecular weight material was more soluble and more difficult to remove by refinery filtration, and hence more likely to cause problems in the Remelt Department[8]. All dextran concentrations in this report were calibrated to Pharmacia T-40 lot 2771.

1 Imrie & Tilbury: *Sugar Tech. Reviews*, 1972, **4**, 291-362.
2 Greenfield & Geronimos: *I.S.J.*, 1978, **80**, 67-72.
3 Coll, Clarke & Roberts: *Proc. 35th Tech. Session Sugar Ind. Tech.*, 1978, **35**, 58-67.
4 Hanson: *Paper presented to 37th Tech. Session Sugar Ind. Tech.*, 1980.
5 Roberts, Godshall & Carpenter: *Sugar J.*, 1978, **40**, (8), 21-23.
6 Murphy & Whistler: "Industrial Gums: Polysaccharides and their derivatives", 2nd edn. Ed. Whistler & Bemiller: (Academic Press, New York), 1973, pp.513-542.
7 Coll, Clark & Roberts: *Tech. Rpt. Cane Sugar Ref. Research Project Inc.*, 1979, (46).
8 Carpenter & Clarke: Private communication, August 1979.

Reproducibility between several analysts of the test as modified was quite good. Additionally, it was later shown that process stream dextran concentrations, as analysed above, varied directly and proportionally with the dextran content of the raw sugar in melt. Processing problems that had been attributed to dextran as previously described in the literature cited also varied directly with the dextran concentration.

Sampling

Samples of the individual refining streams and raws in melt were collected during mid-week operations between March 1979 and March 1980. The majority of the sampling and analysis was concentrated in March and November 1979 and February-March 1980. A total of 400 individual analyses were performed during the course of the study; approximately 100 were run on individual raw sugars, 200 on the refinery streams directly and approximately 100 on liquors and massecuites.

The dextran concentrations of the samples were applied to the available materials balance and a dextran flow through the refinery was calculated. Figs. 1 – 6 illustrate this flow. The units depicted are normalized and can represent either kg or lb dextran or % dextran in melt.

The Chalmette refinery employs carbonatation of an amalgamated washed sugar liquor and remelt liquor main stream, followed by bone char decolorization. Remelt recovery is via a three-strike system.

Affination

Fig. 1 details dextran flow through the wash house. Little (30%) of the dextran was removed by affination and most was retained (occluded) in the washed sugar. This finding concurs with those of others[3,7]. Additional dextran input via the melting water (referred to locally as high purity sweetwater) was minimal and as such does not agree with some published data[5]. It must be remembered however that samples analysed for this survey originated from stabilized mid-week refining operations where all streams were moving and were at operating temperatures. Potential in-house dextran contribution from this stream is illustrated as entity "X" in Fig. 1.

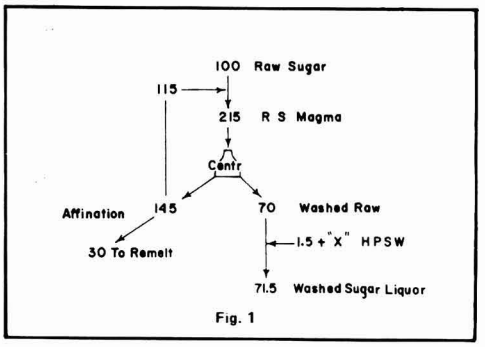


Fig. 1

Carbonatation

Fig. 2 details dextran flow through carbonatation. Analysis of liquors before and after carbonatation consistently showed a 20% to 23% decrease in dextran in carbonatated, filtered liquors. This is a significantly higher figure than shown by others[5]. Dextran flow through the carbonate muds was not determined directly but rather by calculation.

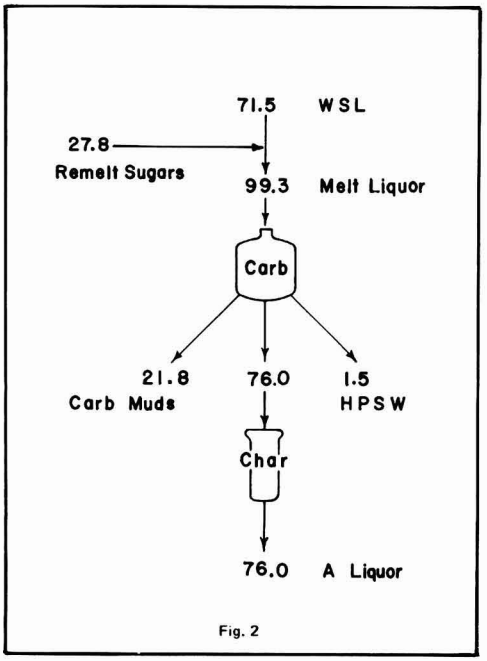


Fig. 2

It is interesting to note that dextran from raws in concentrations as high as 1400 ppm apparently did not affect the melt rate through carbonatation. Starch is the only known polysaccharide to have caused flow problems through the refinery's carbonatation system.

Bone char decolorization

Samples originating from both refinery operations and laboratory decolorization tests showed no decrease in dextran across bone char. This was also true of activated carbon decolorization employed in liquid sugar manufacture. Apparently ion exchange resins also have little effect[5].

White sugar house

Fig. 3 details dextran flow through white sugar pan boilings.

Pan strikes from No. 1 liquors consistently showed 18% to 25% dextran retention with the crystal. This is in agreement with other reports of problems in making low alcoholic haze sugar when the raws to melt contain dextran levels in excess of 250 ppm[4]. The percentage of dextran retention with the crystals decreased directly with the purity of the massecuite from 18% to 25% for 1st strike sugar to about 12% for 4th strike sugar. At this point the dextran concentration had quadrupled in 4th strike sugars which at times led to severe turbidity problems in liquid sugar manufacture. In addition, elongated grains and abnormal viscosities were felt as far upstream as third strike massecuites. The threshold of dextran concentration for the above problems to appear has not been determined; however, massecuites

above 3000 ppm were generally found to exhibit the above symptoms.

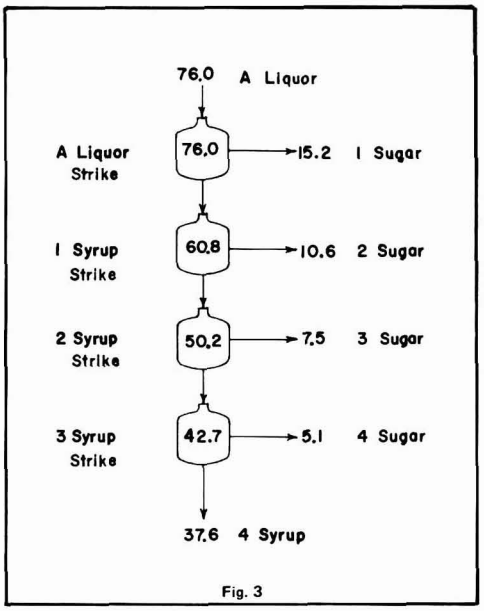


Fig. 3

Soft sugar manufacture

As in high purity sweetwater the potential for refinery generated dextran in low purity sweetwater exists, perhaps even more so owing to the source of the material

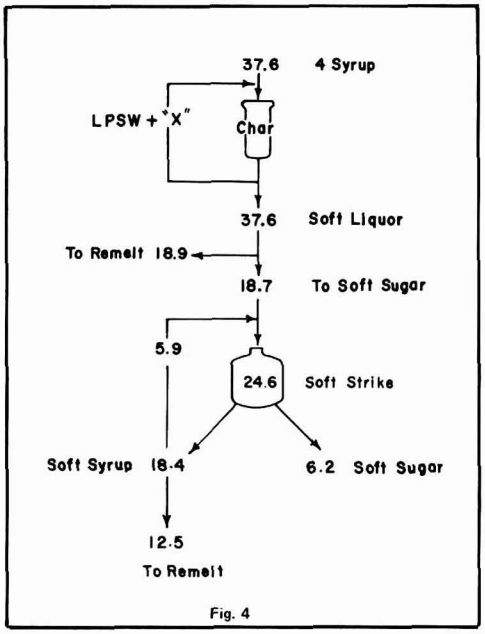


Fig. 4

and generally lower temperatures of the stream. This dextran balance (Fig. 4) assumes good refining practices are maintained and there are no internal dextran contributions. The potential for such, however, is illustrated in Fig. 4 by "X".

Laboratory-spun soft massecuites showed about 12% dextran retention but refinery samples indicated 25% retention was more usual on the centrifugal floor. The difference is probably due to the more complete separation and washing in the laboratory centrifuge and the fact that in the refinery a certain amount of the mother liquor is deliberately left on the soft sugar crystal.

Soft sugar dextran concentration directly affects soft sugar packagability in two ways: first, proper grain size is difficult to obtain owing to the elongated crystals and, second, the viscosity of the molasses coating the crystal is higher. Dextran concentrations above 1500 ppm in the product will guarantee packaging problems.

Remelt

Figs. 5 and 6 detail dextran flow through the remelt department. A detailed description is not necessary; however a few comments are germane:

(a) The trend of decreasing crystal retention with decreasing massecuite purities continued. For example, laboratory-spun final strikes showed 8% crystal retention whereas the same massecuite gave 18% crystal retention in a refinery continuous centrifugal.

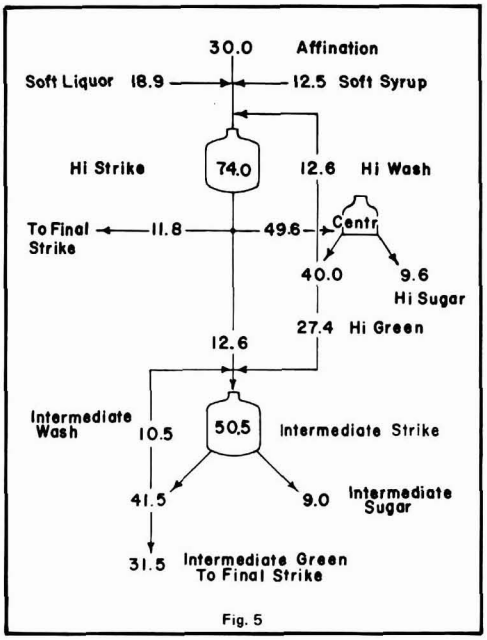


Fig. 5

(b) Moving the centrifugal washes back into the same grade strike increased the massecuite dextran content significantly.

(c) Viscosity and polarization problems due to dextran can be easily aggravated by deliberate recycle. For example, a 500 ppm dextran raw in melt would result in a 7500 ppm final molasses. Recycling one lot of this molasses for, say, higher than standard purity would be equivalent to dumping 500 pounds of pure dextran into the remelt stream of the Chalmette refinery.

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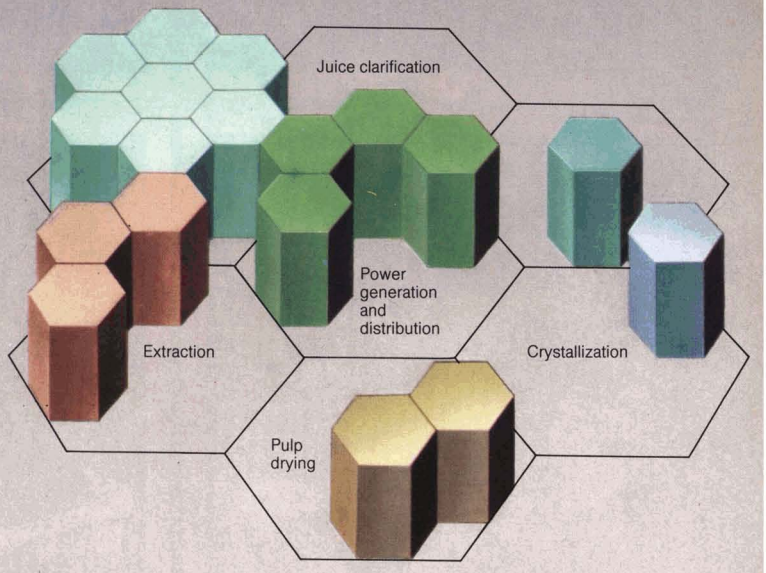

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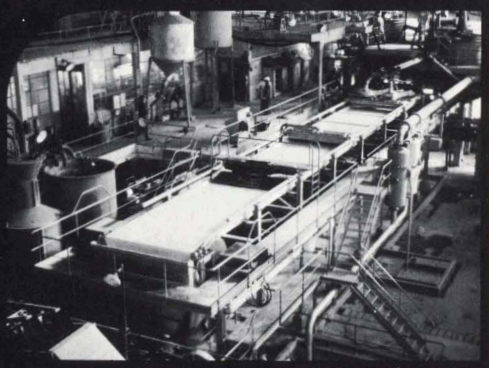

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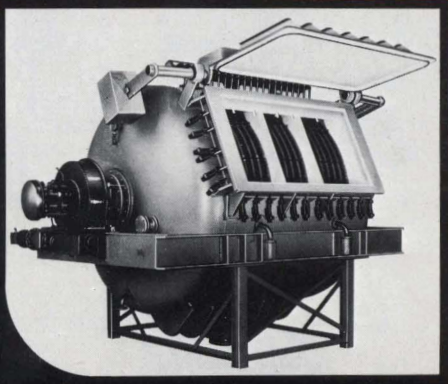

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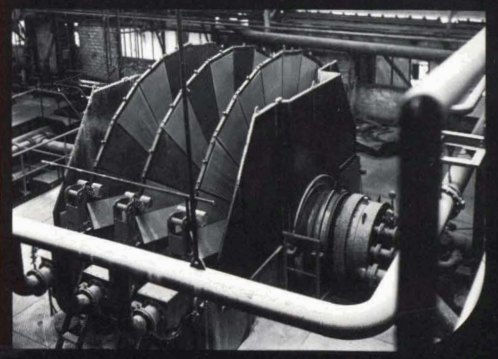

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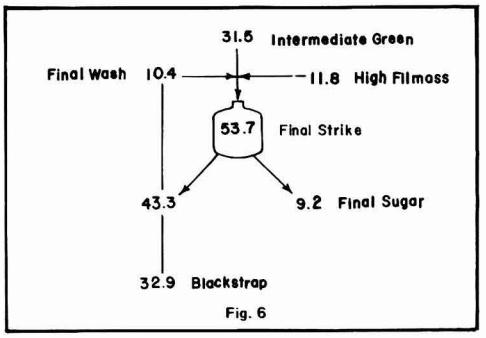

Fig. 6

Dextran forecasting

The dextran material balance above can be used in conjunction with a solids material balance to forecast dextran levels in the refinery streams once the dextran content of the raw in melt is known. The forecast equation is:

$$\text{ppm Dextran in Process Steam} = \frac{\text{ppm Dextran Raw x Norm Dex Unit (kg, lb, or \%)}}{\text{\% Solids Melt}}$$

This can be useful in selecting cargoes or blends of cargoes to take into the melt if there are high dextran raws in the storage sheds. If a blend is not practical then the forecast information can be valuable in planning operations; for example, taking less soft syrup back into soft strikes or planned purges of certain remelt streams to avoid congestion.

Acknowledgements

The author wishes to express his appreciation to the analytical staff of the Chalmette refinery for their efforts in this endeavour; special appreciation is given to Morris Dmitrovsky of the Technical Division of the American Sugar Division of Amstar Corporation for his guidance during the project.

Summary

A modified method of analysis for dextran can be used to determine the levels of this polysaccharide in lower purity refinery streams. Most (70%) of the dextran entering the refinery will pass into the washed sugar liquor. Carbonatation is the only refining unit operation surveyed in this study that significantly removed dextran in melt. Recrystallization incorporated between 8% and 25% of the dextran by weight according to analysis of sugars from laboratory-centrifuged massecuites. There is apparently a direct relationship between massecuite purity and amount of dextran occluded in these sugars. Refinery centrifuged sugars, especially remelt sugars, varied somewhat in this respect. Recycle significantly increases dextran concentrations. Levels of dextran in process streams can be forecast with a simple equation once the dextran level of the input melt raws are known.

Le circuit du dextrane dans le sucre brut à travers une raffinerie de sucre de canne

Une méthode d'analyse modifiée pour le dextrane peut être utilisée pour déterminer les taux de ce polysaccharide dans les circuits à basse pureté d'une raffinerie. La majeure partie (70%) du dextrane qui entre en raffinerie passera dans la clairce. La carbonatation est la seule opération unitaire du raffinage examinée au cours de cette étude qui élimine de façon significative le dextrane de la refonte. La recristallisation incorpora entre 8% et 25% en poids du dextrane, d'après l'analyse de sucres produits par centrifugation de masses cuites en laboratoire. Il y a apparemment une relation directe entre la pureté de la masse cuite et la quantité de dextrane occluse dans ces sucres. Les sucres centrifugés en raffinerie, particulièrement les sucres refondus, variaient quelquepeu à cet égard. Le recyclage accroît significativement les concentrations en dextrane. Les taux de dextrane dans les circuits de fabrication peuvent être prédits à l'aide d'une équation simple une fois connus le taux en dextrane des sucres bruts entrés à la refonte.

Rohzucker-Dextranfluß durch eine Rohrzuckerraffinerie

Eine modifizierte Methode der Dextrananalyse kann verwendet werden für die Bestimmung von Polysacchariden in Raffinerieprodukten niedriger Reinheit. Die Hauptmenge (70%) des in die Raffinerie eingeführten Dextrans wird in die gewaschene Zuckerkläre gelangen. Die Carbonatation ist die einzige von den Stationen der Raffinerie, über die in dieser Studie berichtet wird, in der Dextran signifikant aus dem aufgelösten Zucker entfernt wird. Bei der Umkristallisation werden 8 bis 25 Gew.–% des Dextrans eingeschlossen je nach Analyse der Zucker aus der Füllmasse von Laboratoriumszentrifugen. Anscheinend gibt es einen direkten Zusammenhang zwischen der Füllmassereinheit und der im Zucker eingeschlossenen Dextranmenge. Zentrifugierte Zucker in Raffinerien, besonders wieder aufgelöste Zucker, variierten etwas in dieser Hinsicht. Die Rücknahme erhöht signifikant die Dextrankonzentrationen. Der Dextrananteil im Prozeßstrom kann mit einer einfachen Gleichung vorausgesagt werden, wenn der Dextrangehalt des eingeführten Rohzuckers bekannt ist.

Flujo de dextrano de azúcar crudo dentro una refinería de azúcar de caña

Un método modificado de análisis para dextrano puede usarse para determinar los niveles de este polisacarido en flujos de baja pureza en una refinería. El mayor parte (70%) del dextrano que entra la refinería pasará en el licor que contiene el azúcar lavado. Carbonatación es la sóla operación en refinación examinado en este estudio que separó una parte notable del dextrano del licor. Recristalización incorporó 8 – 25% del dextrano por peso según análisis de azucares de masas cocidas centrifugado en el laboratorio. Parece que hay una relación directa entre pureza de la masa cocida y la cantidad de dextrano ocluido en estos azucares. Azucares centrifugado en la refinería, especialmente azucares refundidos, demuestran variaciones en este respecto. Reciclo crece notablemente las concentraciones de dextrano. Niveles de dextrano en flujos del proceso pueden pronosticarse por una ecuación sencilla del nivel de dextrano en el azúcar crudo para fundir.

Conveying exhibition. – An exhibition of conveying equipment is to be held at Harrogate, Yorkshire, England during August 25 – 27, 1981 and over 60 companies have already taken stands. Conferences will be held simultaneously to look at practical solutions to conveying problems in specific industries, that of food being held on August 25. Details are available from the organizers at ConveyorEX, 91–97 High Road, Ickenham, Uxbridge, Middx. UB10 8LB, England.

SUGAR CANE AGRONOMY

Soil modification with copolymer emulsions. R. T. Bishop and E. M. Kruger. *Proc. S. African Sugar Tech. Assoc.*, 1979, 177-181.– Experiments are reported in which a copolymer emulsion was sprayed over the cane row at a rate of 5 and 10 kg dry product per ha. At the higher rate, treatment improved germination and earlier development, gave more stalks at harvest and increased yield by comparison with controls. In addition to conserving soil moisture, the copolymer may also conserve water-sensitive soil additives such as fertilizers and herbicides by reducing losses caused by leaching.

The results of P fertilizer trials conducted in the Natal Midlands. J. H. Meyer and E. N. Dicks. *Proc. S. African Sugar Tech. Assoc.*, 1979, 182-188.– Experiments to determine the P requirement of strongly P-fixing soils and to provide data for calibration of the P desorption index (PDI) are reported. For routine advisory purposes, the currently used threshold value of 31 ppm P for the Truog test appears to be satisfactory for predicting when P fertilization is necessary, although a rapid screening technique based on the PDI may be justified in order to account for varying degrees of P sorption in soils. Soils with the same Truog P deficiency may not require the same amounts of applied P. A survey suggests that some 30% of the soils in the Natal Midlands would benefit from high rates of superphosphate. The value of third leaf P concentration as an indication of the P status in the plant is questioned, and it is considered possible that an assessment of nutrient balance is also necessary; alternatively, a more sensative diagnostic tissue such as the meristem or 8-10 internode could be of value.

The logistic curve of plant growth and its application to sugar cane. A. McMartin. *Proc. S. African Sugar Tech. Assoc.*, 1979, 189-193. – Quantitative data on the rate of development of a sugar cane crop show that the pattern follows that of the logistic curve of plant growth, in which a period of fast growth changes to one of slow growth at the point of inflexion; this point is important in both the time and growth scales. A formula equating the rate of growth with that of an autocatalytic chemical reaction permits prediction of the ultimate height on the basis of growth at the inflexion point. Factors causing a check in growth before the inflexion point appear to have a greater effect on crop development than if they occurred after the point.

The use of remote sensing from satellite imagery in the sugar industry. J. P. Fourie. *Proc. S. African Sugar Tech. Assoc.*, 1979, 200-202.– The value of satellite imagery for land use surveys is discussed and details are given of the Landsat 1 and 2 satellites launched in 1972 and 1975, respectively. It has been found that computer print-outs of spectral signatures reflected by the land surface of a test area, as sensed by the multispectral scanner on Landsat 2, give an extremely accurate picture of the vegetation, water bodies and land management practices in a region of Natal. It is considered that this could serve as a valuable aid in monitoring land use trends in the sugar industry.

Calcium silicate slag for sugar cane in Florida. I. Agronomic response. G. J. Gascho. *Sugar y Azúcar,* 1979, **74,** (8), 28-29, 32. **II. Economic response.** J. Alvarez and G. J. Gascho. *ibid.,* 32, 34-35.

I. Calcium silicate slag was applied at 4.9-11.6 tonnes.ha^{-1} before planting of four varieties of cane at eleven sites characterized by sandy and muck soils of low pH and low available Si. Results for plant and 1st and 2nd ratoon cane showed that treatment at nine of the locations increased cane and sugar yield per ha but did not affect the sugar content. There was no significant response at the two sites where there was sandy soil.

II. Examination of the economics of calcium silicate application showed that treatment would be profitable under conditions considered average by the authors.

Cane/sugar quality can be improved. Anon. *Cane Growers' Quarterly Bull.,* 1979, **43,** 17-18. – Programs for the improvement of cane and sugar quality have been set up in Queensland factory areas and involve liaison between growers and producers, with both cane farms and factories being open to inspection to ascertain that all is being done that is capable of being done to produce high-quality cane and sugar.

Water penetration problems in the Burdekin. P. J. McGuire. *Cane Growers' Quarterly Bull.,* 1979, **43,** 24. – Poor penetration of the soil by irrigation water was found to be due to the presence of sodium carbonate and bicarbonate in the water. The sodium replaces calcium in the soil which subsequently forms a slurry and leads to poor penetration, particularly where the soil has a high silt and clay content as well as a low organic matter content. The problem has been overcome by applying calcium sulphate as gypsum to the soil in order to replace the sodium with calcium.

Lime application can aid productivity. C. R. Nalder. *Cane Growers' Quarterly Bull.,* 1979, **43,** 26-27. – The requirements of a good lime are discussed, and a list is presented of types of lime, their analyses and suppliers in Queensland. Here, the term "lime" is used for CaO, pulverized limestone ($CaCO_3$), magnesium carbonate and gypsum (calcium sulphate); the Ca content ranges from 13% to 64%.

Effect of chemical ripener Asulox-40 on sugar cane quality. J. D. Chougule and B. R. Patil. *Maharashtra Sugar,* 1979, **4,** (8), 41-42, 44-45. – Foliar application of Asulox-40 increased the juice Brix in plant and ratoon cane, the maximum effect being obtained by harvesting 8 weeks after treatment with 4 kg a.i. per ha in the case of plant cane and with 3 kg a.i. per ha in ratoon cane. However, pol % cane was higher only in the case of plant cane treated with 3 kg ripener per ha. Treatment did not adversely affect crop yield in plant cane and produced a 10% increase in ratoon yield.

Mechanical stool eradication. Anon. *S. African Sugar J.,* 1979, **63,** 357. – A simple modification to a mouldboard plough for eradicating old cane stools is described. An alternative method mentioned is spraying with Roundup at 10 litres.ha^{-1} but only when the crop is growing actively.

SUGAR CANE MECHANIZATION

Equipment maintenance program at Honokaa Sugar Company. T. Matsunaga. *Rpts. 37th Ann. Conf. Hawaiian Sugar Tech.*, 1978, 123-124. – The field equipment and road vehicle maintenance program at Honokaa Sugar Co. is outlined.

Pioneer Mill Company maintenance management principles and implementation. A. S. Hall and W. H. Frankenfield. *Rpts. 37th Ann. Conf. Hawaiian Sugar Tech.*, 1978, 125-127. – Factors in the operation of an efficient maintenance program are considered, and implementation of a system of field equipment maintenance management based on the principles of such a program is described.

Newest harvester at Stubenberg. J. R. Marshall. *Rpts. 37th Ann. Conf. Hawaiian Sugar Tech.*, 1978, 131-132. Details are given of the Stubenberg S-75 II chopper-harvester and of tests on it at Laupahoehoe.

Effect of seedpiece length and covering delay on yields of mechanically harvested seed cane. B. Eiland and J. Miller. *Rpts. 37th Ann. Conf. Hawaiian Sugar Tech.*, 1978, 133-135. – Setts of four different lengths from two varieties were placed in open furrows by hand and covered with soil either on the same day or 3, 5 and 7 days later. The lengths were approx. 15-20, 30-55, 45-50 and 53-58 cm; the varieties were CP 63-306 (of small diameter but relatively quick emergence) and CP 63-588, the major variety in Florida, which has a large diameter and is known to compensate for skips. Tabulated results indicated that, for each length of sett, delay in covering had an adverse effect on yield, this effect increasing with the delay. In November and February plantings, the yield differences between setts covered on the same day and 3 days later were considerable, whereas in January the difference was not statistically significant, although the trend was the same as in the other two months. CP 63-588 gave higher yields than CP 63-306, except in the case of setts covered on the same day in November, and was less affected by delays in covering. Setts at least 45 cm long gave the highest yields.

Sugar cane varietal characteristics and harvester performance efficiency in Florida. B. Eiland, J. Clayton and J. Miller. *Rpts. 37th Ann. Conf. Hawaiian Sugar Tech.*, 1978, 136-140. – The harvesting properties of 9 cane varieties were determined in 3-year experiments. Harvester losses and performance were governed by stem erectness and diameter, stems of small diameter and high population giving lower losses than large-diameter stems. Yields of a number of varieties fell as a result of fall in population and % skippage in 2nd ratoon crops, only those varieties of good ratooning ability, small stalk diameter and having good root systems maintaining yields over the three harvests and therefore showing promise for mechanical harvesting in Florida.

Experiences with mechanized cane production systems at La Mercy. E. Meyer and B. Worlock. *Proc. S. African Sugar Tech. Assoc.*, 1979, **53**, 143-146. – The La Mercy farm, acquired by the South African Sugar Association Experiment Station, has been used to measure the performances of cane equipment under reasonably standard and well-defined field conditions. Long-term average standards (expressed in tractor hours per ha) have been established for a number of operations and the average performances of specific harvesters and loaders determined. Time-and-motion studies were used to establish standards for various cane handling systems that should be well within the reach of cane farmers. In addition, studies were made of the effects of compaction and of planting date on germination. Compaction reduced germination under certain conditions, particularly in heavy soils (soil moisture also affecting results), while planting in spring and early summer was preferable to planting in late summer and autumn; provided soil tilth conditions were good, soil type had only slight effect on germination.

A first report on the La Mercy project. J. P. Fourie and A. G. de Beer. *Proc. S. African Sugar Tech. Assoc.*, 1979, **53**, 147-151. – Details are given of the La Mercy farm leased by the SASA Experiment Station for tests on mechanical harvesters and harvesting systems. Of the 958 ha (expropriated but not immediately required for a new airport), 112 ha was divided into four adjacent catchments of about the same area and laid out according to designs already in use on cane farms. All operations on each catchment were recorded, including conservation and land preparation work. Information is given on the field layouts, and, briefly, on the mechanization systems. A plant crop and at least one ratoon crop have been harvested, from which much experience has been gained on soils and topography typical of a large proportion of land used in the South African cane industry.

Field performance of chopper harvesters. A. G. de Beer and T. C. Boevey. *Proc. S. African Sugar Tech. Assoc.*, 1979, **53**, 158-162. – In an experiment to compare losses incurred in manual and mechanical harvesting, comparison was also made between two makes of harvester, both practically new (having previously been used only for demonstration purposes) but one (A) maintained in excellent condition, while the other (B) had been somewhat neglected. Of an estimated 118.9 tonnes of cane per ha standing in the field, manual cutting recovered 116.4, machine A 110.8 and machine B 100.7 tonnes.ha^{-1}. Trash content of the harvested cane (burnt after chemical ripening) was 3.1% for hand cutting, 6.1% for harvester A and 7.0% for harvester B. The results obtained with harvester A were comparable to those found previously for other machines, while those for machine B should not be considered typical for that make of harvester but do indicate the effect of neglect on performance.

A report on the mechanization of the sugar industry in Mexico. S. F. Echevarría. *Sugar y Azúcar*, 1979, **74**, (9), 25-26, 28-29, 32. – A survey is presented of mechanical cane loading and cane transportation in Mexico, where cane is cut manually.

More on wide furrows. C. Richard. *Sugar Bull.*, 1979, **57**, (21), 8-10. – Various techniques and equipment used by Louisiana cane farmers in experimentation with wide-furrow planting are described.

CANE PESTS AND DISEASES

Some observations on sugar cane rust in Andhra Pradesh (India). M. N. Sarma and S. V. R. Rao. *Sugarcane Pathologists' Newsletter,* 1979, (22), 13-14.-CoA 7601 is the cane variety, introduced for commercial cultivation in 1976, that has proved most susceptible to rust in Andhra Pradesh; Co 975 cane, previously unaffected by the disease, became infected when grown adjacent to CoA 7601. The disease becomes severe in crops ratooned in December-January, which appear to act as a focus of infection in crops planted in February-March, although crops planted in May-August for seed production are more prone to the disease than the February-March planted cane. The relationship between climatic factors and rust incidence is discussed. While Ferbam, of a number of fungicides applied at monthly intervals in November-February, approximately halved incidence when this was at its peak, the incidence rate in untreated cane fell to about 10%, compared with 5% in sprayed crops, when the temperature rose in February, so that such treatment is not considered economically justified.

Monitoring the spread of Fiji disease. P. E. Ledger and B. T. Egan. *Sugarcane Pathologists' Newsletter,* 1979, (22), 29-31. – Details are given of the monitoring scheme applied to Fiji disease in the Bundaberg district of Queensland, where the disease has caused considerable losses but is expected to decrease in intensity as N:Co 310 cane is replaced by resistant varieties.

Downy mildew: a new disease of sordan and Johnson grass in Puerto Rico. L. J. Liu. *Sugarcane Pathologists' Newsletter,* 1979, (22), 32-33. – The occurrence of *Sclerospora graminicola* on sordan and Johnson grass in Puerto Rico is reported. The disease has not been found on sugar cane in the country.

Autoclavable polypropylene bags as culture vessels for bulk production of eye spot toxin. R. G. Birch and C. C. Ryan. *Sugarcane Pathologists' Newsletter,* 1979, (22), 34-36. – Helminthosporoside, the host-specific toxin produced by *Drechslera sacchari,* has been shown to be of value in determining the reaction of cane seedlings to eye spot. However, the quantities of partially purified toxin obtained is only a small fraction of the original *D.sacchari* culture used, so that an efficient method of producing large culture volumes was sought. Success was achieved using as culture vessel a polypropylene bag which was treated in such manner that it could then be heated under constant pressure for 20 min and gently inflated while still warm. When cooled, the bag retained its inflated shape. Inoculum was injected with a sterile syringe and incubation carried out for 22 days at 28°C. Plants (1 month old) of cane varieties known for their responses to eye spot were sprayed with the toxin and subsequently found to have symptoms that conformed reasonably well to their known range of susceptibility to eye spot.

Sheath rot disease of sugar cane in Bangladesh. H. U. Ahmed, M. A. Khan and M. H. Rahman. *Sugarcane Pathologists' Newsletter,* 1979, (22), 36-37. – CP 63-588, introduced at the Sugarcane Research Institute in Bangladesh from Canal Point, Florida, was found to exhibit symptoms subsequently identified as those of sheath rot (*Cytospora sacchari*). Four more varieties grown in the same net-house as CP 63-588 were also infected, but not seriously. The disease has not been found on field-grown cane in Bangladesh. Although sheath rot is considered of minor importance, care is considered necessary in the introduction of new varieties of cane.

Canopy penetration of agrochemicals sprayed by helicopter in sugar cane. C. Ricaud, S. Sullivan, C. Soopramanien and R. Julien. *Sugarcane Pathologists' Newsletter,* 1979, (22), 38-41. – Investigations were carried out to determine the penetration of the leaf canopy by droplets of Benomyl sprayed from the air to control yellow spot. A phosphorescent chemical was mixed with the Benomyl solution, so that the spray droplets on the cane leaves appeared as orange fluorescent spots under ultra-violet light. Results indicated good penetration, with satisfactory coverage as far as the 10th leaf down the stalk. Coverage was better at 34.1% with variety M 13/56 than with S 17 (21.6% for flowered stalks and 21.8% for vegetative stalks); this difference is attributed partly to the high flowering rate with the latter variety, the arrows interfering with droplet distribution, and partly to leaf morphology differences, the leaves of M 13/56 being narrower and more erect. The limited systemic action of Benomyl and the presence of morning dew on the leaf surface are expected to promote redistribution of the droplets and thus make treatment more effective.

Cane pathology. *Ann. Rpt. Sugar Ind. Research Inst., Agric. Divn.* (Jamaica), 1975, 21-22. – Information is given on the cane disease situation in Jamaica, where the only disorders were of minor importance.

Entomology. *Ann. Rpt. Sugar Ind. Research Inst., Agric. Divn.* (Jamaica), 1975, 29-35. – The jumping borer *(Elasmopalpus lignosellus),* West Indian cane fly *(Saccharosydne saccharivora)* and subterranean termites are the insect pests mentioned as causing cane damage in Jamaica. Mention is also made of damage to cane by trespassing livestock, which cause a considerable monetary loss despite efforts by cane farmers to control the situation.

Screening of sugar cane varieties against red rot disease. M. R. Gupta, R. Kumar and R. S. Solanki. *Indian Sugar,* 1979, **28**, 745-748. – Details are given of the resistance ratings of 12 cane varieties to red rot as determined in screening tests in 1975-78.

Insect pests of sugar cane in Punjab and their control. II. Borers. D. O. Garg and J. P. Chaudhary. *Indian Sugar,* 1979, **28**, 749-755. **III. Mandibulate pests.** *Idem ibid.,* 799-802.

II. Nine species of borer responsible for cane damage in Punjab (including the maize borer, *Chilo zonellus*) are described, with details of their life cycles, and means of control are indicated.

III. The pests discussed include two species of grasshopper (*Hieroglyphus banian* and *H. nitrorepletus*), a species of armyworm (*Pseudaletia unipuncta*), termites and three species of white grub.

The study of physiological races in *Ustilago scitaminea* Syd. V. V. Shingte, D. G. Hapase, S S. Lambhate and M. B. Bachchhav. *Indian Sugar*, 1979, **28**, 803-804. See *I.S.J.*, 1980, **82**, 213.

Screening of sugar cane varieties against smut disease in Maharashtra state. V. V. Shingte, M. B. Bachchhav, S. S. Lambhate, T. K. Ghure and D. G. Hapase. *Indian Sugar*, 1979, **29**, 81-85. – The smut resistance ratings of 157 cane varieties are listed. Only 6 were found to be completely free from the disease under field conditions after inoculation of 3-budded setts by soaking in a spore suspension for 30 minutes.

A comparison of methods for extracting nematodes from soil and roots of sugar cane. V. W. Spaull and J. M. C. Braithwaite. *Proc. S. African Sugar Tech. Assoc.*, 1979, **53**, 103-107. – Of five methods compared for extraction of nematodes from soil samples (three sandy and three clay), none was superior to the others for all genera in any one particular soil; however, the decanting-sieving-Baermann tray method was generally best for sandy soils and the decanting-sieving-sugar flotation method the most suitable for clay soils. Descriptions are given of these and the other three methods (Baermann tray, two-flask sedimentation and direct sugar flotation). Differences were found between the numbers of nematodes extracted according to the incubation technique and between chopped and macerated roots.

The situation regarding *Eldana* borer (*E. saccharina* Walker) during 1978/79 and assessments of crop loss. R. J. Smaill and A. J. M. Carnegie. *Proc. S. African Sugar Tech. Assoc.*, 1979, **53**, 108-110. – Data are given showing the percentage of cane stalk samples damaged at each of 14 sugar factories and the incidence of *E. saccharina* and *Sesamia calamistis* in 1978/79. Results indicated an increase in *E. saccharina* incidence south of the Tugela river in Natal, but otherwise a stabilization of the situation. Measurements of crop loss showed that about 0.1% recoverable sugar is lost for every 1% of stalks damaged by *E. saccharina* which, although mainly a stalk borer, can also be considered as a shoot borer, a stubble borer and very occasionally a top borer.

Distribution and natural hosts of *Eldana saccharina* Walker in Natal, its oviposition sites and feeding patterns. P. R. Atkinson. *Proc. S. African Sugar Tech. Assoc.*, 1979, **53**, 111-115. – Details are given of the distribution of the borer in Natal, where it is found in a relatively narrow coastal belt, and of natural and host crops as recorded in the literature and found by surveys. The insect was found to lay its eggs in dead rather than live leaf material, and showed a preference for *Cyperus immensus* (large sedge), sugar cane and *Cyperus latifolius* (a large sedge similar to *C.immensus* but not usually a host plant) in that order. From investigations of the feeding sites in the various host plants, it is suggested that cane attracts the pest because it provides attractive egg-laying sites in the form of abundant dead leaf material about the base of the plant. This explains why incidence is usually low in young green cane but rises in older cane.

Attempts at the biological control of *Eldana saccharina* Walker (Lepidoptera:Pyralididae). A. J. M. Carnegie and G. W. Leslie. *Proc. S. African Sugar Tech. Assoc.*, 1979, **53**, 116-119. Details are given of attempts at parasitization of *E.saccharina* with four species of tachinid fly, a braconid wasp and two trichogrammatid egg parasites. For various reasons there was no success in achieving sufficient parasitization to justify field releases. *Descampsina sesamiae*, a natural African parasite of the borer which has not yet been recorded in southern Africa, was not sufficiently tested because of high mortality in transport and because of mating difficulties, but is to be further tested; a consignment of *Paratheresia claripalpis*, a natural parasite of *Diatraea* spp. in Brazil, became infected with a fungus, but is also to be subjected to further tests.

An assessment of the status of sugar cane diseases in South Africa. R. A. Bailey. *Proc. S. African Sugar Tech. Assoc.*, 1979, **53**, 120-128. – The incidence, potential for further spread, estimated yield losses and possibilities for control of a number of diseases are assessed. While ratoon stunting disease is considered the worst in terms of yield loss, it is stressed that it is the easiest disease to control by hot water treatment of setts and ensuring that these are planted in fields free from infected volunteer cane. The incidence of smut and mosaic is increasing, largely because of the dependence of areas, climatically favourable to disease development, on highly susceptible varieties. A list of varieties shows that N:Co 376, representing 63.5% of the 1977/78 crop, is highly susceptible to smut, mosaic, red rot and basal stem rot and is highly intolerant of RSD, while N 55/805, constituting 10.4% of the crop, is highly susceptible to smut, rust and gumming disease.

Possibilities for the control of sugar cane smut (*Ustilago scitaminea*) with fungicides. R. A. Bailey. *Proc. S. African Sugar Tech. Assoc.*, 1979, **53**, 137-142. – Of various treatments and fungicides tested for their effectiveness in controlling smut in N:Co 376 cane (which is highly susceptible to the disease), the best was 2 hours' hot water treatment at 50°C with addition of Triadimefon to the hot water (125, 250 or 500 $\mu g.cm^{-3}$). This also eliminated ratoon stunting disease from seed cane and prevented re-infection by smut. Some promising results were also obtained when the fungicide was applied as a cold soak treatment to setts or when applied to them in the furrow in granular or spray form. A 30 min hot water treatment with the fungicide may also be effective and would be suitable for use in planting cane in commercial fields. The questions of suitable concentration of Triadimefon in the hot water tank and of the period during which it remains active in the tank remain to be answered.

Sugar cane rust in Florida. J. L. Dean, P. Y. P. Tai and E. H. Todd. *Sugar J.*, 1979, **42**, (2), 10. – Mention is made of the discovery of rust (tentatively identified as *Puccinia melanocephala*) in Florida in 1979.

The need for sugar cane quarantine. Anon. *S. African Sugar J.*, 1979, **63**, 337. – Details are given of the quarantine procedure used in South Africa for imported cane varieties; the entire process from introduction in the country to removal to Mount Edgecombe experiment station takes about two years.

Updated general recommendations for control of *Eldana*. Anon. *S. African Sugar J.*, 1979, **63**, 355. Testing for presence of the borer *E.saccharina* and recommended control measures are described. There is no insecticide at present that is successful against the pest, so that control is limited to cultural practices designed to keep the borer in check.

CANE BREEDING AND VARIETIES

B 41242, an early maturing and high yielding sugar cane for suru planting. A. D. Karve and A. R. Ghanekar. *Proc. 27th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1976, (1), Ag.61-Ag.63. – Comparison of B 41242 with Co 678, Co 740, J 46 and J 64 showed that it was the earliest maturing variety of the five and outyielded the four indigenous varieties.

Co 6407, a new promising sugar cane variety. V. S. Mane, C. D. Salunkhe and Y. D. Aher. *Proc. 27th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1976, (1), Ag.83-Ag.88. – Varietal trials are reported in which Co 6407 was compared with other varieties in the Co series as well as P 12666. It was comparable to Co 740 in yield and quality; other varieties that gave higher yields of cane and sugar suffered from a number of disadvantages. Co 6407 is a fairly good ratooner and is resistant to red rot, although slightly susceptible to smut.

Yield performance of 67-611 in the VMC district farms. F. C. Barredo, A. T. Barredo and F. I. Ledesma. *Sugar News* (Philippines), 1979, **55**, 17-19, 28. – The cane and sugar yields are given for eight years of trials and two years of commercial growing of the variety VMC 67-611. While the hybrid has given consistently high yields of cane, its yield of sugar per tonne of cane was lower than for other commercial varieties grown in the same district; however, before its release in 1976 it raised sugar yield on some farms by 22-31%, and after release raised it by 19% on eleven farms.

Varietal development – future outlook. D. J. Heinz and T. Tew. *Rpts. 37th Ann. Conf. Hawaiian Sugar Tech.*, 1978, 32-35. – An outline is presented of cane breeding and its objectives at the HSPA Experiment Station, including the work involved in developing new varieties, the value of chromosome manipulation as a means of increasing yield, and breeding for higher weights of cane (as opposed to cane of higher juice quality) through development of new germplasm sources and ripeners. Details are given of some varieties that have shown promise in various aspects.

More on the Louisiana variety program. W. Jackson. *Sugar Bull.*, 1979, **57**, (19) 6, 11. – The problems facing the cane breeder in Louisiana are discussed and desirable characteristics in a variety are indicated, particularly resistance to lodging and disease, and ratooning ability.

Variety improvement. *Ann. Rpt. Sugar Ind. Research Inst., Agric. Divn.* (Jamaica), 1975, 16-20. – Details are given of the distribution of commercial varieties in Jamaica, where HJ 5741 accounted for 37% of the area reported, followed by UCW 5465 (24%). Information is also given on varietal trials and other aspects of cane breeding.

Sugar cane crossing at Canal Point between 1973 and 1977. J. D. Miller. *Sugar Bull.*, 1979, **57**, (19), 8-11. Details are given of the cane crossing program at Canal Point, Florida, with mention of procedural changes shown by experience to be desirable.

Energy crisis – sugar cane a candidate. J. T. Rao, A. S. Ethirajan, P. Sankaranarayanan, B. V. Natarajan, R. Nagarajan and K. V. Bhagyalakshmi. *Indian Sugar*, 1979, **29**, 77-80. – The yields of fermentable solids and fibre are given for a number of clones of *Saccharum spontaneum* and *S. robustum* in the collection at the Sugarcane Breeding Institute, Coimbatore. On the basis of the data, it is suggested that these and *Erianthus* germplasm could serve as the nucleus of a breeding program to establish varieties for fermentation to ethanol and methanol for use as fuel.

Co 7704 – a rich, high-yielding, early variety of eight month's duration. P. A. Candasami, K. C. Alexander, C. M. Radhakrishnan and P. N. Santhakumariamma. *Indian Sugar*, 1979, **29**, 87-88. – Performance data are given for the title variety, first released in 1977 and having as parents Co 740 and Co 6806.

Observations on the interaction between selected seedlings and the selection stage. D. W. Thomas. *Proc. S. African Sugar Tech. Assoc.*, 1979, **53**, 165-166. – Reasons for low numbers of seedlings from crosses made in recent years were investigated. High temperature and low humidity at the time of pollen shed evidently have a direct effect on the seedling numbers, while time of flowering in the seasons, photoperiod treatments and possibly nutritional status of the cane seem to have an indirect effect through their influence on the flower before pollination.

Evaluating a new variety (N 11) in seed cane increase plots by means of a sample harvest method. R. S. Bond. *Proc. S. African Sugar Tech. Assoc.*, 1979, **53**, 170-172. A method of estimating yield is described which was used to determine the yield of the new variety, N 11, in 17 seed cane increase plots. Comparison with results for the variety in selection trials before release and with estimated potential yield (obtained from yields of N:Co 376 cane planted in adjacent plots at the same time) showed, by regression, that N 11 was apparently a stable variety. However, the method should be extended to ratoon crops to enable yield stability to be established satisfactorily.

Improvements in the methods of raising sugar cane seedlings. C. C. Lo, K. S. Yang and Y. H. Hsieh. *Rpt. Taiwan Sugar Research Inst.*, 1979, (84), 1-10 (*Chinese*). Four new methods of improving the raising of cane seedlings are described. Each cross was tested for germination, and from the number of seedlings per flat an optimum was established. Use of a tunnel made of polyethylene inside the greenhouse saved electrical energy and protected young seedlings from low night temperatures. Dazomet applied as soil sterilant at 150 $g.m^{-3}$ gave results comparable to those obtained with methyl bromide at 1.5 $lb.m^{-3}$ and was safe to handle. Clipping seedlings during transplanting increased the number of tillers.

The release of new variety N 12. Anon. *S. African Sugar J.*, 1979, **63**, 332. – Details are given of this variety, a progeny of N:Co 376 x Co 331. Its performance relative to that of N:Co 376 is reported.

SUGAR BEET AGRONOMY

Sugar beet cultivation in the Nile Delta region of Egypt (Kafr el Sheikh perimeter). J. C. Legoupi. *Agron. Trop.*, 1979, **34**, (1), 80-87 *(French)*. – On the basis of results obtained in beet agronomy in the Mediterranean region particularly the irrigated area of Upper Cheliff in Algeria, the author gives guidelines for beet cultivation in the Kafr el Sheikh area of the Nile Delta, where the Egyptian Government plans to create a major beet-growing industry.

Sugar beet cultivation in Japan. G. Mantovani. *Ind. Sacc. Ital.*, 1979, **72**, 72-76 *(Italian)*. – A brief survey is presented of beet agronomy and breeding in Japan.

Advantages of the three-row bed system. G. Scott. *British Sugar Beet Rev.*, 1979, **47**, (2), 45-46. – Details are given of the system used at a farm in East Anglia where the beets are grown in 3-row beds made up of rows 46 cm (18 in) across with 60 cm (24 in) between beds, instead of the previous 50 cm (20 in) rows. The system was introduced in order to allow more room for tractor and machinery wheels. Advantages of the method are listed.

Effect of plant spacings and methods of sowing on quality of sugar beet (*Beta vulgaris* L.) varieties. S. Kumar and K. L. Behl. *Indian Sugar Crops J.*, 1979, **6**, 34-35. Results of trials showed that, for highest root and sugar yield, the most suitable was an inter-seed spacing of 15 cm; next best was a spacing of 20 cm, while one of 25 cm gave poorest results. In all cases, an inter-row spacing of 50 cm was used.

Losses in harvesting and storage. Anon. *Die Zuckerrübe*, 1979, **28**, (5), 16-17 *(German)*. – Advice is given on how to reduce harvest losses, through adoption of suitable speed and harvester adjustment for minimum dirt tare and optimum topping height, and minimize beet respiration during storage, Factors favouring respiration are listed, and protection of stored beet against frost is also briefly mentioned.

Problems concerning liquid manure. H. Hoffman. *Die Zuckerrübe*, 1979, **28**, (5), 18-20 *(German)*. – The advantages and disadvantages of liquid manure application to beet fields are discussed, and crop results obtained by applying various quantities of pig and poultry manure are tabulated. Typical nutrient compositions are given, as are the average K, Na and N concentrations in beet (hence, the melassigenic effect) as a result of liquid manure application in 1975-78.

Results obtained during the final year of the sugar beet project in Natal. N. G. Inman-Bamber. *Proc. S. African Sugar Tech. Assoc.*, 1979, **53**, 194-199. – Results of experiments covering lime application, chemical weed control, nematode control, varietal sugar yield differences, disease control with fungicides, sowing date and yield potential are discussed.

Causes of chlorosis in certain fields. R. Vanstallen. *Le Betteravier*, 1979, **13**, (134), 11-12 *(French)*. – Chlorosis among beets in a year when virus yellows was either completely absent or present only to a very slight degree was attributed to poor moisture retention in soil of high lime content. Means of overcoming the problem are briefly indicated.

The value of sugar factory muds. R. Vanstallen and A. Jardin. *Le Betteravier*, 1979, **13**, (134), 13 *(French)*. The value of filter cake as a source of lime for application to beet fields is discussed, and the typical composition of 1 tonne of filter cake is given. When and how much to apply to the soil is briefly indicated.

Clamping for minimum sugar and beet losses. J. F. T. Oldfield, J. V. Dutton and B. Houghton. *British Sugar Beet Rev.*, 1979, **47**, (3), 7-10. – Sugar losses in beets stored in clamps of various types for 5-10 weeks could be typically 5% over the period, although they could be double this figure where clamp temperatures were high and/or the beets stored in a dirty state. In addition, deterioration of the beets may occur, resulting in an extra loss in the form of inversion, although invert sugar poses nothing like the serious problems created by dextran formed as a result of frost damage. Mention is made of the stages in deterioration of beets when thawed, and advice is offered on means of avoiding excessive losses.

Cultivations on heavy soil types. A. Kennedy. *British Sugar Beet Rev.*, 1979, **47**, (3), 12, 21. – Comparison of various methods of seedbed preparation showed that highest plant population was obtained where autumn ploughing plus two autumn passes with a heavy springtine cultivator (to give a loose soil with clods of a size easily penetrated by frost and allowing drainage of heavy winter rains) was followed by two passes with a Dutch harrow in spring. Using a power harrow after the two cultivations in autumn to give a finer soil resulted in the next highest population. The other treatments involved autumn ploughing and spring cultivation.

Sugar beet growing in the seventies. G. Maughan. *British Sugar Beet Rev.*, 1979, **47**, (3), 53-54. – A brief survey is presented of beet agricultural practices in the UK, showing changes that have come about during the 1970's.

Soil preparation for sugar beet. I. Gutmanski *Gaz. Cukr.*, 1979, **87**, 208-212 *(Polish)*. – From results obtained during past years at various locations in Poland, it is concluded that highest beet and sugar yields are obtainable if the soil is disced in the autumn to a depth of 5-10 cm at a time that is suitable as regards soil type and moisture content.

Effect of the French harvesting method (removal of leaves by flailing) on the processing quality and storage properties of sugar beet. M. Disman, S. Hajkova and J. Styblo. *Listy Cukr.*, 1979, **95**, 193-198 *(Czech)*. Comparison was made between the composition and storage losses of beets topped by flailing, so that 3-5 cm of the leaves remained, and topped in accordance with Czechoslovakian standard instructions. Results showed that flailing reduced the sugar content and increased ash and amino N contents as well as storage losses, while processing was little affected.

CANE SUGAR MANUFACTURE

Extraneous matter in cane and its effect on the extraction plant. J. P. Lamusse and S. Munsamy. *Proc. S. African Sugar Tech. Assoc.*, 1979, 84-89.– Data are given on the amount of extraneous matter (trash, tops, sand and soil) found in cane delivered to South African factories. Tests on milling of burnt and unburnt cane showed that throughput was increased by 15% as a result of a 5% reduction in trash brought about by burning, while average extraction was somewhat higher for burnt cane, although pol % bagasse and moisture % bagasse were almost the same in both cases, indicating that it was the reduction in fibre content and the resultant lower weight of bagasse that led to the higher extraction. The power consumption of knife sets and shredder was only 3-5% higher with unburnt cane when expressed as kWh per tonne of fibre, which indicates that "quality" of fibre is also of importance. The effect of burning was not as great in cane diffusion; this was attributed to the effect of higher imbibition % fibre (at constant water flow rate) with unburnt cane, so that pol % bagasse was lower and helped compensate for the increased weight of bagasse per tonne of cane. The economic effects of extraneous matter are examined; increased length of crushing season as a result of reduced throughput, reduction in sugar production and extra transport and factory maintenance costs represent a total extra cost of over R 1,000,000 ($1,350,000) without allowing for reduced boiling house recovery.

Steam balance for a low-fibre Brazilian sugar factory. D. J. L. Hulett. *Proc. S. African Sugar Tech. Assoc.*, 1979, 94-97.– Two steam balances are given for a sugar factory crushing 800 tonnes of cane per hr at a fibre content of 10%. Both schemes use exhaust steam from high-pressure turbo-alternators to drive mill turbines. The first makes use of thermo-compressors and allows for a 45.9% steam consumption on weight of cane, while the second, using more extensive bleeding, reduces it to 39.5%.

Single-tray rain-type condensers. J. M. Moult and J. H. Smits. *Proc. S. African Sugar Tech Assoc.*, 1979, **53**, 98-102. – After a request for design data to improve the performance of an existing evaporator condenser of the tray type, the Sugar Milling Research Institute consulted the literature on rain-type condensers and examined the performance of one at another South African factory. This led to successful conversion of the tray-type, after which the SMRI proceeded to develop a design program for rain-type condensers. As a result, a number of these are now in operation in South Africa, and their performance has been generally successful, regularly returning approach temperatures below 3°C. Conversion of a cascade condenser to a rain-type costs only a fraction of that of a new condenser. The design criteria and tests conducted on various single-tray, rain-type condensers are described.

Quality sugar from quality cane. Anon. *Cane Growers' Quarterly Bull.*, 1979, **43**, 6-11. – For the production of high-quality raw sugar it is necessary to: (1) minimize the delay between cane burning and crushing, (2) ensure that the billets are of adequate length and undamaged, (3) aim for a fibre content that is not excessive, and (4) minimize organic and inorganic impurities through control of maturity, harvesting practices, post-burn and post-harvest delays, fertilizer usage and amount of tops left on the cane (normally constituting 60% of extraneous matter). The adverse effect of extraneous matter (tops, trash, roots and soil) on processing and amount of sugar produced is examined, and suggested instructions for extraneous matter sampling are indicated by a simple illustration.

Ash is a measure of raw sugar quality. Anon. *Cane Growers' Quarterly Bull.*, 1979, **43**, 19-21. – The adverse effect of raw sugar ash on refining is indicated, and cane agronomic factors affecting the ash content are discussed, including excessive K application, varietal differences in nutrient uptake rates and subsequent juice ash contents, irrigation water quality, and extraneous matter.

Mexico's Ingenio San Cristóbal. A. Bobadilla G. *Sugar y Azúcar*, 1979, **74**, (9), 34-35, 38-39, 41. – The history of Ingenio San Cristóbal is recounted and details are given of processes and equipment used in the raw sugar factory and refinery section.

Optimizing the diatomite pressure filtration process. A. J. Basso. *Sugar y Azúcar*, 1979, **74**, (9), 55, 58-59. Pressure filtration of juices and liquors using kieselguhr is discussed, with each step described and factors having a major effect on efficiency considered. Advice is given on how to achieve optimum conditions, and a table is presented showing the typical particle size analyses of diatomite filter aids available in the USA.

The multiple-effect evaporator - optimum number of effects. S. K. Ghosh. *Maharashtra Sugar*, 1979, **4**, (8), 17, 19-20. – By means of appropriate mathematical equations, the author discusses the economical optimum number of evaporator effects at which the benefit of saving in fuel is cancelled by the greater capital and maintenance costs as well as the costs of cleaning.

Voltage regulation in the sugar industry. R. B. Talange and R. Y. Samel. *Maharashtra Sugar*, 1979, **4**, (8), 21-22. – A voltage regulation system for turbo-generators is described that is intended to overcome problems created by their breakdown. At the factory in question, the solid-state automatic voltage regulators (AVR) on three turbo-generators were standardized and an extra AVR made available as standby in the event of a fault in any one of the three. The system of interconnexion of the AVR's and the design of the standardized AVR are described.

Effect of bound water on sugar cane juice extraction. A. J. Dangre. *J. Univ. Poona, Sci. Technol.*, 1976, **48**, 241-247; through *S.I.A.*, 1979, **41**, Abs.79-1334. – It is recommended that the extraction efficiency of a mill should be measured by the juice lost % fibre. The fibre holds 2-2½ times its own weight of bound water, i.e. water which cannot be extracted by crushing. Calculations based on "whole juice" (absolute juice minus bound water) show that, at equal extraction % cane, the juice lost % fibre decreases with increasing fibre content of the cane.

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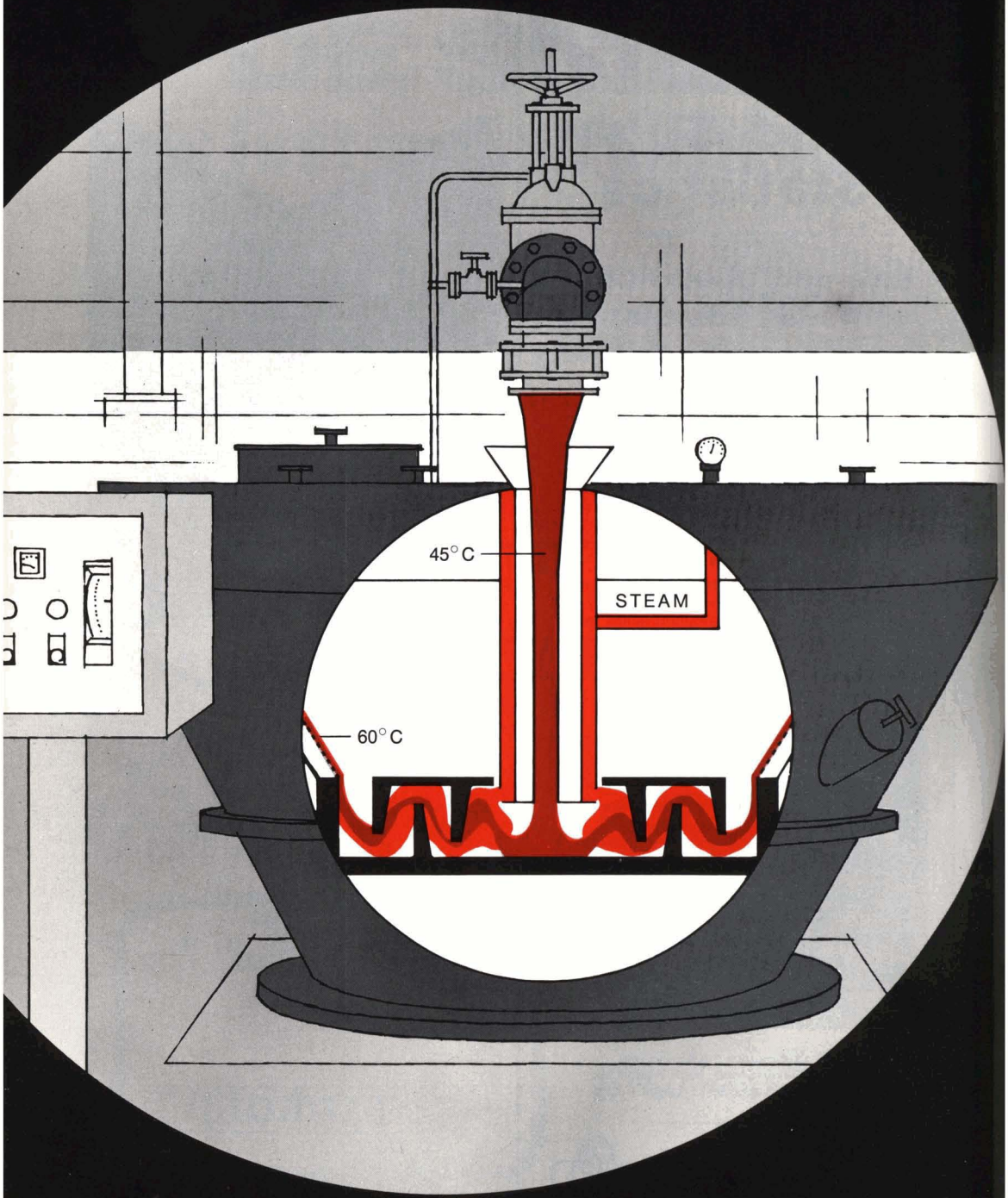

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BEET SUGAR MANUFACTURE

Granulometry and screening of sugar. II. Sieves and their systems in the screening of sugar. J. Gebler. *Listy Cukr.*, 1979, **95**, 136-144 (*Czech*). – The fundamentals of square-meshed wire screen dimensioning are briefly explained, and parameters of screens of various mesh sizes manufactured to Czechoslovakian standard specifications are tabulated. The use of screens in the sugar industry is discussed, and details are given of the granulometry of types of sugar produced in various countries.

Adsorptive treatment of beet sugar factory products with AG-3 granular active carbon. Ya. O. Kravets, G. P. Pustokhod, R. D. Gorbunova, M. V. Dvornichenko and L. D. Naumova. *Sakhar. Prom.*, 1979, (9), 32-36 (*Russian*).– Details are given of the active carbon system used at Yagotin to treat standard liquor (thick juice plus remelted low-grade sugar) before boiling. The liquor is treated at 79-82°C at a specific load of 0.8-1.0 $m^3.hr^{-1}$ per tonne of carbon. The colour content is halved and the purity slightly raised by treatment. Boiling time is shortened typically by 17%, while sugar yield is increased and molasses purity reduced by comparison with absence of treatment.

A rotary sieve for white sugar. S. I. Temper, S. M. Lantsman, N. I. Baranik and V. I. Gorobets. *Sakhar. Prom.*, 1979, (9), 42-44 (Russian).– A description and diagrams are given of a rotary sieve having a throughput of 20 tonnes.hr^{-1} and rotating at 16 rpm.

A computerized system for data recording and processing at Lublin sugar factory. S. Swietlicki, J. Zajdel, D. Piotrowski and K. Urbaniec. *Gaz. Cukr.*, 1979, **87**, 175-176 (*Polish*). – The computerized system of the title is briefly described.

Recalcination of carbonatation mud – experiences and results with an experimental plant at the Rain factory of Süddeutsche Zucker-Aktiengesellschaft. H. Schiweck, T. Cronewitz and F. Schoppe. *Zuckerind.*, 1979, **104**, 813-819 (*German*). – See *I.S.J.*, 1980, **82**, 344.

Recalcination of carbonatation mud in a high-velocity reaction chamber. F. Schoppe, H. Schiweck and T. Cronewitz. *Zuckerind.*, 1979, **104**, 819-824 (*German*). – See *I.S.J.*, 1980, **82**, 345.

Corrosion protection of steel and concrete in sugar factories. F. J. Bundies. *Zuckerind.*, 1979, **104**, 824-827 (*German*). – Advice is offered on various anti-corrosion treatments for steel and concrete surfaces in sugar factories.

A technico-economic analysis of beet sugar production in India. D. R. Bhumbla and P. S. Gill. *Indian Sugar*, 1979, **29**, 161-167. – From examination of the question of sugar production from beet in India, it is concluded that, for a number of reasons stated, it is better to look upon cane as the more suitable raw material.

Operation of continuous diffusers. S. Nikiel. *Gaz. Cukr.*, 1979, **87**, 203-207 (*Polish*). – Factors affecting the performance of DDS diffusers, as used in Polish sugar factories, are examined, and the extent of losses and how to reduce them discussed; some references are made to results obtained at Nakskov sugar factory in Denmark.

Factors causing increased wear of continuous diffusers. L. Fassatiova, J. Smolik and M. Stenglova. *Listy Cukr.*, 1979, **95**, 174-180 (*Czech*). – The literature on wear of beet diffusers is surveyed, and tests are reported in which the degree of wear in DDS and tower diffusers at a number of Czechoslovakian sugar factories was determined. Results showed that internal components were subjected to both corrosion and abrasion; pH and impurities (particularly sand) were the main causes. Values are tabulated showing the type and percentage of impurity found as well as pH and dissolved oxygen in diffusers at certain factories.

The fuel problem and energy situation. Its (present) state and possibility of solving it. O. Böhm. *Listy Cukr.*, 1979, **95**, 180-184 (*Czech*). – Fuel, steam and power consumption in Czechoslovakian sugar factories is discussed, and ways of reducing the level are examined; both long- and short-term measures are considered for each process station or major piece of equipment. It is mentioned that most of the factories operate boilers that are more than 40 years old.

The purification line - a new concept. A. Kyncl and J. Kuchynka. *Listy Cukr.*, 1979, **95**, 184-187 (*Czech*). A description is given of a carbonatation scheme, conceived as a complete integral process station and installed at Brodek factory.

The sugar industry in Sweden. G. Helgesson. *Sucr. Franç.*, 1979, **120**, 323-328 (*French*). – A survey is presented of the Swedish sugar industry, with mention of sugar consumption and marketing.

The reception centre at Toury sugar factory. M. Moraillon and C. Bailly. *Sucr. Franc.*, 1979, **120**, 329-335 (*French*). – Details and illustrations are given of the automatic beet sampling system installed at Toury for the 1977/78 campaign. All operations, including division of the samples into 25-kg sub-samples and recording of beet weight, dirt tare and sugar content, are monitored and controlled by micro-processor.

Reconstruction of the (waste water) ponds at Arcis-sur-Aube sugar factory. D. Fayoux, H. Lebourg and J. L. Wilmart. *Sucr. Franç.*, 1979, **120**, 339-342 (*French*). – Details are given of the work carried out in the construction of a new 90,000 m^3 mud pond as part of a major expansion program to allow for the increase in daily slice from 7000 to 11,000 tonnes of beet.

SO_2 generation in sugar factories and its utilization in diffusion. N. Taygun. *Seker*, 1979, **29**, (111), 14-22 (*Turkish*). – The advantages and disadvantages of using SO_2 to adjust the pH of diffusion water and for disinfection are discussed, and the sulphur burner and gas absorption plant at Ankara sugar factory are described.

Experience at Lokhvitsk sugar factory in treatment and processing of beet. N. D. Khomenko, A. K. Buryma, A. P. Ponomarenko, A. M. Rudyachenko and E. E. Belokon,. *Sakhar. Prom.*, 1979, (10), 30-33 (*Russian*). – Information is given on beet reception and handling as well as diffusion at the title factory.

Lime consumption in treatment of flume-wash water at sugar factories. A. P. Parkhomets and N. A. Zan'ko. *Sakhar. Prom.*, 1979, (10), 33-35 (*Russian*). – Laboratory and full-scale tests on flume-wash water treatment with milk-of-lime used as flocculant are reported, and graphs based on the results are reproduced for establishment of the quantity of lime to add as a function of the initial and optimum pH, quantity of suspended matter and density of the milk-of-lime.

Improving the performance of pulp drying stations at sugar factories. Yu. G. Shchegolev, M. P. Khazin and V. I. Khristenko. *Sakhar. Prom.*, 1979, (10), 37-39 (*Russian*). -- The performance of a typical pulp dryer as used in the USSR, particularly its fuel consumption, is discussed, and a new type of small, cooled-lining furnace to replace the conventional furnace is described; advantages of the new furnace include reduced fuel consumption and increased lining life.

Recalcination of carbonatation mud – experiences and results with an experimental plant at the Rain factory of Süddeutsche Zucker-AG. H. Schiweck, T. Cronewitz and F. Schoppe. *Sucr. Belge*, 1979, **98**, 257-267 (*French*). – See *I.S.J.*, 1979, **81**, 344.

Beat the clock. E. Long. *The Furrow*, 1979, (Sept.-Oct.), 20-21. – An outline is given of practices on a farm in the Red River Valley of Minnesota/North Dakota, where harvesting has to be completed by the third week of October, after which the local Moorhead sugar factory does not receive any beet because of the onset of very sharp frosts. No beet are clamped in the fields, so that the factory has to provide for considerable piling. Once unfrozen beets have been processed (by mid-December), the slicer knives are changed and frozen beets then processed. The frozen beets are easy to handle ("like slicing ice cubes") and, because the sugar cells are ruptured, diffusion is also easy.

Solids separation in carbonatation by filtration of slurry and admixed carbonatation mud. U. Curdts. *Zuckerind.*, 1979, **104**, 907-909 (*German*). – Reference is made to filters that have been installed or tested in recent campaigns with the aim of increasing the dry solids content of carbonatation mud so as to reduce the disposal problem, provide a source of lime for agricultural purposes and facilitate recalcination. At Appeldorn, use of the Hoesch automatic filter-press and the Alfa-Laval tube press provides a cake of 70-80% solids content and approx. 30% CaO content.

Tests with new filtration systems in the sugar industry. G. Klohn. *Zuckerind.*, 1979, **104**, 909-912 (*German*). Descriptions are given of four filters tested at Ameln sugar factory in 1978. The Alfa-Laval tube press consists of a filter candle and cloth located in a vertical tube and separated from the inner wall by a rubber membrane. The slurry, fed from below, is briefly pre-pressed at low-pressure followed by sweetening-off; the candle returns to its original position and is then forced down under high pressure, followed by loosening of the cake and its discharge when the candle is forced to its lowest position. The Krauss-Maffei automatic plate filter-press operates at 20 bar pressure; after the plates have been pressed together and then separated, the cake is discharged automatically. The Alfa-Laval Ecobelt P 1500 double-belt press operates in three distinct zones: a draining zone, where the carbonatation mud is fed over a perforated belt to the low-pressure zone, in which it is compressed between two perforated belts; the perforated rollers between which the belts pass have successively reducing diameters, so as to permit the pressure applied to the mud to increase. In the high-pressure zone, the perforated belts are pressed against a perforated roller by a number of separately driven flat belts at a large circumferential angle. The dewatered mud is removed from the perforated belt by a scraper. Belt speed and applied pressure are variable. In the case of the Pannevis vacuum belt filter, the horizontal moving filter cloth passes over a vacuum trough made up of wheel-mounted sections, each connected to a vacuum source. The trough sections move in one direction with the cloth under the effect of vacuum and are then pulled back to their original position by a pneumatic cylinder when the vacuum is broken. The performances of the filters are reported.

Two years' experiences with automatic filter-presses in the filtration of carbonatation slurry. H. Weidner. *Zuckerind.*, 1979, **104**, 912-915 (*German*). – Experiences gained in the operation of the Hoesch automatic filter-presses, first installed in Appeldorn factory in 1977[1] and subsequently in other West German factories, are reported. Typical results in the treatment of carbonatation slurry are a cake pol of 0.007% on beet at a specific load of 160-190kg.m^{-2}.hr^{-1}; filter cake solids content is 75%. The manufacturer has remedied most of the snags initially encountered.

A new process for increasing the dry solids content of filter cake. A. F. Johnsen, R. F. Madsen and W. Kofod Nielsen. *Zuckerind.*, 1979, **104**, 917-920 (*German*). – A description is given of the DDS vacuum filter-press[2], with details of performance and economics.

Sugar factory waste water. Physico-chemical and biological parameters to obtain the best purification with a minimum consumption of energy. F. Zama, C.A. Accorsi and G. Mantovani. *Ind. Sacc. Ital.*, 1979, **71**, 97-111 (*Italian*). – The waste water purification scheme at the 6000 tonnes per day Jesi sugar factory is described and illustrated. After passage through a mechanical settling basin, the waste water is subjected to a natural anaerobic process followed by aerobic treatment. After a second mechanical separation, the purified water contains only 3.2% of the original COD content and 2% of the original BOD. Use of a horizontal centrifuge after the first mechanical settling removes a considerable amount of soil from the waste water and thus eases both the load on the water purification system and the task of cleaning out the settling basins at the end of the campaign.

Contribution of modern techniques to sugar factory automation. G. Windal. *Ind. Alim. Agric.*, 1979, **96**, 737-744 (*French*). – See *I.S.J.*, 1980, **82**, 382.

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[1] Weidner: *I.S.J.*, 1979, **81**, 217.

[2] Madsen: *ibid.*, 1978, **80**, 314; 1980, **82**, 350.

LABORATORY STUDIES

The formation and composition of beet molasses. G. Vavrinecz. *Sugar Tech. Rev.*, 1979, **6**, 117-305.– See *I.S.J.*, 1965, **67**, 250, 316; 1966, **68**, 28, 91; 1967, **69**, 151; 1968, **70**, 346, 377; 1969, **71**, 249; 1970, **72**, 90, 282; 1971, **73**, 90; 1972, **74**, 219; 1974, **76**, 347; 1975, **77**, 185.

Density of sugar solutions. R. Bretschneider P. Kadlec, A. Dandar and Z. Bubnik. *Zuckerind.*, 1979 **104**, 719-722 *(German)*. Details are given of a dilatometer and the procedure used to determine the density of sugar solutions having a dry solids content of 69-80% at 40-95°C. An accuracy of ±0.5 $kg.m^{-3}$ was attained. The measured values were processed by an APPROXI program to give equations for calculation of density as a function of temperature and dry solids. Tabulated values of density obtained from the experiments were compared with those based on values found by Schneider *et al*[1] as well as with values obtained by Dolak[2]. Better agreement was found with the values based on Schneider's data, especially at higher temperatures. An equation was derived based on these values, for calculation of density at 0-69% solids and 20-100°C.

Colorimetric determination of reducing compounds in sugar juices. H. Gruszecka. *Gaz. Cukr.*, 1979, **87**, 169-172 *(Polish)*.– For determination of invert sugar, Müller's solution is added to the test juice. $Cu(OH)_2$ is precipitated and reacts with the tartrate in the reagent to form dark blue cuprotartrate; in the presence of a reducing sugar, Cu_2O is then precipitated (reducing the intensity of the blue) and is removed by centrifuging for 5 min at 3000 rpm or 3 min at 5000 rpm, leaving a clear solution which is then measured photocolorimetrically at 680 nm. Comparison of the method with that of the Berlin Institute[3] showed close agreement, the mean value for 50 beet juice samples being 0.4807% invert sugar as given by the Berlin Institute method and 0.4766% by the photocolorimetric method. For juices that are too dark for colorimetric determination, atomic absorption using a spectrophotometer is recommended. The method is based on reduction of 0.905 mg Cu^{++} by 1 mg invert sugar and gives values which deviate from those given by the colorimetric method by between –0.53 and +0.28 units, although statistical analysis indicates that atomic absorption will tend to give higher values than the other method. Its disadvantage lies in the costliness of the equipment required.

Automation of a laboratory-scale ion exchange unit. J. Dobrzycki, Z. Skibicki and S. Zarzycki. *Gaz. Cukr.*, 1979, **87**, 173-174 *(Polish)*. – To reduce the work involved in evaluating resins for their performance and service life, an automatic system involving a time relay has been developed for laboratory units working on a 4- and 8-cycle basis. The relay receives, via a Wheatstone bridge, signals from pairs of electrodes measuring the conductance of the in- and out-flowing solutions and controls the opening and closing of the appropriate valves. Application of the system is demonstrated.

Freeze preservation of sugar cane mixed juice samples. M. A. Brokensha. *Proc. S. African Sugar Tech. Assoc.*, 1979, 70-72.– Experiments showed that mixed juice samples can be preserved for seven days at –25°C or –40°C without affecting the sucrose content, pol or Brix, so that weekly composite samples can be prepared for gas-liquid chromatography instead of individual hourly samples (so reducing costs). The lower temperature is preferred, since it provides a greater margin of safety in the event of a power failure. An initial shock freezing at approx. –60°C is not necessary; initial freezing in an alcohol bath stored in the deep freezer is adequate.

Cane testing service looks at laboratory computerization. S. King, E. P. East and A. D. Evans. *Proc. S. African Sugar Tech. Assoc.*, 1979, 73-75. – Details are given of the mini-computer system installed by the Sugar Industry Central Board (which is responsible for sampling and analysing cane delivered to 18 sugar factories for purposes of payment) in order that data could be obtained directly from weighbridges and laboratory instruments, thus reducing labour requirements and possible error in the manual capture of data. The interface hardware designed and developed to overcome problems caused by the factory environment and to cut costs is described. The first test run of the system was generally successful.

Sugars in molasses. M. A. Clarke and M. A. Brannan. *Sugar J.*, 1979, **42**, (2), 19-23. – See *I.S.J.*, 1980, **82**, 255.

Some observations on the chemical composition of the cane juices of different promising varieties grown in north Bihar conditions and their clarification characteristics. S. C. Sharma, P. C. Johary and G. S. C. Rao. *Indian Sugar*, 1979, **29**, 141-147. – The Brix, pol, purity and chemical composition of juice from six named varieties were determined as well as the cane fibre content. Details are tabulated, as are the clarification properties of each juice, including the colour of the raw juice (ranging from golden yellow to brownish red).

Research trends in the sugar industry. S. Zagrodzki and H. Zaorska. *Gaz. Cukr.*, 1979, **87**, 193-197 *(Polish)*. Sugar industry prospects in Poland are discussed, and an outline is given of sectors still requiring some research. A survey is given of major fields of research in recent years, and a list is presented of specific items that should be subjects of experimental investigation.

Amino-acids in beet. R. Bretschneider, J. Copikova and D. Matejova. *Listy Cukr.*, 1979, **95**, 207-209 *(Czech)*. Present knowledge on the formation of soluble nitrogenous compounds in beet, particularly amino-acids, as a result of N fertilization is summarized, and a procedure for determination of amino-acids in beet and sugar factory intermediate products described, in which an automatic analyser is applied to an acid hydrolysate of the sample (analysis being based on the method of

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[1] *Zucker-Beiheft*, 1963, (17), 1-19.
[2] Drachovska *et al.*: "Potravinarske tabulky" (Prague, 1952), p.426.
[3] "Sugar analysis: ICUMSA methods". Ed. F. Schneider (ICUMSA, Peterborough, England) 1979, pp.55-56.

Speckmann, Moore & Stein), while the Vratny & Ouhrabkova method[1] is used for analysis of the free amino-acids. Details of results are to be reported later.

Chromatography and the sugar industry. G. Carr. *S. African Sugar J.*, 1979, **63**, 338. – Brief descriptions are given of liquid, gas-liquid and thin-layer chromatography, and the advantages and disadvantages of each noted. The applicability of each technique to types of sample is indicated in a table.

An automated line for rapid analysis of beet for sugar content. A. I. Sergeev, V. P. Khotimskii and V. V. Vis'ko. *Sakhar. Prom.*, 1979, (10), 45-48 (*Russian*). – Details are given of a mock-up of an automatic line for determination of beet sugar content; some results obtained with it are reported.

Rapid and simple spectrophotometric method for the determination of ketosaccharides. C. Laluce, A. de Carvalho and R. Molinari. *Ecletica Quimica*, 1976, (1), 7-18; through *S.I.A.*, 1979, **41**, Abs.79-1234. - Preliminary tests on the acid degradation of sucrose (100 μg in 3 cm^3 solution) showed that maximum formation of a compound (possibly 5-hydroxymethyl furfural) which absorbed light in a band around 284 nm occurred in the presence of 4M HCl after 8 min at approx. 97°C. Seven other acids were less effective than HCl; indeed, nitric and acetic acids gave zero values of ΔE_{285} (the difference in extinction between the heated mixture and an unheated "blank"). The chosen method consisted of adding 2 cm^3 6M HCl to 1 cm^3 sample, immersing for 8 min in a boiling water bath, rapidly cooling and measuring ΔE_{285} at room temperature. Aldohexoses gave zero response, while that of oligo- and polysaccharides was proportional to their content of ketohexose groups, the limit of detection being 2 μg. The % inhibitions shown by various concentrations of KNO_3, $NaNO_2$ and H_2O_2 are tabulated; ΔE_{285} increased by approx. 30% in the presence of 30 vol.% ethanol, which presumably inhibits decomposition of the reaction product. The method showed good agreement with (a) the Shaffer-Hartman titrimetric method in the determination of sucrose in raw, white and refined sugars, (b) the Hagedorn-Jensen method in monitoring the consumption of sucrose by *Streptomyces aureofaciens*, and (c) added amounts in determination of fructose in deproteinated blood. The possibility of further reaction with 2,4-dinitrophenylhydrazine followed by colorimetry in the visible range is mentioned.

Determination of sucrose in sugar beet juices by nuclear magnetic resonance spectrometry. D. W. Lowman and G. E. Maciel. *Anal. Chem.*, 1979, **51**, (1), 85-90; through *Anal. Abs.*, 1979, **37**, Abs.4F24. – The method is based on a time-resolution approach (viz. time-resolution water-eliminated Fourier-transform nuclear magnetic resonance) for removal of the resonance due to water protons. An added paramagnetic relaxation reagent [$Cr(NO_3)_3,9H_2O$] relaxes the water protons faster than it does the sucrose protons. Pre-truncation of the free induction decay before calculation of the NMR power spectrum removes the resonance due to water. Response is rectilinear over the range 0 to 26% (w/w) of sucrose in water, and the absolute accuracy is better than 0.5%. The standard deviation for a single determination of 15% of sucrose is better than ± 0.65%, and the technique is considered to be more reliable than polarimetry.

Relationship between sugar content and cell juice dry solids content as determining factors in sugar beet value. H. Zaorska and S. Zagrodzki. *Zuckerind.*, 1979, **104**, 926-931 (*German*). – An indirect method of determining beet sugar content is described in which a "dependence factor" (DF) represents the relationship between beet sugar content on the one hand and cell juice purity and dry solids content on the other. The beet sugar content is obtained by multiplying DF by pressed juice refractometric Brix; values of DF have been pre-determined by tests on Polish beets and cossettes. Statistical evaluation has shown that results of 172 tests reduced to a beet sugar content of 16% do not differ by more than 0.1% from the sugar content determined directly.

Development and operation of an industrial unit for biological determination of the sugar content in press water. G. Pollach and M. Gratzl. *Zuckerind.*, 1979, **104**, 940-942 (*German*). – An automatic system incorporating a micro-processor has been developed by Tulln sugar factory on the basis of the technique described earlier[2] for determining press water sugar in which sugar is converted to acid by highly thermophilic micro-organisms and the acid then titrated with an alkaline nutrient solution containing yeast extract. Details are given of the system's components, analysis program and automatic control. Comparison of results for snap samples with polarimetric values showed that differences between the two methods lay in the range between -0.02 and +0.01°S.

Observations on granulometric control of sugars and the practice of seeding. D. Ahari and J. Genotelle. *Ind. Alim. Agric.*, 1979, **96**, 791-797 (*French*). – Sugar crystal growth and habit are discussed, and it is shown by simple simulation (allowing for the angles between the different faces, whatever the form of crystal, and restricting the number of faces to 10) that the volume V of a crystal is given by kL^3, where k is a coefficient found to have a value in the range 0.22-0.27, and L is length. Comparison between size analysis by screening and by photography shows that both methods will give identical results if used correctly. Crystal weights as found directly, by calculation using the Thieme formula and by calculation based on analysis by photography are found to be of the same order of magnitude. Brief mention is made of the practical value of the conclusions drawn for massecuite seeding.

Composition of waste gases from a sugar beet pulp dryer and its relation to the process conditions. B. C. Huisman, L. H. de Nie, J. Schaefer, H. Maarse and F. de Vrijer. *Sucr. Belge*, 1979, **98**, 295-307. – See *I.S.J.*, 1980, **82**, 347.

Separation and analysis of some sugars by using thin-layer chromatography. S. Farag. *J. Amer. Soc. Sugar Beet Tech.*, 1979, **20**, 251-254. – A TLC method is described in which 3:3.5:0.5 chloroform:acetic acid:water is used as solvent; the spraying agent is made from 1 g diphenylamine and 1 cm^3 aniline in 100 cm^3 acetone which is mixed 10:1 with 85% orthophosphoric acid prior to use. The procedure is outlined, and some chromatograms are reproduced.

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[1] *J. Chromatog.*, 1978, **152**, 214.
[2] Pollach & Klaushofer: *I.S.J.*, 1972, **74**, 219.

BY-PRODUCTS

Perspectives on ethanol manufacture. A. B. Ravnö. *S. African Sugar J.*, 1979, **63**, 239, 241-243. – The potential role of ethanol as motor fuel in South Africa is examined, and its manufacture from sugar cane described, reference being made to production costs and vinasse treatment.

Ethanol as a petroleum extender and additive in automotive engines. E. J. Buchanan. *S. African Sugar J.*, 1979, **63**, 244, 246-247, 249-251, 253-254. – The history of ethanol:petrol blend application is summarized, and past and future changes in the design of automotive engines for use with ethanol are outlined. The properties of ethanol, petrol and their blends are compared, and the performance of blends indicated. Reference is made to experience in the USA and Brazil, and the economics of ethanol as fuel are discussed.

Additives for pulp pressing. G. Rousseau and A. Carrière. *Sucr. Franç.*, 1979, **120**, 301-309 (*French*).– Various diffusion water additives were tested for their effect in raising the dry solids content of pressed pulp. While the results given by calcium chloride, triple superphosphate, single superphosphate and calcium sulphate were about the same, the last-named was preferred because of its ease of handling. At Eppeville sugar factory, carbonatation mud is diluted and enough sulphuric acid added to decompose a maximum quantity of carbonate. The water containing soluble calcium sulphate is adjusted to pH 4.0-6.5 and added to fresh diffusion water. The quantity of $CaSO_4$ in the diffusion water is determined from knowledge of the Ca content in the fresh and recycled press water. Indications are that the increase in pulp dry solids in a Ferriani press installed in 1978 is almost a linear function of the quantity of $CaSO_4$ added; the maximum increase is almost 5% absolute at 470 g $CaSO_4$ per tonne of beet.

Process design and economic studies of various fermentation methods used for the production of ethyl alcohol. G. R. Cysewski and C. F. Wilke. *Seker*, 1979, **29**, (110), 4-16 (*Turkish*).– Four systems for ethanol fermentation of a substrate containing cane molasses were investigated: batch, continuous, continuous with cell recycle and a vacuum system with cell recycle. The optimum sugar concentration was found to be 10%; above this, ethanol production was inhibited, whereas at lower concentrations the biomass concentration fell (if cell recycle was not used) and distillation costs rose. The economics of the various methods are compared.

Effect of (beet) molasses fermentation conditions on the formation of by-products. N. I. Derkanosov, A. Z. Obraztsova and N. G. Kursheva. *Ferment. Spirt. Prom.*, 1977, (4), 22-25; through *S.I.A.*, 1979, **41**, Abs.79-1011.– Effects of pH (4-6), initial Brix (18-36.5) and quantity of inoculum (at 75% moisture, 7-18 $g.litre^{-1}$) on yields of yeast biomass, ethanol and impurities after 25 hr were studied, using strains K-69 and V; results are tabulated. Conditions recommended for K-69 are: pH 5-5.1, 21-24°Bx, 28-30°C and 11 g inoculum per litre.

Production of acetic acid from agricultural wastes. A. Alian. *Zambia J. Sci. Technol.*, 1977, **2**, (2), 16-20; through *S.I.A.*, 1979, **41**, Abs.79-1012.– A locally isolated strain of *Acetobacter aceti* was cultured in media based on (cane) molasses, mango waste or mpundu waste, and in a synthetic medium; bacterial growth and acetic acid formation were greatest in the molasses medium. Increasing the alcohol concentration in the medium in the range 2-8% decreased the number of bacterial cells and decreased the amount of acetic acid when the shaking rate was 150 rpm but increased the amount when the shaking rate was 350 rpm.

Fermentation of citric acid by *Aspergillus niger*. I. Role of impurities present in different grades of sucrose. II. Use of molasses as a substitute for sucrose. T. K. Abraham and K. L. Chaudhuri. *Indian J. Microbiol.*, 1977, **17**, (2), 93-95; through *S.I.A.*.,1979, **41**, Abs. 79-1013. – *A. niger* 6N3 was cultured in media containing as C source (1) analytical-grade sucrose, (2) laboratory reagent-grade sucrose, (3) commercial cane sugar. Mycelial growth and citric acid production were maximum with (3) and minimum with (1). Culture on media containing cane molasses gave a low yield of citric acid; purification of the molasses with charcoal, $K_4Fe(CN)_6$ and cation exchange resin progressively increased the yield to approx. that obtained with (2).

Spontaneous fermentation of sugar cane. E. de Gonzalez and N. A. Macleod. *Trop. Anim. Prod.*, 1976, **1**, (2), 80-84; through *S.I.A.*, 1979, **41**, Abs.79-1037. – Whole cane which had been chopped finely or coarsely (particle sizes < 5 mm and 10-20 mm, respectively) was fermented in open plastic buckets for 24 hr, either alone or after treatment with 10% (on cane) molasses-urea (100 g urea/litre), or molasses-urea-ammonium sulphate (90 g urea + 20 g ammonium sulphate per litre). Fine chopping and addition of urea accelerated yeast growth and alcohol production. Initial and final pH values were higher in the presence of additives and with coarse chopping. Acetic acid concentration tended to be higher in the presence of additives but was unaffected by the fineness of chopping.

Comparison of the influence of various wet bulk storage methods on the pulping quality of sugar cane bagasse. C. R. Gonin and J. S. M. Venter. *Rpt. CSIR* (South Africa), 1976, (127), 22 pp. + tables; through *S.I.A.*, 1979, **41**, Abs. 79-1045.– Depithed bagasse from a milling tandem was stored in bulk, the piles being irrigated with a dilute molasses solution until the pH reached 4.5 or 4.0, or with Ritter liquor, paper factory effluent or formic acid solution; tests were also carried out on diffuser bagasse irrigated with dilute molasses to pH 4.5. Samples taken after 2, 8 and 20 weeks' storage were analysed for chemical composition and fibre dimensions, and properties of pulps prepared from them were measured. Fibre dimensions did not change during storage; tests on chemical changes gave inconclusive results. Storage time did not affect pulp yield or strength, but may have influenced the beating characteristics. In some cases, bagasse storage led to a decrease in pulp brightness, but not with the bagasse

treated with Ritter liquor or formic acid, or with molasses solution to pH 4.0. Diffuser bagasse did not differ from mill bagasse in fibre dimensions or strength potential. Factors such as season and area of origin may have affected pulp quality more than the storage method.

Thermophysical properties of mineral additives for production of pelleted pulp. M. G. Parfenopulo, V. M. Kravchenko and N. E. Karaulov. *Sakhar. Prom.*, 1979, (9), 36-38 (*Russian*).– Details are given of experiments to determine the heat diffusivity, heat conduction and specific heat of urea and diammonium phosphate as functions of moisture content. Empirical equations were obtained for use in the design of plant for production of enriched pelleted pulp.

Ethanol from sugar cane. G. D. Thompson. *Proc. S. African Sugar Tech. Assoc.*, 1979, **53**, 1-5, 18-20. – See *I.S.J.*, 1981, **83**, 59–.

Perspectives on ethanol manufacture. A. B. Ravnö. *Proc. S. African Sugar Tech. Assoc.*, 1979, **53**, 6-9, 18-20. See *I.S.J.*, 1981, **83**, 89–.

Ethanol as a petroleum extender and additive in automotive engines. E. J. Buchanan. *Proc. S. African Sugar Tech. Assoc.*, 1979, **53**, 10-20. – See *I.S.J.*, 1981, **83**, 89–.

Sugar beet tops. D. Miller. *British Sugar Beet Rev.*, 1979, **47**, (3), 25-26. – Details are given of a farm where sugar beet is grown on 60 ha and the tops used as fodder by sheep.

Feeding sugar beet tops silage. I. Mole. *British Sugar Beet Rev.*, 1979, **47**, (3) 36-37, 40. – The harvesting, ensilage and advantages of beet tops as animal fodder are discussed.

Sugar beet pulp: a valuable feedstuff. J. Harland. *British Sugar Beet Rev.*, 1979, **47**, (3), 51, 54. – The feed value of dried molassed beet pulp and of pressed pulp is discussed.

Determination of microflora in pulp necessary for its ensilage. J. Januszewicz and K. Zelazny. *Gaz. Cukr.*, 1979, **87**, 198-202 (*Polish*). – Mesophilic lactic bacteria in beet pulp are determined by adding reductase, incubating for two hours at 35-36°C and measuring the fall in colour accompanying the drop in oxidation-reduction potential; suitable indicators are resazurine, triphenyltetrazolium chloride and methylene blue. Laboratory experiments showed that, although pulp from a DDS-type diffuser contained sufficient sugar to allow the pH to fall to below 4.2 during ensilage, the fall was due, to a large extent, to other bacteria, so that injection with lactic bacteria is advisable.

Alcohol fermentation with re-use of yeast cells adsorbed on the carrier. S L. Cheng, C. L. Lai and M. C. Hsie. *Rpt. Taiwan Sugar Research Inst.*, 1979, (84), 71-78 (*Chinese*). – Laboratory tests showed no significant difference in ethanol yield and fermentation time between a system in which the sterilized molasses medium was freshly inoculated with yeast cells before each of a number of cycles and a system in which the carrier (crushed brick or bagasse pith) was recovered after each cycle and used as inoculum for the next batch. On the other hand, alcohol yield fell after the ninth cycle when the molasses was not sterilized. Shaking of the flask at 100 rpm shortened the requisite fermentation time by about 24 hr by comparison with a static flask.

Can ethyl alcohol of agricultural origin contribute to fuel requirements? S. Tourlière. *Sucr. Franç.*, 1979, **120**, 337-338 (*French*). – The practicality of producing fuel alcohol from beet is discussed. While the ratio of energy consumption to potential energy production is approx. unity in a distillery producing potable alcohol, it is thought possible to reduce the ratio to 0.75 by using vinasse as fertilizer (thereby reducing the energy consumed in fertilizer manufacture) and producing methane from the waste pulp. However, production of fuel alcohol from beet would be seasonal, so that the fixed costs of running the distillery would be greatly increased unless it could be used for other purposes outside the beet season; moreover, at least 300,000 ha under beet solely for alcohol production is considered the economic minimum. Other factors to be taken into consideration are also briefly discussed, including the greater potential of cane as alcohol source in view of the use of bagasse as fuel and the greater yield per ha that is possible. An energy balance is given for 45 tonnes of beet containing 16% sugar and yielding 41 hectolitres of alcohol per ha.

Effect of protein restriction on growing-finishing pigs fed final molasses *ad libitum*. P. Lezcano and A. Elías. *Cuban J. Agric. Sci.*, 1979, **13**, 25-32. – From studies on pigs fed set amounts of protein as well as final molasses *ad libitum*, it is concluded that with such high-energy rations it is practical and economically desirable to reduce the levels of protein below those given in recommended feeding standards.

Cattle manure and final molasses silage in pig feeding. II. Substitution of a maize-based diet by manure silage for growing pigs. C. P. Díaz, P. Lezcano and A. Elías. *Cuban J. Agric. Sci.*, 1979, **13**, 33-38. – Investigations suggested that no more than 25% of a maize-based ration (as dry matter) should be in the form of manure silage to which cane molasses had been added; further studies are considered necessary in order to determine the effects of various factors on the silage and its feed efficiency, so that more could be included in a ration.

The use of high-test molasses for weaning piglets. II. Some digestive indices. J. Ly and J. Díaz. *Cuban J. Agric. Sci.*, 1979, **13**, 39-45. – Trials showed that, from a digestive point of view, 75% of the maize (as dry matter) in a ration fed to piglets could be replaced with molasses.

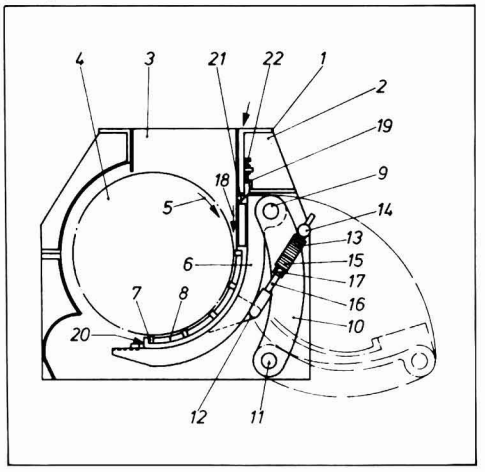
Effect of blending waste paper with some indigenous agricultural residues on the properties of hardboard. N. A. Fadl, M. Z. Sefain and M. M. Rakha. *Indian Pulp and Paper*, 1977, **32**, (1), 11-13; through *S.I.A.*, 1979, **41**, Abs.79-1199. – In the production of boards from bagasse, rice straw or cotton stalk pulps with the addition of 0, 1.5 or 3% phenol-formaldehyde resin, the effects of replacing 20, 40, 60, 80 or 100% of the pulp by waste paper were studied. The properties of the bagasse board were improved by addition of resin, i.e. the bending strength increased and the water absorption decreased. Partial or complete replacement of bagasse pulp by waste paper adversely affected both these properties, and resulted in a slight increase in density.

PATENTS

UNITED KINGDOM

Cane shredder. Braunschweigische Maschinenbauanstalt, of Braunschweig, Germany. **1,524,931.** January 10, 1977; September 13, 1978.

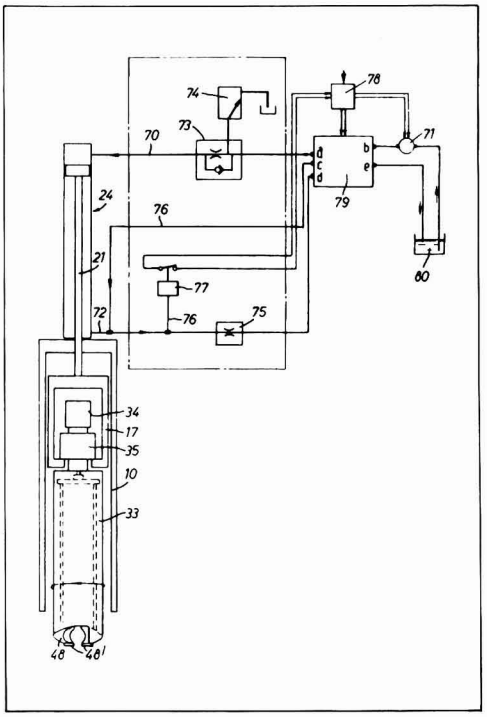
To avoid damage resulting when stones, tramp iron or other hard objects enter with a cane supply, the shredder is provided with means to move resiliently during operation. The cane enters the housing 2 through opening 3 and is shredded by the action of the overlapping hammers fitted to the driven rotor 4 against the anvil 6. The latter extends over a 90° arc and has a grid-type working surface formed by axial bars 7 and circumferential bars 8 connecting them. The anvil is connected at its upper end through a pivot pin 9 to a guide rod 10 which is mounted almost vertically and supported by pivot pin 11.



A joint 12 in the middle of the anvil is connected to a pivot 14 by a compression member 13 which is spring loaded by means of cup springs 15 prestressed to the desired extent by means of the nut 17 on threaded spindle 16. Abutments 19, 20 at each end of the anvil are adjustable against key beds 21 using setscrews 22 so as to set an exactly defined working gap 18 between the hammers of rotor 4 and the bars 7 and 8 of the anvil 6. When some foreign body enters the gap 18, the upper end of anvil 6 pivots about the lower abutment 20. At the same time the joint 12 pivots about pin 9 under the action of the spring-loaded compression member 13. The length of the latter is little altered even as a consequence of quite large movements of anvil 6 so that the pressing force is only slightly increased, while the anvil is protected.

Beet sampler. Cocksedge & Co. Ltd., of Ipswich, England. **1,525,241.** December 31, 1974; September 20, 1978.

To be representative, a sample of beet taken from a lorry by a core sampler should be obtained from all the height of the load down to the lorry floor, because of the settling of dirt in this lower part. This entails a risk of damage either to the lorry floor or to the sampler mechanism which is avoided by use of the hydraulic system shown. The core sampling tube 33 is rotated by a separate motor while moving vertically under the control of a double-action piston and cylinder device 24. This is provided with a pressurized fluid supply through pipes 70 and 72 from pump 71, the flow of fluid in pipe 70 being controlled by variable rate flow regulator 73 and pressure regulating valve 74, and that in pipe 72 by regulator 75. Between the cylinder 24 and valve 75 is a pipe 76 leading to a pressure switch 77 which controls an electric switch 78 which in turn controls a solenoid-operated multiport valve 79 by means of a relay control circuit.



The regulator valves 73 and valve 74 are set to provide the thrust necessary for the sampling tube 33 to penetrate the beets on the lorry without stalling. During penetration the tube is rotated and the output flow rate and pressure are determined by the setting of regulator 75, with the switch 77 normally open. During downward movement of the tube, the ports *a* and *b* of valve 79 are coupled, as are ports *d* and *e*, hydraulic fluid passing from pump 71 to cylinder 24 and the exhaust fluid returning via ports *d* and *e* to reservoir 80. When the shoes 48' touch the floor of the lorry, the pressure provides sufficient force to stall downward motion

Copies of specifications of United Kingdom patents can be obtained on application to The Patent Office Sale Branch, Block C, Station Square House, St. Mary Cray, Orpington, Kent, England (price £1.45 each). United States patent specification are obtainable from: The Commissioner of Patents, Washington, D.C., USA 20231 (price 50 cents each).

without causing damage; the pressure in the pipes 72 and 76 drops instantly and the switch 77 closes and energizes the control circuit to switch the ports so that *c* and *b* and ports *a* and *e* become coupled, whereupon the direction of movement of the tube 33 and the sample of beet in the tube is reversed.

Manufacture and storage of bales of fermentable material. K. Ruckstuhl, of Basel, Switzerland. **1,527,897.** October 17, 1975; October 11, 1978. – Hydraulically compressed bales of green and wet bagasse can ferment and be degraded internally so that they become unsuitable for paper making without any sign of this at the surface of the bale. By using a baler with a central piston device and a housing with more than four wall surfaces, bales are produced which have internal passages through them which, when the bales are stacked, provide a passage, either horizontal or vertical depending on the stacking arrangement, to the outer surface of the stack. In addition, the polygonal nature of the bale sections also provides a series of passages between bales which run through the length or height of the stack.

Stabilized dextrose isomerase enzyme concentrate preparation. CPC International Inc., of Englewood Cliffs, NJ, USA. **1,527,972.** March 9, 1977; October 11, 1978. The enzyme concentrate has a protein content of 50 – 80% (60 – 75%) on dry weight, a Mg^{++} content of 3 – 45 (5 – 25) (5 – 18) $mg.cm^{-3}$ of concentrate, a Mg^{++}: protein ratio of 0.02 – 0.75 (0.03 – 0.5), a specific isomerase activity of at least 10 (at least 12) IGIU per mg of protein [at least 5000 (8000) IGIU per g, dry basis], and a stability such that it retains up to 95% (at least 80 ± 10%) of its activity when stored at 26°C for up to 30 days (at 18°C for up to 12 months). [The concentrate may also include 5 – 25% of a water-miscible solvent (*iso*-propanol). It may also (be free of added Co and) have a moisture content of 50 – 80% (55 – 75%) and dry substance of 5 – 30% by weight.] The enzyme is derived from a *Streptomyces* micro-organism (*S. olivochromogenes* ATCC 21713, ATCC 21714 or ATCC 21715). The concentrate is prepared by treating an aqueous mixture of cell-free dextrose isomerase and [30 – 60% (40 – 45%) by weight of] a water-miscible organic solvent (methanol, ethanol, *iso*-propanol, *t*-butanol, acetone, *p*-dioxane) with a water-soluble Mg salt (Mg acetate, chloride or sulphate) to being it to 0.02 – 0.3M with respect to Mg. This gives a stabilized Mg-enzyme precipitate which is recovered. The cell-free dextrose isomerase is obtained by treating cells containing the enzyme with a lysozyme enzyme preparation and separating the enzyme solution from insoluble cell debris, etc.

Immobilizing dextrose isomerase and continuous dextrose isomerization. CPC International Inc., of Englewood Cliffs, NJ, USA. **1,528,304.** March 31, 1977; October 11, 1978. – An aqueous solution of dextrose isomerase (derived from *Streptomyces olivochromogenes* or *Lactobacillus brevis*) is brought into contact with colloidal silica (having a particle size of 10 – 30 mμ) to absorb the enzyme, [treated with a bifunctional agent (glutaraldehyde, to the extent of 10 – 20% by weight of dextrose isomerase)] (gelatinized and) repeatedly frozen (at −10 – −30°C) and thawed (at room temperature) during 20 – 30 hours, and the enzyme isolated from the mixture when thawed. A dextrose solution is then continuously isomerized by bringing it into contact continuously with the immobilized enzyme (at pH 7 – 9), the enzyme being in the form of 20 – 100 mesh granules or flakes contained in a column.

Rotary hoe for sugar cane cultivation. Instituto Nacional de la Reforma Agraria. of Havana, Cuba. **1,529,826.** December 30, 1975; October 25, 1978.

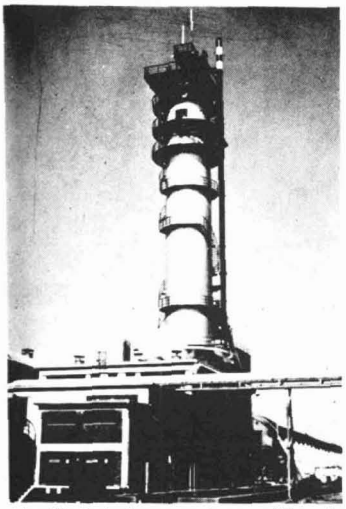
Beet harvester. Cómhlucht Siuícre Eireann Teo., of Dublin, Ireland. **1,529,905.** November 4, 1976; October 25, 1978.

Citric acid fermentation of molasses. Standard-Messo Duisburg Gesellschaft fur Chemotechnik m.b.H. & Co., of Duisburg, Germany. **1,530,370.** September 10, 1976; October 25, 1978. – A substrate containing molasses is inoculated in a germ-free chamber witha micro-organism in a germination phase to form a mycelial layer covering the surface of the substrate under an atmosphere, at slight excess pressure [5 – 50 (20) mm water gauge] of highly sterile air which has been passed through a coarse-fine-absolute filter and a U-V sluice, and heated to 120°C (and is admitted to the chamber at 1 $m^3.hr^{-1}$ per m^3 of substrate. The fermentation chamber is heated separately and independently of the air supply (to compensate for heat losses from the substrate) and a fermentation phase is effected in which the hot sterile air supply and chamber heating are switched off and a supply of fresh, filtered, unconditioned air (warmed or cooled as necessary) provided as cooling air to keep the temperature of the substrate substantially constant. The fermentation produces citric acid which is recovered.

Sucrose esters. W. H. T. John, of Leicester, England. **1,530,475.** November 15, 1975; November 1, 1978. Sucrose esters are produced by heating sucrose with a long-chain (C_8 – C_{22}) fatty acid (stearic acid or oleic acid) [at 110 – 140°C (120 – 130°C)] in the presence of ammonia or [up to 15% (8%) on weight of desired product of] an ammonium salt (the ammonium salt of a fatty acid; ammonium carbonate). The ratio of sucrose: fatty acid is about (<)3:1 (2:1) and the reaction time up to 10 hours (2½ hr). The sucrose may be in the form of a very concentrated solution (of b.p. above the reaction temperature); the acid is melted and forms a supernatant phase above the sucrose solution and the ammonia or ammonium salt is added to this acid phase [together with an inert gas (N_2, CO_2)]. An inert barrier layer of organic solvent (an alkyl phthalate), permeable to one or other of the acid and sucrose, is between the two reactant phases.

Production of polysaccharides by fermentation. Rhone-Poulenc Industries, of Paris, France. **1,531,644.** February 23, 1977; November 8, 1978. – A glucide (sucrose, dextrose or starch) is fermented with a *Xanthomonas* micro-organism (*X. campestris*) wherein, after the initial preparation of the inoculum, a fermentation medium containing [1 – 6 (1.3 – 3) g per litre] ammonium phosphate as the sole source of nitrogen is used for the subsequent fermentation stages(s). The pH is maintained at 6 – 7.5 (6.5 – 7.2) and the process yields a polysaccharide usable in petroleum recovery.

Removal of sucrose from a sugar mixture. Hayashibara Seibutsu Kagaku Kenkyujo K.K., of Okayama, Japan. **1,533,339.** December 30, 1976; November 22, 1978. Sucrose is removed from a sugar mixture (e.g. molasses) by bringing a water-insoluble glucan (comprising mainly



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Vertical skip hoist with maximum operating safety.

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GEGR. 1860

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1 kWh/cycle

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- *22 hours/day*
- *180 days/year*

Energy savings/year:
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Assume energy costs=
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The savings will amount
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1 → 3, 1 → 4 and 1 → 6 linkages), obtained by cultivating a *Streptococcus* micro-organism (*S. salivarius* TTL-LP, FERM-P No. 3310) and which possesses suitable activity, into contact with the mixture whereby reaction occurs and the sucrose is removed (e.g. allowing recovery by crystallization of raffinose in greater yield and uncontaminated with sucrose).

Waste water purification. Svenska Sockerfabriks AB., of Malmö, Sweden. **1,535.549.** April 23, 1976; December 13, 1978. — A waste water rich in carbohydrates is biologically purified by treatment in an anaerobic stage while leading off methane generated; sludge is separated from the water and part sent for disposal while the remainder is returned to the anaerobic stage. The water is further treated in an aerobic stage and a second sludge-bearing water obtained from which the sludge is separated and sent to the anaerobic stage. Where the original waste water is rich in proteins these are converted to ammonium salts in the anaerobic stage, and alkali is added to the water (to bring it to pH 9-11) before the anaerobic stage, ammonia being driven off (by blowing air through the water). Alternatively, the ammonium ions may be removed by adsorption on a cation exchanger saturated with sodium ions.

UNITED STATES

Beet topper. N. B. Glifberg, of Staffanstorp, Sweden, *assr.* Svenska Sockerfabriks AB. **4,064,681.** August 29, 1975; December 27, 1977.

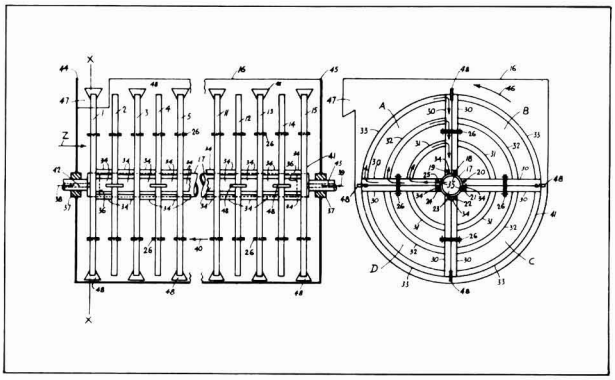
Prehydrolysis and digestion of plant material (bagasse). H. F. Funk, of Murray Hill, NJ, USA. **4,070,232.** May 30, 1975; January 24, 1978. — Bagasse is prehydrolysed by heating under pressure in the presence of (3 times its weight of) steam and the vapours of a dilute acid solution (0.2% HCl + 1.3% formic acid + 2.7% acetic acid) of pH 1.5 – 3.5, at 105° – 135°C (125°C) for 7 – 20 (15) min, to convert at least part of the hemicelluloses into pentoses and hexoses which pass into solution, leaving a fibrous material. The sugars are separated and recovered while the fibrous material is heated under pressure with (6 times its weight of) "white liquor" [an alkaline (NaOH or Na_2CO_3) solution of 10 – 20% (12 – 15%) Na_2O equivalent containing sulphidity as Na_2S equivalent to 0 – 25% (25%) of the Na_2O content] at 105° – 135°C (125°C) for a time sufficient to digest the fibre [15 – 55 (20) min]. The digested fibre is then separated and washed.

Cane harvester. R. Soulat, of Paris, France, *assr.* Sodia S.A. **4,070,809.** August 15, 1975; January 31, 1978.

Screen for a continuous centrifugal. W. Dietzel, of Braunschweig, Germany, *assr.* Braunschweigische Maschinenbauanstalt. **4,072,266.** May 27, 1976; February 7, 1978. — See UK Patent 1,489,857[1].

Continuous crystallizer element. J. C. V. Ducasse, of Martinez, CA, USA, *assr.* Unice Machine Co. **4,074,751.** March 3, 1976; February 21, 1978.

The heat exchange element 41 for a continuous crystallizer rotates in the direction of arrow 46 within a housing 16 and is supported by bearings 37. It comprises a hollow shaft 17 carrying coil sets 1 – 15 each of which comprises four separate identical coils, preferably of square tubing, forming sectors A, B, C and D located in a plane perpendicular to the shaft 17. The sectors comprise radial arms 30 and concentric arcs 31, 32, 33 and provide separate circuits in which cooling water follows the flow patterns described by arrows in the diagram. Channels 34 run the length of the shaft 17 and holes are provided in the ends of arms 30 so that water passes from shaft 17 through hole 35 into the cooling circuit A1; it leaves the return arm 30 of circuit A1, passes into channel 34 and so enters the outward arm of circuit B2. From the return arm of circuit B2 it passes into channel 34 and thence to circuit C3, thence to D4, thence to A5 and so on along the crystallizer. Similarly water entering circuit B1 from shaft 17 continues to circuit C2, circuit D3 and so on.



Hot massecuite is fed into the crystallizer at end 45 and passes in the direction of arrow 40, eventually overflowing through channel 47 at the other end 44 of the housing 16. Cooling water 38 enters through the central duct 42 in the end of shaft 17, passes through the cooling circuits and leaves (39) through the central duct 43 in the other end of shaft 17. The multiple circuits and parallel flows through coils 31, 32, 33 ensure that the cooling water temperature in the planes formed by the coil sets is more uniform than in conventional crystallizers.

Decolorizing sugar solutions with peroxide. S. A. Farag and L. W. Norman, of Moses Lake, WA, USA, *assrs.* U & I Inc. **4,076,552.** August 24, 1976; February 28, 1978. — To beet juice or cane juice (obtained by diffusion) is added lime, slaked lime, milk-of-lime or calcium saccharate and 0.01 – 0.4% by weight of an alkali metal or hydrogen peroxide, and the pH brought to 10.4 with CO_2, the peroxide addition being prior to or at the same time as the CO_2 addition. The juice is filtered to remove the precipitated $CaCO_3$ plus colouring matter and colour precursors, and the filtered juice treated with SO_2, concentrated by evaporation and sugar crystallized. The CO_2 treatment may be in two stages with an intermediate sedimentation and filtration; the peroxide treatment may be prior to or at the same time as either the first or second carbonatation. The pH may be brought to 9.0 – 9.5 by the second carbonatation.

[1] *I.S.J.*, 1980, **82**, 259.

Cane mill. J. P. Georget, of Denain, France, *assr.* Fives-Cail Babcock. **4,077,316.** July 28, 1976; March 7, 1978. See UK Patent 1,494,306[1].

Stabilized dextrose isomerase enzyme concentrate. R. P. Cory, of La Grange, IL, USA. **4,077,842.** March 19, 1976; March 7, 1978. -- A stabilized dextrose isomerase concentrate is prepared by placing an aqueous mixture containing cell-free dextrose isomerase and a water-miscible organic solvent such as *iso*-propanol in contact with a magnesium salt to form an enzyme-Mg precipitate. The stabilized concentrate contains Mg and retains at least 95% of its initial isomerase activity when stored at 26°C for up to 30 days and about 80% when stored at 18°C for up to one year.

Insolubilized dextrose isomerase. Y. Fujita, A. Matsumoto, I. Kawakami, T. Hishida, A. Kamata and Y. Maeda, *assrs.* Mitsubishi Chemical Industries Ltd. and Seikagaku Kogyo Co. Ltd., of Tokyo, Japan. **4,078,970.** September 10, 1976; March 14, 1978. – An insolubilized dextrose isomerase having an enzymatic activity yield of >40 (>60) is produced by placing a macroporous anion exchange resin, having a porosity of 4.5 – 20% measured by the dextran method and an ion exchange capacity of 0.035 – 0.1 meq.cm^{-3} resin, in contact with dextrose isomerase in a proportion of 700-5000 U (1000 – 3500 U) per cm^3 of resin in a wet state at 40° -- 75°C and pH 5.5 – 9.5 for 2 – 18 hr to effect adsorption of $>50\%$ and 500 – 4000 U.cm^{-3} (1000 -- 3000 U.cm^{-3}) of enzyme on the resin.

Juice or syrup clarification. J. C. Torres, of Cali, Colombia, *assr.* Fabcon International Inc. **4,081,288.** December 13, 1976; March 28, 1978. – Syrup is (agitated with air and) treated with a composition (A) comprising 10 -- 100% (40 -- 100%) $CaHPO_4,2H_2O$, 0 – 40% (0 – 20%) $Al_2(SO_4)_3$, 0 – 40% (0 -- 20%) kaolin, 0 -- 90% (0 – 30%) Na_3PO_4,H_2O and 0 – 5% (0 – 2%) Na polyacrylamide, and another composition (B) which comprises 10 -- 100% (40 -- 70%) Na_2CO_3, 0 – 80% (0 – 50%) NaOH, 0 – 80% (20 – 50%) CaO and 0 – 40% (0 – 20%) MgO. The amounts added (sequentially as dry powders or slurried together before addition) are 1 – 500 ppm (15 – 40 ppm) of A and 2 -- 200 ppm (5 – 20 ppm) of B. 1 -- 5 ppm of Na hydrosulphite is added to the pans in which the syrup is fed and boiled to sugar.

Sugar decolorizing quaternary ammonium acrylamide resins. W. Fries and S. Napierski, *assrs.* Rohm & Haas Co., of Philadelphia, PA, USA. (A) **4,082,564.** March 23, 1977; April 4, 1978. (B) **4,082,701.** May 13, 1977; April 4, 1978.

(A) Sugar solutions are decolorized by bringing into contact with a cross-linked (gel-type) macroreticular quaternary ammonium acrylamide resin which is the product of reaction of a compound of formula R-X with a cross-linking macroreticular tertiary amine, acrylamide precursor resin which comprises a copolymer of 0.1 - 50% w/w of a polyethylenically unsaturated monomer and 50 - 99.9% w/w of a monoethylenically unsaturated aliphatic ester of acrylic acid which has been aminolysed with a polyamine, the resin having units of chemical formula $-CH_2-CH-CO-NH-(CH_2)_3-NR(CH_3)_2^+ X^-$ where R is a substituted or unsubstituted hydrocarbyl group of 5 - 22 C atoms [a (linear or branched, saturated or unsaturated) alkyl or C_5 - C_{18} aralkyl group (which may be substituted with 1 - 3 alkoxy, acyl, acyloxy or hydroxy groups)] and X is an anion [a hydroxide, halide, alkyl sulphate, bisulphate or alkyl or aryl sulphonate (a halide, preferably Cl^- or Br^-)], either alone or in series combination [about 8% (3.7%) divinyl benzene, about 2% (0.5%) diethylene glycol divinyl ether and about 90% methyl acrylate (95.8% ether acrylate) which has been aminolysed with N, N-dimethyl-aminopropylamine].

(B) The resin in (A) is specified in greater detail.

Conversion of cellulose and lignin organic waste material into a more digestible and manageable form. S. Katzen, of Herzilya Pituach, Israel. **4,082,859.** July 1, 1975; April 4, 1978.– The organic waste material (bagasse) is rendered suitable as animal fodder by reducing to less than 2 inches, mixing 40 - 60% of it with phosphoric, hydrochloric or sulphuric acid (or a mixture of these) and mixing the remainder, before, after or simultaneously, with $Ca(OH)_2$, NaOH, KOH, NH_4OH or mixtures of these; the two mixtures are then mixed and reacted together (at 20 - 150°F) to give a more digestible form of the waste containing 20 - 60% of water by weight (adjusted by prior drying or moistening of the untreated waste) and this is formed into pellets, cakes, blocks, etc.

Cane shredder. D. Dittman, of Salzgitter, Germany, *assr.* Braunschweigische Maschinenbauanstalt. **4,083,502.** February 2, 1977; April 11, 1978.– See UK Patent 1,524,931[2].

Sugar juice treatment. L. A. Paley, of Aurora, IL, USA. **4,083,732.** January 11, 1975; April 11, 1978.– Cane juice is mixed with chlorine to sterilize it and then treated at room temperature with oxalic acid solution to form a mud of non-sugar impurities; this mud is removed and the juice treated with active carbon to give a cold, water-white solution which is concentrated by reverse osmosis and/or evaporated to form a direct white sugar and an edible molasses having a natural maple flavour and odour.

Cane planter. C. Dugas, of Loreauville, LA, USA. **4,084,465.** July 2, 1976; April 18, 1978.

Method of pressing bagasse (paper) webs. C. N. Rempel and M. G. Linkletter, of Beloit, WI, USA, *assrs.* Beloit Corporation. **4,086,131.** May 6, 1975; April 25, 1978. A continuous travelling paper web is formed from bagasse fibres between a pair of looped travelling wires to dewater from both sides of the web, and lifted off one of the wires, immediately passing it through a first press nip sandwiched between two press felts with the web being continuously supported between the forming wire and first nip, carrying the web on the upper side of one of the felts to a second nip, bringing the web to a dryness of at least 30% in the first two double-felted nips, transferring the web onto a plain roll and passing it through third and fourth nips on the plain roll with felts outwardly of the web, and removing the web from the plain roll to transfer it to a dryer section. Pressure is applied to the bagasse web in the range of 200 - 250 pli (pounds per linear inch) in the first nip, 300-350 pli in the second, 350 - 400 pli in the third and over 500 pli in the fourth nip.

[1] *I.S.J.*, 1980, **82**, 259.
[2] *ibid.*, 1981, **83**, 91.

BREVITIES

International Conference on Filtration. – The 1981 International Conference of the Filtration Society will be held at the Cunard Hotel, London, during September 15 - 17, in conjunction with the FILTECH/81 exhibition at the nearby Olympia exhibition centre. The theme of the Conference is "Filtration and separation equipment selection for optimum results" and papers have been submitted by experts from industry, research institutes and universities in ten countries. Details may be obtained from the conference organizer, Mr. D. Wyllie, Knights Place, Whichford, Shipston-on-Stour, Warwickshire, England.

International Colloquium on World Sweetener Policy for the 80's. – This colloquium, sponsored by the Sugar Users Group in Washington, DC, USA, under the Chairmanship of John M. Mount of the Coca-Cola Company, was held in Phoenix, Arizona, during February 1 - 4. Papers were presented on sweeteners demand in 1980 and the short and longer term outlook for sweetener supply and demand. A number of contributors discussed costs of production of cane and beet sugar and HFCS while other topics included alcohol production from corn and sugar, the International Sugar Agreement and US sweetener policy in 1981 and beyond.

Belgian sugar machinery group changes. – Ateliers Belges Réunis, of which A-B-R Engineering is a division, has agreed on amalgamation with the Belgian civil engineering and control/automation firm IMSAY-ETS. The new firm formed by the amalgamation will be known as ABAY S.A. and will be located in Brussels, as will A-B-R Engineering who will continue in operation as the division concerned with cane and beet sugar plants, corn syrup facilities and alcohol distilleries.

European sugar policy survey. – The European News Agency, of 46 Avenue Albert-Elisabeth, B-1040 Brussels, Belgium, has published a 200-page survey, in English and French, concerning sugar policy in the EEC for the period 1981 - 85, on the Community's relationship with the International Sugar Agreement, on the future of the EEC/ACP protocol on cane sugar imports by the Community, and on fuel alcohol as an option for sugar producers. The survey costs 8800 Belgian francs (£134, $303) and is available in English and French.

Kenya sugar expansion[1] . – The Kenya Sugar Authority, with financial assistance from the World Bank, is to expand the six sugar factories at Miwani, Muhuroni, Chemelil, Mumias, Nzoia and Awendo. The government is also to build two new factories at Kapsorok in Mkericho district and at Kemeloi in Nandi district. Production in 1980 was expected to rise to 414,000 tonnes, white value, against 296,000 tonnes in 1979, but production might fall in 1981 owing to the prevailing drought.

Sudan alcohol from cane[2]. – Wescon Nederland and the JGC Corporation of Japan are carrying out a feasibility study for an ethanol plant in the south of the Sudan. Japanese reports say the plant will be at Mongalla, near the Uganda border, and that it will produce 120,000 litres of alcohol per day from 2000 tonnes of sugar cane waste. The project may involve the planting of 12,000 hectares of cane on land adjacent to the White Nile.

Cane carrier chain order for Cuba. – Ewart Chainbelt Co. Ltd., of Derby, England, have won a further major contract worth some £250,000 for the supply of steel cane carrier chains and spares for the Cuban sugar industry.

Energy-efficient alcohol fermentation process[3]. – A fermentation process to produce 20 million gallons per year or more of fuel-grade ethanol that uses 25% less steam than current processes has been developed by Stone & Webster Engineering Corporation, of Boston, Mass., USA, according to a report in *Chemical & Engineering News*. The low steam consumption was achieved by integrating energy-intensive drying, evaporating and distilling steps. Company representatives said that the by-product carbon dioxide can be recovered economically.

Malaysia sugar cane trials[4]. – The Sabah Economic Development Corporation is carrying out trial plantings of sugar cane in several areas in an attempt to produce sugar locally. In addition, the Corporation plans to set up a sugar factory to process either locally-grown cane or imported raw sugar.

Starch Convention, 1981. – The 1981 Convention of the Association of Cereal Research, Detmold, Germany, will be held during April 28 – 30 and will be combined with an exhibition of machinery and apparatus, social events and a ladies' program. Non-members should register with the Association at 10 Schützenberg, D-4930 Detmold 1, before March 31. Papers will be presented with simultaneous translation in the two congress languages, English and German, and the preliminary program includes the following, a number of which are concerned with corn-based alcohol and sweeteners: Starch as chemical source material – Chances and limits (H. U. Woelk, Hamburg); X-ray and nuclear magnetic resonance investigations on some structure problems of starch (I. Schwier & H. Lechert, Hamburg); Nuclear magnetic resonance investigations on the mechanism of water mobility in different starches (H. Lechert, Hamburg); Density and crystallinity of native potato starch (C. van den Berg, Wageningen); The use of energy-dispersive microanalysis in the study of cationic potato starches (D. J. Gallant *et al.*, Nantes); Ultra-structural and nutritional aspects of some tropical tuber starches (D. J. Gallant *et al.*, Nantes); Differential scanning calorimetry – investigations on starch-lipid complexes (G. Konieczyn-Janda & R. Stute, Heilbronn); Specific association of starch polymers with lipids (E. J. Welsh & P. V. Bulpin, Bedford); Increase of bio-availability of medicaments by cyclodextrins (J. Szejtli, Budapest); Specific binding of bacteria on particular polyglucans (U. Winkler & M. L. Portales, Bochum); Analytical investigations on phosphate cross-linked starches (H. Koch *et al.*, Hamburg); Rheological studies on starch (J. L. Doublier, Nantes); Shorter measuring time period for starch measurement with the Viscograph (W. Sietz, Duisburg); Air classification of cereals (F. Holm, Aarhus); Extrusion cooking of grains or tubers for the production of ethanol (I. Ben-Gera *et al.*, Kansas City); Processing of starch industry by-products, preferably to bio-alcohol (J. Hutterer, Vienna); Alcohol from biomass with particular consideration of starch-bearing plants (K. Schreier, Vienna); Anaerobic procedures for purification of wate water from starch plants (H. Sahm, Jülich): Purification and recovery of waste water from wheat starch plants by means of enzymes (A. J. Wieg, Naarden-Bussum); Purification of waste water from potato starch plants by the deep-shaft system (G. Knobloch, Emlichheim); Modern chromatographic methods for the analysis of carbohydrate mixtures (K. M. Brobst & H. D. Scobell, Decatur); Separation of starch hydrolysates by gel chromatographic and high performance liquid chromatographic methods (E. Wilhelm *et al.*, Detmold); Kinetics of product production by *Aspergillus niger* glucoamylase immobilized on alumina (R. E. Pyle, Elkhart); Diffusion hindrance in isoglucose production with immobilized enzymes (J. Holló *et al.*, Budapest); Isoglucose – the most important food technological development within one generation. (J. V. Hupkes, Delft); and Application of activated carbon in starch sugar production (T. M. W. van Asbeck, Amersfoort).

Thailand raw sugar quality[5]. – Thailand has assured overseas buyers that it will produce and export raw sugar of an internationally acceptable standard. The government is requiring strict quality control on sugar coming out of local factories. London traders expressed concern about buying Thai sugar owing to quality problems earlier in 1980. Government officials and exporters confirmed some 80,000 – 90,000 tonnes of raws from the old crop still remaining in warehouses following government action earlier last year to ease a local shortage. Exporters said the extended storage had slightly darkened the raws but that other quality aspects remained unchanged.

New Canadian HFCS plant[6] . – Canada Starch Co. Ltd., a subsidiary of CPC International Inc., is to build a corn wet milling plant in Port Colborne, Ontario, to produce second-generation high fructose corn syrup (containing 55% levulose). The plant will have an initial capacity of 16,000 bushels of corn per day, with a potential to double this. The plant will also produce first-generation HFCS (42% levulose) as well as corn starch, corn oil and a variety of ingredients for animal fodder. Construction is expected to be completed by the autumn of 1982.

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1 F. O. Licht, *International Sugar Rpt.*, 1980, **112**, 734.
2 *Middle East Economic Digest*, November 7, 1980.
3 *Cereal Foods World*, 1980, **25**, 722.
4 F. O. Licht, *International Sugar Rpt.*, 1980, **112**, 736.
5 *Public Ledger's Commodity Week*, December 27, 1980.
6 F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 13-14.

BREVITIES

USSR sugar expansion[1]. – During the period 1966 – 1979 beet slicing capacity in the USSR rose from 535,300 tonnes per day to 794,900 tonnes. Of this increase 116,000 tonnes per day was due to the erection of new factories, raising the total from 296 to 324, and the remaining increase of 143,600 tonnes was realised through expansion, modernization and re-equipping of existing plants. The 1981/85 Plan calls for erection of six new sugar factories with a daily capacity of between 6000 and 12,000 tonnes of beet.

Brazil sugar for oil deals[2]. – Brazil has already signed a number of medium-to-long term sugar supply deals and is negotiating others, according to the Sugar and Alcohol Institute. Brazil intends to ship up to 50% of all exports under such contracts in 1981 and special emphasis will be placed on oil-for-sugar barter deals. The USSR is to take 1,600,000 tonnes between 1981 and 1985, Venezuela will receive 200,000 tonnes a year until 1983 and a number of Middle Eastern countries will take around 300,000 tonnes a year. The Institute estimates 1980/81 sugar production at 8.3 – 8.4 million tonnes, against 7.2 million in 1979/80. Alcohol production will be 3.85 – 3.90 billion litres, somewhat down on the 4.1 billion originally planned.

Zambia cane area expansion[3]. – An agreement has been signed under which a total of $11.2 million will be raised to finance the development of 1885 hectares of irrigated sugar cane at Kaleya, near Mazabuka in the southern province. The cane will be sold to the Zambia Sugar Co. for processing, making it possible for the factory to utilize more fully its spare milling capacity. The main development of the scheme was due to commence towards the end of 1980, with completion of cane planting in 1983.

New Cuban sugar factory[4]. – The new Batalla de las Guásimas sugar factory went into operation in May 1980. It is the second of four factories to be built since the revolution and is located near Vertientes in Camagüey Province. It has a capacity of 6800 t.c.d.

Zimbabwe sugar expansion[5]. – The capacity of the Triangle sugar factory in the southern Lowveld is to be increased by almost 50%, allowing it to crush 1.9 million tonnes of cane per year. The $28.7 million project, which includes new plant and modernization of the existing mill, is due to be completed by early 1982. Triangle is then due to start accepting cane from the new Mkwasine sugar cane estate, jointly owned by Triangle and Hippo Valley Estates Ltd. About a third of the total cost will be spent on capital equipment and technical advice from the UK and West Germany.

Brazilian alcohol project[6]. – A Brazilian consortium is planning to grow sugar cane in the Mato Grosso do Sul state, near the border with Paraguay, and is to erect a facility to produce fuel alcohol which would produce 1.5 million litres of alcohol per day. It will be the largest plant of its kind in the world, and its cost is estimated at $70 million. It will begin operating in 1982.

West Germany campaign results, 1980/81[7]. – The campaign ended in West Germany with a total slice of 19,083,495 tonnes, some 780,000 tonnes more than in 1979/80. The beet area was 9000 ha higher than in 1979, at 414,301 ha. The sugar content of the beets was lower, however, at 16.02% *vs.* 17.12% and sugar production from beets was lower than last campaign at 2,961,505 tonnes, raw value, against 3,067,224 tonnes. When sugar recovered from molasses is added, total sugar production is around 2,982,000 tonnes, more than 100,000 tonnes lower than 1979/80 but 200,000 tonnes more than the quantity expected at the beginning of the campaign.

New Morocco beet sugar factory. – Fives-Cail Babcock has announced that it has won a contract to supply a facility to S.A. de la Sucrerie des Zemamra for processing of 4000 tonnes of sugar beet per day. The plant will be situated at Khemis des Zemamra and should commence operations in May 1982.

Thailand sugar cane payment[8]. – The sugar Institute has issued a statement that the price for sugar cane for the 1981/82 season will be announced in advance and that the price for the 1982/83 season will be set according to sugar content and not only cane weight as at present. The Institute also anticipates that the recovery of raw sugar will be about 90 kg per tonne of cane in the 1981/82 season, some 8 kg higher than the estimated ratio for the 1980/81 season. The Internal Trade Department has issued a directive that the full amount of 600,000 tonnes of white sugar required for domestic consumption must be produced before permission for the export of raw sugar is given.

New Yugoslavia sugar factory[9]. – A new sugar factory which is nearing completion at Pozarevac in Serbia is designed to process about 6000 tonnes of beet per day. The equipment is supplied by Technoexport of Czechoslovakia and the Djuro Djakovic enterprise of Slavonski Brod. Investment in the construction of the factory is estimated at some 2715 million dinars (US $94.7 million).

Switzerland 1980/81 campaign results[10]. – In the 1980/81 campaign the two Swiss sugar factories sliced a total of 675,052 tonnes of beet to produce 96,184 tonnes of white sugar, almost sufficient to cover domestic requirements estimated at 680,000 tonnes. An increase in beet slice of 50,000 tonnes is anticipated for the next campaign.

Indian sugar factory rehabilitation[11]. – The West Bengal government is to take over the Beldanga sugar factory, an 800 t.c.d. plant which has been closed since 1947. About US $378,000 has been allocated for its rehabilitation.

Poor USSR beet crop[12]. – On January 23 Moscow Radio reported that the beet crop in the USSR had improved by 7.4 million tonnes to 79.6 million tonnes. It was nevertheless the second poor harvest in succession, falling about 20 million tonnes below target.

New Pakistan sugar factories. – A new cane sugar factory, the country's 32nd, went into operation in the 1980/81 season in Pakistan. The Gojra-Samundari Sugar Mills Ltd. project was built by Polimex-Cekop and the state-owned Heavy Mechanical Complex at Taxila and has an initial crushing capacity of 2000 t.c.d. with the possibility of enlargement to 3000 t.c.d. It cost about $29.2 million and produces white sugar by the defecation remelt process. The factory is located at Chak 45, near Gojra in the irrigated area of the Punjab. Two more factories are making trial runs[13]; these are Kamalia Sugar Mills Ltd., Kamalia, and Bab-Fareed Sugar Mills Ltd., Okara. Both have initial capacities of 2000 t.c.d. and were built by Smith Mirrlees and Polimex Cekop/Heavy Mechanical Complex, respectively.

Sweden 1980/81 campaign results[14]. – In the 1980/81 campaign the seven beet sugar factories in Sweden sliced a total of 2,226,006 tonnes of beet to produce 240,442 tonnes of white sugar, 62,493 tonnes of raw sugar, 82,611 tonnes of molasses, 356,244 tonnes of pressed pulp and 134,870 tonnes of dried pulp.

Peru sugar plans[15]. – Imports of 139,000 tonnes, raw value, are required by Peru in 1981, owing to drought, but, assuming that rainfall and irrigation water supplies become normal, sugar production is expected to rise from 500,000 tonnes in 1981 to 700,000 tonnes in 1982, 900,000 tonnes in 1983, 950,000 tonnes in 1984 and 990,000 tonnes in 1985. After allowing for domestic consumption increasing from 619,000 tonnes in 1981 to 830,000 tonnes by 1985, this will still permit exports to be resumed next year and to reach 150,000 tonnes annually thereafter while also permitting stocks to be built up again. There are plans to raise the capacities of Tuman, Andahuasi and Chucarapi factories but, owing to economic difficulties facing the industry, it is not certain that these plans will be realised.

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1 F. O. Licht, *International Sugar Rpt.*, 1980, **112**, 730.
2 *Public Ledger's Commodity Week*, December 27, 1980.
3 F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 16.
4 *Cuba Economic News*, 1980, **16**, (107), 13.
5 F. O. Licht, *International Sugar Rpt.*, 1981, **113**, 16.
6 *Westway Newsletter*, 1980, (86), 10.
7 F.O. Licht, *International Sugar Rpt.*, 1981, **113**, 30. 94.
8 *Standard Chartered Review*, January 1981, 33.
9 F.O. Licht, *International Sugar Rpt.*, 1981, **113**, 31.
10 *Zuckerind.*, 1981, **106**, 102.
11 F.O. Licht, *International Sugar Rpt.*, 1981, **113**, 85.
12 *The Times*, January 24, 1981.
13 F.O. Licht, *International Sugar Rpt.*, 1981, **113**, 65.
14 *Zuckerind.*, 1981, **106**, 100.
15 F.O. Licht, *International Sugar Rpt.*, 1981, **113**, 36 - 37.

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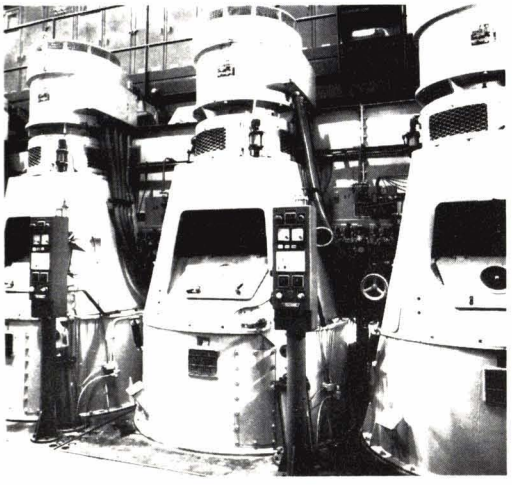

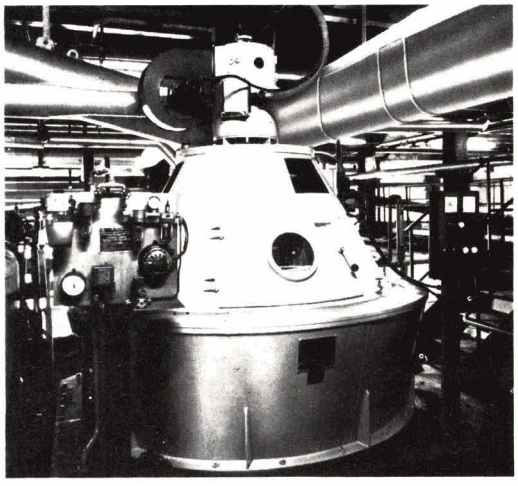

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