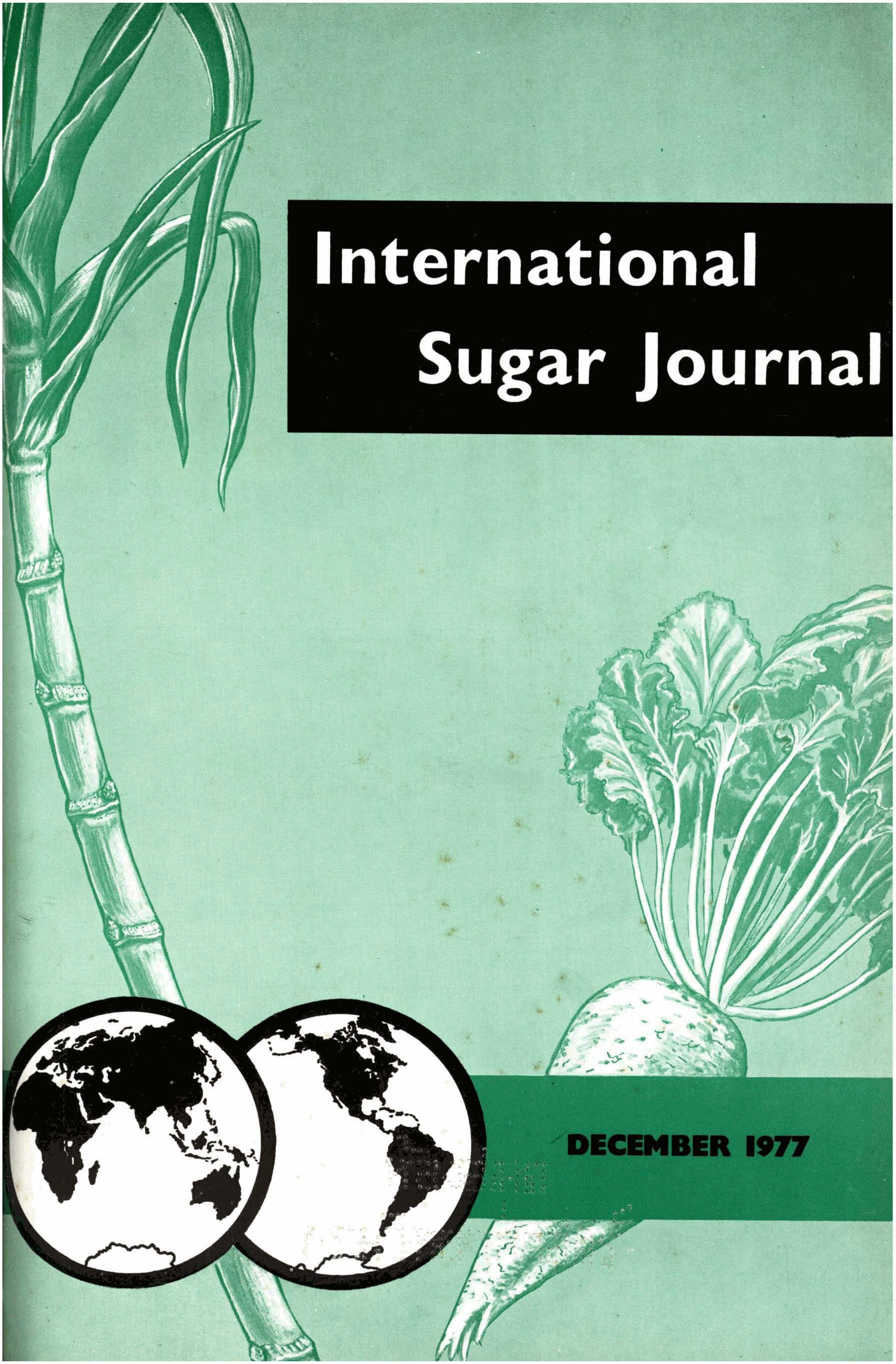
International Sugar Journal



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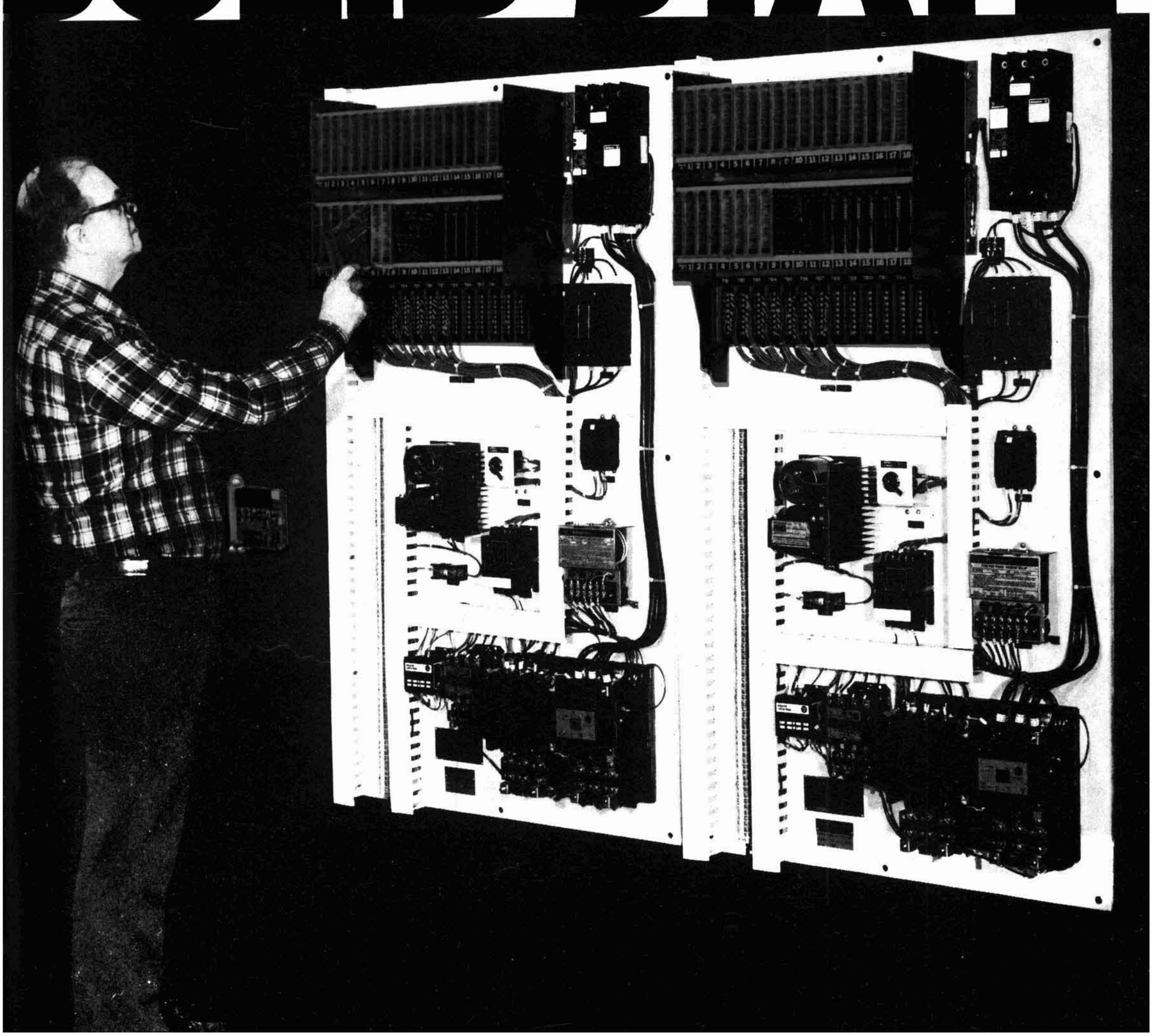

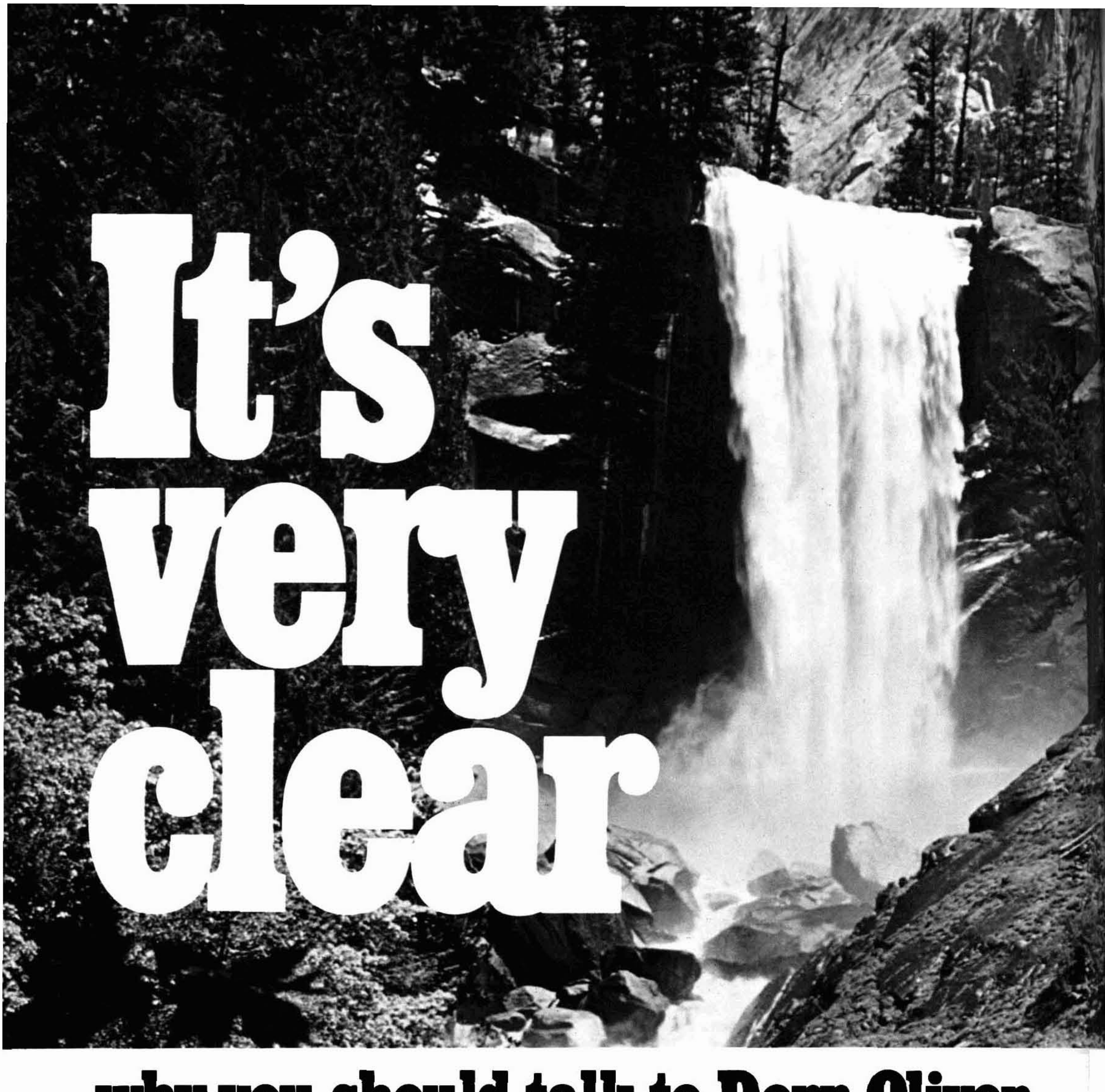
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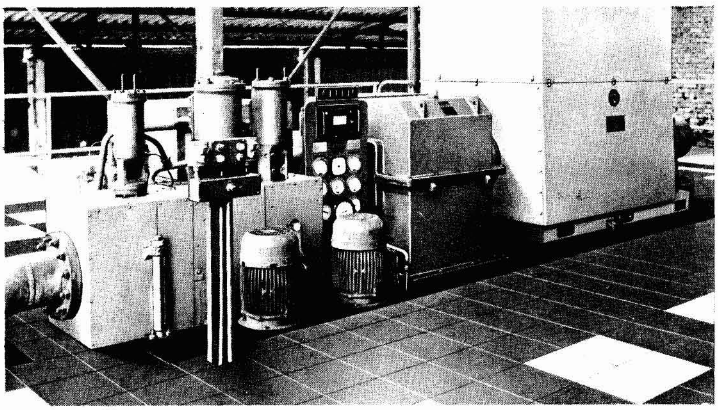

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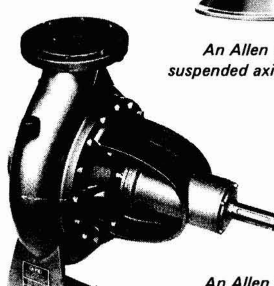

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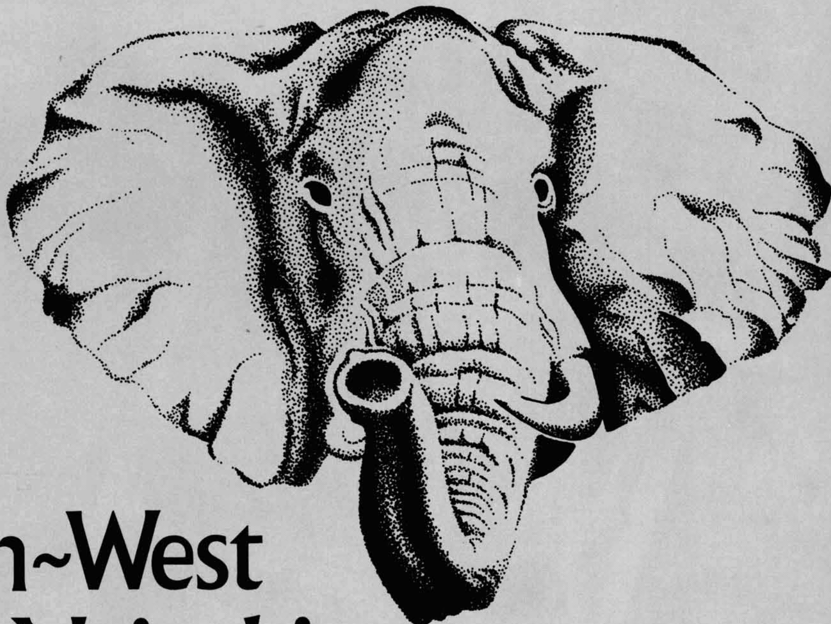

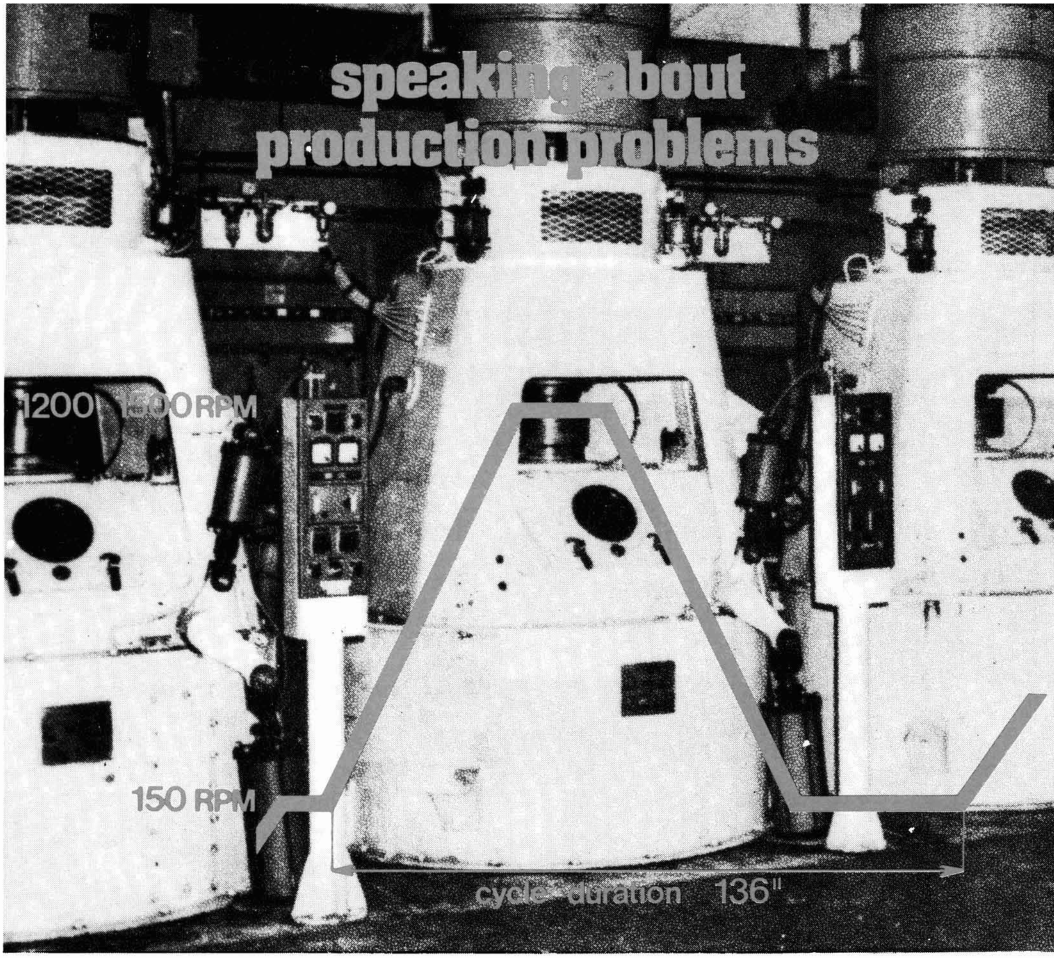

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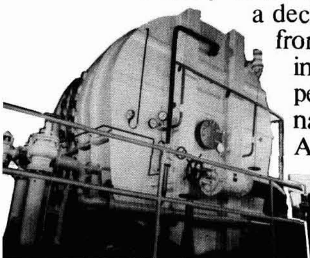

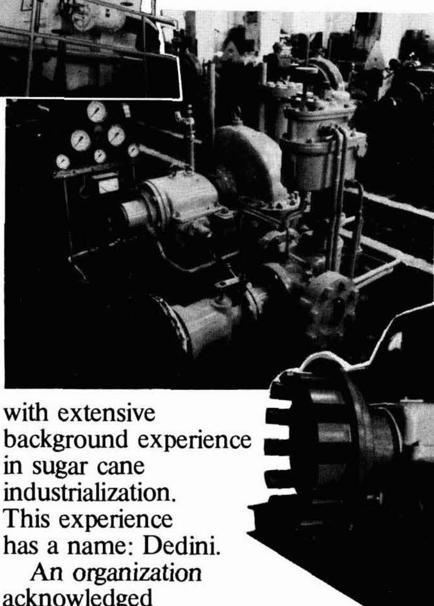

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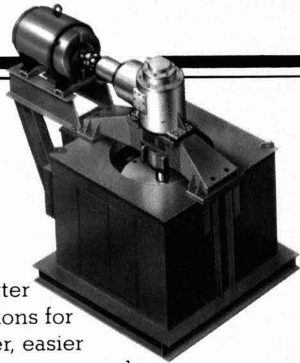

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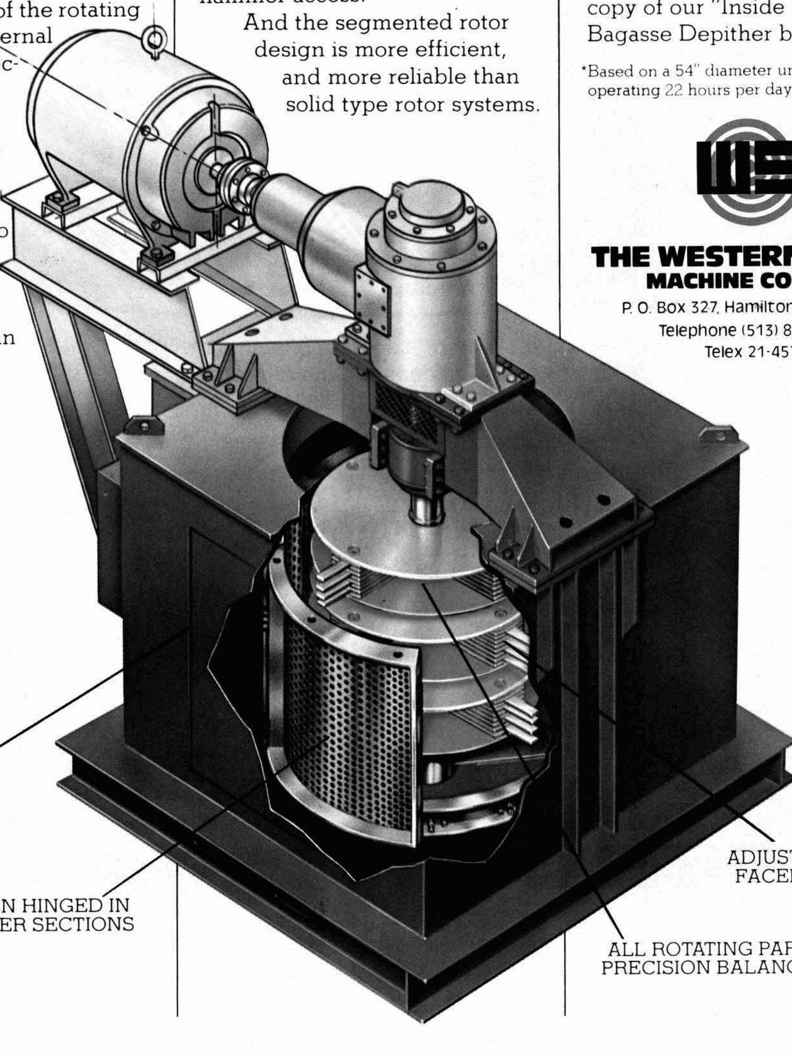

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SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

16ème congrès ISSCT, 1977. *p.* 333–340,

On présente la rapport du 16ème congrès de l'International Society of Sugar Cane Technologists qui a eu lieu à São Paulo, Brésil, en septembre 1977. Des informations sont également données concernant les attractions touristiques visitées par les participants ainsi qu'au sujet de l'industrie du sucre brésilienne, avec des détails des diverses usines et autres installations visitées. Des excursions après le congrès, vers des sucreries au Tucumán, Argentine, et au nord-ouest du Brésil sont également décrites.

* * *

Etudes sur la maturation à basses températures dans le nord de l'Inde. R. S. KANWAR, O. SINGH et S. K. BATTA. p. 340–346

On décrit l'expérience au cours de laquelle a été étudié l'effet du gel sur quatre variétés de canne. Alors que la teneur en sucre d'une variété de maturation hâtive (CoJ 64) n'était pas affectée, pour les deux variétés tardives (CoJ 46 et Co 1148) la teneur en sucre et la pureté du jus sont tombées au cours de la période de basse température, par suite du manque de maturité. On a enregistré le maximum de réduction de ces deux paramètres dans la partie non mûre supérieure de la canne. Ces variétés sont toutes les trois modérément résistantes au gel. Co 1158, une variété de mi-saison très sensible aux dégâts aux feuilles par le gel, a révélé une chute moins importante de la teneur en sucre et de la pureté du jus que les deux variétés tardives, quoique la teneur en gomme, l'acidité titrable et la conductivité électrique étaient plus élevées que dans les trois autres variétés. La diminution de la teneur en sucre allait de pair avec un accroissement correspondant de la teneur en sucres réducteurs.

* * *

L'industrie sucrière au Brésil. P. DUARTE. *p.* 346–349

L'industrie brésilienne du sucre de canne est passée en revue avec son histoire, ainsi que la production d'alcool et la fabrication de matériel de sucrerie.

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16. Kongress 1977 der ISSCT. *S.* 333–340

Es wird über den 16. Kongress der International Society of Sugar Cane Technologists (ISSCT) berichtet, der im September 1977 in São Paulo in Brasilien stattgefunden hat. Der Bericht informiert weiter über die Sehenswürdigkeiten, die von den Teilnehmern besichtigt wurden, sowie über die brasilianische Zuckerindustrie mit eingehenden Details über die verschiedenen besuchten Fabriken und Einrichtungen. Schliesslich werden die nach Ende des Kongresses veranstalteten Fahrten zu den Zuckerfabriken in Tucumán (Argentinien) und im Nordwesten Brasiliens behandelt.

* * *

Reifeuntersuchungen bei niedrigen Temperaturen in Nordindien. R. S. KANWAR, O. SINGH und S. K. BATTA. *S.* 340–346

Die Verfasser berichten über einen Versuch zur Bestimmung des Frosteinflusses auf vier Zuckerrohrarten. Während der Zuckergehalt einer frühreifen Rohrart (CoJ 64) nicht beeinträchtigt wurde, zeigte sich bei zwei spätreifenden Arten (CoJ 46 und Co 1148) infolge der ungenügenden Reife ein Abfall des Zuckergehaltes und der Saftreinheit während der Periode niedriger Temperaturen. Der stärkste Rückgang bei beiden Parametern wurde im unentwickelten Spitzenstück des Zuckerrohrs beobachtet. Alle drei Rohrarten sind einigermassen frostbeständig. Bei Co 1158, einer Art mit einem mittleren Reifetermin, an der durch Frost sehr leicht Blattschäden auftreten, wurde ein geringerer Abfall von Zuckergehalt und Saftreinheit gefunden als bei den beiden spätreifenden Arten. Der Gehalt an Pflanzengummi, die titrierbare Acidität sowie die elektrische Leitfähigkeit lagen dagegen höher als bei den drei anderen Rohrsorten. Der Rückgang des Zuckergehaltes war von einem Anstieg des Gehaltes an reduzierenden Zuckern begleitet.

* * *

Die Zuckerindustrie in Brasilien. P. DUARTE. *S.* 346–349

Der Verfasser gibt einen Überblick über die brasilianische Rohrzuckerindustrie und ihre Entwicklung, über die Alkoholerzeugung sowie über den Zuckerfabriksmaschinenbau.

16o. Congreso del ISSCT, 1977 *Pág.* 333–340

Se presenta un informe sobre el 16o. congreso de la International Society of Sugar Cane Technologists que se celebró en San Pablo, Brasil, en Setiembre 1977. Se presenta también información sobre las atracciones turísticas visitado por los participantes, así como sobre la industria azucarera de la Brasil, con detalles de los varios ingenios azucareros y otros instalaciones visitado por los miembros. Visitas después del congreso en ingenios azucareros de Tucumán, Argentina, y en el norte-oeste de la Brasil se describen también.

* * *

Estudios sobre maduramiento en condiciones de baja temperatura en el norte de la India. R. S. KANWAR, O. SINGH y S. K. BATTA. *Pág.* 340–346

Un experimento se describe en que se ha estudiado el efecto de helado sobre cuatro variedades de caña. Aunque el contenido de una variedad que madura tempranamente (CoJ 64) no estuvo afectado, en dos variedades que maduran tardiamente (CoJ 46 y Co 1148), el contenido de sacarosa y la pureza del jugo cayeron durante el periodo de baja temperatura como resulta de inmadurez. La disminución máxima en ambos parámetros ocurró en la más alta parte inmadura de la caña. Todo las tres variedades estan módicamente resistente al helado. Co 1158, una media-zafra variedad que es muy susceptible a daño de las hojas por helado, manifestó caídas más pequeña en el contenido de sacarosa y pureza del jugo que las tarde-zafra variedades aunque el contenido de gomas, acidez titrable y conductancia eléctrica estuvieron más alto que en las otras tres variedades. La disminución del contenido de sacarosa se acompañó por un aumento correspondiente en el contenido de azúcares reductores.

* * *

La industria azucarero en el Brasil. P. DUARTE. *Pág.* 346–349

Se presenta un examen de la industria de azúcar de caña en el Brasil y su historia, de la producción de alcohol, y de la fabricaciónt de maquinaria para los ingenios azucareros.

INTERNATIONAL SUGAR JOURNAL

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Notes & Comments

Australia-Japan dispute settlement

Shipments of Australian sugar sent to Japanese ports in fulfilment of their long-term contract were refused after 1st July and have been awaiting acceptance and unloading. The sixteen cargoes, totalling some 213,000 tons, had been a source of contention during the continuing negotiations over the contract and the Australians had asked for judgment by the Sugar Association of London, arbitrator under the contract. In mid-October, however, the Japanese agreed to accept the waiting sugar at a "provisional" price of $A 386 a ton, only about 5% less than the original contract price, and this enabled negotiations on the future of the contract to continue.

Eventually, near the end of the month, fresh terms were agreed for the sale of Australian raws to Japan. Of the orignal quantity of 600,000 tons for each of five years, three years' sugar or 1,800,000 tons remained to be shipped at the middle of 1977. This quantity is now to be supplied over four years instead of three and, as a result of revision of the fixed-price terms, the effective price will be about 7% lower than the original price of $405 per ton. In exchange, an additional contract has been signed for the supply of a further 150,000 tons a year over the next four years at a price which will be partly dependent on the world market price but which will be held within maximum and minimum limits.

* * *

World sugar production, 1977/78.

F. O. Licht KG recently issued their first estimate of world sugar production[1] in the crop year September 1977–August 1978, and the figures are reproduced elsewhere in this issue. The total outturn is set at 89,957,000 metric tons, raw value, more than 3·2 million tons higher than for the 1976/77 crop year.

With normal weather in Europe after the drought of the past two years a sizeable increase had been anticipated and, indeed, the figure for France alone is more than one million tons higher than 1976/77, and there are smaller increases for Denmark and the UK, partly offset by reductions in the Dutch and Italian crop estimates. In Western Europe outside the EEC there are expected to be some small increases in production but the Spanish crop is expected to be lower by an appreciable 187,000 tons. Licht notes that the substantially higher EEC production will result in a marked increase in export availability, from 1·66 to 2·5 million tons, which explains the difficulties the Community has had in respect of the International Sugar Agreement negotiations; "If the EEC should join a quota-type agreement, it seems to be almost certain that production and exports would have to be reduced in the coming years".

The East European figures reflect the good condition of the beets in those countries but the 9·1 million ton figure for the USSR assumes the successful harvesting, storage and processing of the crop without repetition of the difficulties which reduced the Soviet crop in 1976/77. A marked decline in the US beet crop, owing to reduced plantings, is forecast while Chile, Iran and China are also expected to produce less beet sugar. The net result is an expected rise of 2 million tons in beet sugar production.

Of cane countries, Brazil has now become the major producer following steady expansion in recent years; the 1977/78 forecast of 8,500,000 is almost a million tons higher than the previous crop. In the remainder of the Western Hemisphere modest increases are forecast for many countries, although Cuba's crop is set 500,000 tons higher than 1976/77 at 6 million tons. The same applies generally in Africa and Oceania; however, in Asia several countries face reductions owing to bad weather and reduced plantings because of the lower return. Thailand's crop is expected to fall by some 20% or 534,000 tons and the Philippine crop by more than 10% or 285,000 tons, while in Taiwan a drop from 1,123,000 tons to only 750,000 tons is forecast.

Total cane sugar production is expected to rise by 1,250,000 tons so that the total beet-plus-cane sugar figure is about 3,250,000 tons higher. Licht estimates that consumption will b about 85·4–86 million tons, indicating that a further 4–4½ million tons will be added to world stocks over the coming season, which would exert strong downward pressure on world market prices.

* * *

World sugar prices

Sugar prices held up well during the negotiations in September/October which concluded with the new International Sugar Agreement. It was anticipated that, in order to start the new year with as low inventories as possible, to avoid limitations on the export of old-crop sugar next year, the producing countries would make great efforts to rid themselves of their stocks and that consequently the price of raw sugar on the world market would sink. On the other hand, importing countries would want to buy at low prices in anticipation of higher prices when the Agreement took effect.

[1] *International Sugar Rpt.*, 1977, **109**, (27), 1–5.

In fact, following the Agreement, the LPD slid gently to a low of £95 per ton by 21st October (compared with £102 at the beginning of the month). There was resistance to further reductions however, and the price rose to £101 on the 28th, to be followed by a sudden drop to £95 again on the 31st.

The price of white sugar showed a small discount on that of raws for two days at the beginning of October but remained remarkably stable, within a range of £102–£108 throughout the month.

* * *

Possible Australian sugar supply contract with China[1]

Chinese buying authorities and the Queensland Government's marketing agent, CSR Ltd., have agreed to hold substantive discussions on a possible long-term sugar supply contract. In a statement released on 7th October by the Queensland Primary Industries Minister, the negotiations were said to be centred around a precious unconcluded agreement originally negotiated in 1973 which was to supply 300,000 metric tons for five years. CSR's chief negotiator, JOHN LAURIE, had flown to Peking to begin discussions, but no details became public except that an agreement for the supply had been reached in principle.

Australia's insistence on firm pricing provisions in the 1973 negotiations was the main stumbling block to agreement at that time, but the relative price stability expected to ensue from the new International Sugar Agreement may make the Chinese less wary.

* * *

US price support quandary

The US Secretary of Agriculture, while recommending government approval of the new International Sugar Agreement, has acknowledged that it will take some time before it pushes prices up to the 13·5 cents per pound which is the support price set under the recently signed US Farm Bill. Consequently domestic legislation must be the main hope of the US sugar industry for the time being.

Informed Administration sources are quoted[2] as saying that the government is still looking at ways of implementing a domestic sugar price support programme and President CARTER has not ruled out the continuation of a Treasury-funded purchase programme. Restrictive import quotas are a very last resort, but still cannot be completely ruled out since the third option—an increase in the import tariff—might not work.

Under the rules of the General Agreement on Tariffs and Trade (GATT), the President may impose a 50% *ad valorem* increase in the current import tariff of 1·875 cents per pound to prevent disruption of the domestic support programme. But at present world prices of below 7 cents/lb, this would not be sufficient to bring the level up to the 13·50 cents floor price guaranteed to US producers.

For the US government to purchase the roughly 5½ million short tons of domestically-produced sugar at 13·5 cents per pound would cost about $500,000,000 a year. Despite the cost, it would enable the US to avoid increasing the tariff which both President CARTER and his special trade representative, ROBERT STRAUSS, feel would damage the US position at the current multilateral trade liberalization negotiations in Geneva. However, a domestic purchasing programme faces implacable opposition from the corn industry which has protested vigorously against the idea of subsidized purchases of US sugar. Some senior Administration officials believe corn lobbyists could successfully take the issue to court and have the sugar programme declared illegal.

The Administration promised Senator ROBERT DOLE that the sugar provisions of the Farm Bill, calling for a sugar loan or price support programme, would be implemented by 8th November, when the regulations would have to include the eventual decision on which of the three options to take.

* * *

India sugar situation[3]

The 1976/77 sugar season in India finally ended on the 30th September with an all-time record production of 4,840,000 million tons, tel quel, as against the previous season's output of 4,262,000 tons. Carry-over stocks of sugar at the start of the 1977/78 season were of the order of 1,579,000 tons as against an opening stock of 832,000 tons on 1st October 1976. There has thus been a net accretion to the stocks of 747,000 tons against an increase in production of 578,000 tons.

Clearly the Indian sugar industry has carried forward the entire additional production from1976/77 to the new season in addition to a portion of the previous season's stocks. This is primarily due to lower off-take of sugar as exports which are set at only about 350,000 tons during October 1976/September 1977 as against 970,000 tons in the previous twelve-month period. While the fall in world sugar prices by almost £100 a ton during the course of the year has been a main factor leading to lower exports, indecision by the Government has also contributed to the slow pace of export movements. No shipment has taken place since March 1977 although about 50,000 tons of sugar are lying at Indian ports and a further 70,000 tons of sugar committed for exports are waiting at the factories to be lifted by the State Trading Corporation of India, through which exports are channelled. With a basic export quota under the new International Sugar Agreement of 825,000 tons raw value (although subject to reduction pending improvement in the world price), Indian exports may be expected to pick up.

With good and widely spread monsoon rains, the condition of the cane crop for 1977/78 is reported to be quite good. Cane plantings are also reported to be higher in most of the important sugar producing states, so that sugar production is generally expected to increase. The installed capacity of the sugar industry is increasing at a rapid pace following the incentives permitted by the Government of India to new sugar factories and expansion projects in the existing units. During the 1976/77 season as many as 17 new sugar factories started crushing, each with an installed capacity of 1250 tons of cane per day, while 20 more may commence crushing in 1977/78, taking the total number of installed plants to almost 300.

It is noteworthy that, while the industry is expanding and sugar production increasing rapidly, there is no diversion of land from other crops to sugar cane. The area under cane during the 1976/77 season is estimated at 28·73 million hectares which is lower than the 1974/75 figure of 28·94 million hectares. Clearly, cane productivity is improving and a proportionately larger quantity of cane is being converted to white crystal sugar.

[1] *Public Ledger*, 8th October 1977.
[2] *ibid.*, 29th October 1977.
[3] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (30), 14–16.

International Society of Sugar Cane Technologists

16th Congress 1977

THE first function of the 16th Congress of the International Society of Sugar Cane Technologists was a dinner given by the organizing bodies STAB (Brazilian Sugar Technologists Association) and Copersucar (Central Cooperative of Sugar and Alcohol Producers of the State of São Paulo) at the National Hotel in Rio de Janeiro on the 9th September. Guests were those ISSCT members and their wives who had gathered in Rio during the previous several days. After dinner they were entertained by a Brazilian Follies show—"Brazil in three ages"—which represented the history of the country from its discovery and colonization by the Portuguese in the early 16th century up to modern times.

On the following day groups of members were taken on excursions in or near the city, including trips past the famous Copacabana and Ipanema beaches, through the tropical forest of the Tijucas National Park to the Corcovado mountain on which stands the huge statue of Christ the Redeemer, overlooking Rio de Janeiro, which was erected forty years ago to commemorate the city's centenary. Another excursion was around the city to Rio's landmark, the Sugar Loaf mountain, the summit of which was reached by a two-stage cable car and provided a remarkable view over Rio and Guanabara Bay.

Members travelled the next day to São Paulo, a bustling, noisy city which provided a striking contrast to the relatively peaceful Rio de Janeiro. After arrival at Congonhas airport, they were taken to the Congress centre in the Parque Anhembi to collect preprinted papers, guide book, identification badge and programme, etc., before dispersing to the nine hotels where they were housed for the duration of the Congress.

Early on Monday morning, 12th September, buses took members in their respective interest groups—field and factory—on a two-day visit inside São Paulo state. The field members were aole to visit the Copersucar and IAA (Instituto do Açúcar e do Alcool) experiment stations at Piracicaba and Araras, respectively, and also went to Pradopolis where they were able to see the cane plantations of Usina São Martinho and to attend a "Field Day" which, in addition to a static display of equipment (Fig. 1) included demonstrations of soil preparation, cultivation, application of chemicals and vinasse as fertilizer (Fig. 2), mechanical harvesting, loading and transportation of the cane.

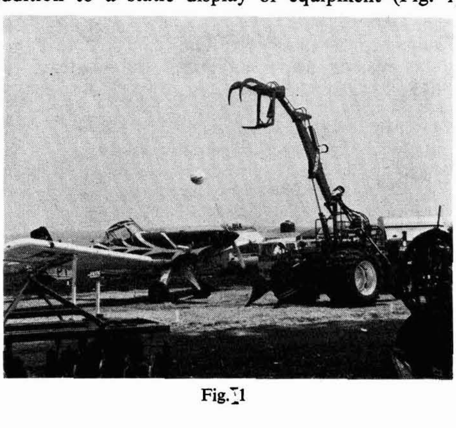


Fig. 1

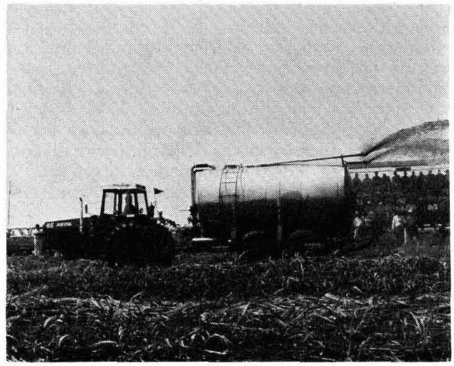


Fig. 2

The factory members travelled to Sertãozinho and visited Usina Santo Antonio where the mill is of 300 t.c.h. capacity, producing sulphitation white sugar during a 7-month crop and also a total of 160,000 litres per day of anhydrous alcohol in two distillery units. The sugar factory and distillery plant is of Brazilian manufacture by Dedini, Zanini, Mausa, Codistil, etc., some being built under licence from European and US companies.

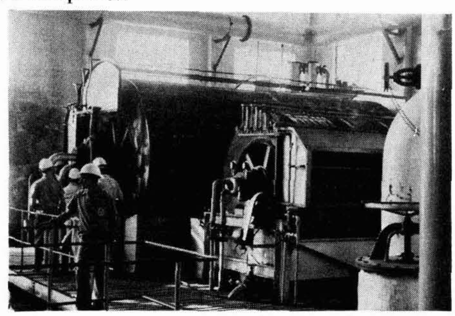


Fig. 3. Filter station at Usina Santo Antonio

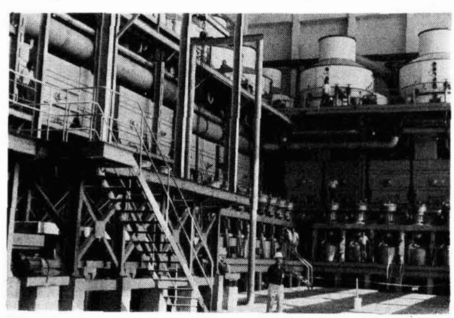


Fig. 4. Pans, crystallizers and centrifugals at Usina Santo Antonio

A visit was also made to the new Sertãozinho works of Zanini S.A. Equipamentos Pesados where the group were given guided tours through the plant's quality control laboratory, pattern shop, foundry and machining and plate shops. The second day also featured an early start and a journey from Riberão Preto to Araras for a visit to Usina São João, a factory also producing sulphitation white sugar and having a distillery capable of producing 350,000 litres of anhydrous alcohol per 24 hours. As has been published earlier, there is great emphasis on the manufacture of alcohol by fermentation of final molasses, as well as of *A*-molasses and even cane juice in some plants, in order to be able to fulfil Government requirements for alcohol availability of 3000 million litres per year by 1980 for incorporation up to 20% in motor fuel, thereby saving $300 million in oil costs. Currently about half the production target for 1980 has been reached and much investment is being made for its full attainment.

The São João factory is larger than Santo Antonio, crushing 14–15,000 tons of cane per day in two 6-mill tandems, one manufactured by Dedini and the other

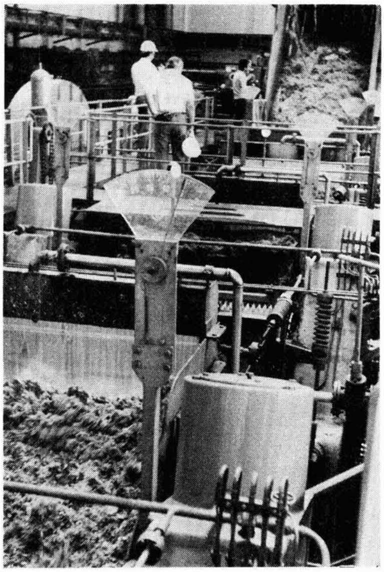


Fig. 5. Milling tandem at Usina São João

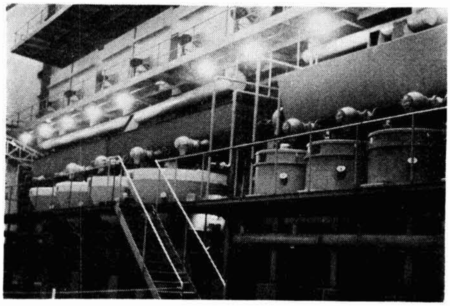


Fig. 6. Brazilian-built continuous and automatic centrifugals at Usina São João

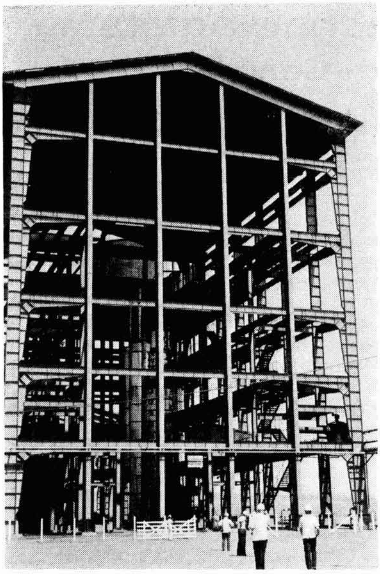


Fig. 7. Distillery columns at Usina São João. Provision has been made for considerable expansion of capacity

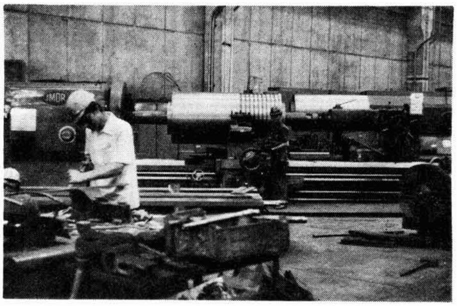


Fig. 8

having four Dedini and two Zanini-Farrel mills, with a mixture of domestic and imported plant in the remainder of the factory.

Further visits were made to the manufacturing facilities in Piracicaba of M. Dedini S.A. Metalúrgica (Fig. 8) and their associated companies·Mausa S.A. Equipamentos Industriais and Codistil, the three plants making heavy equipment (mills, steam turbines, gearing, steam boilers, evaporators, heaters, vacuum pans, crystallizers, etc.), other sugar factory equipment (travelling cranes, batch and continuous centrifugals, pumps, filters, juice scales, electric motors and alternators, etc.) and distillery equipment (Fig. 9), respectively. Another associated company, Motocana S.A., had some of its tractor-mounted loaders and grabs on display (Fig. 10) at the Dedini works where a complete new milling tandem was assembled, as well as a "Unigrator" shredder made under licence from Fabcon/Unice (Fig. 11).

Factory delegates then continued to the Copersucar Technology Centre where they saw a short visual presentation of the work of Copersucar and also an exhibition of the research and training carried out at the Centre in cane breeding (Fig. 12), pest and disease control (Fig. 13), design of sugar factory plant, cane utilization, safety measures, etc. Both groups returned to their São Paulo hotels after two very interesting but tiring days.

The opening plenary session of the Congress was held in the Parque Anhembi Auditorium (Fig. 14) the following afternoon, in the presence of a number of distinguished Brazilian government and sugar industry officials, with speeches by the General Chairman, Dr. HELIO MORGANTI, the President of Copersucar, Sr. J. W. ATALLA, the General Vice-Chairman, Mr. J. L. DU TOIT, and Sr. P. DA ROCHA CAMARGO, Secretary of Agriculture of the State of São Paulo. Subsequently, members and their wives were taken for a welcoming cocktail party before returning to their hotels.

On the morning of the 15th began the main business of the Congress, with presentation of papers to the various sections in different lecture rooms and auditoria of the Parque Anhembi Convention Centre. These were to continue through to the middle of Saturday and to resume on Monday morning, finishing at the end of that day. On the 15th September, however, after the technical meetings, members were addressed by Sr. J. P. DOS REIS VELLOSO, Minister of Planning, who described the National Sugar Programme in Brazil and discussed the application of research in tropical agriculture, especially breeding of new varieties and cane mechanization, in his country, as well as the modernization of sugar factories and expansion of alcohol production.

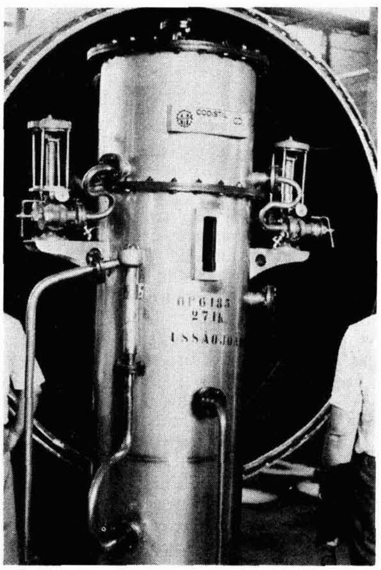


Fig. 9

Fig. 10

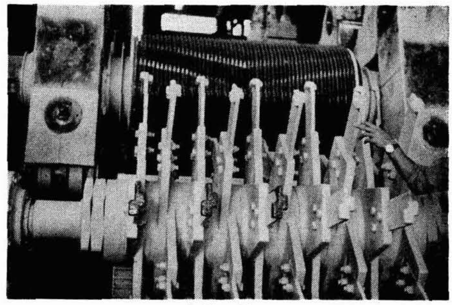


Fig. 11

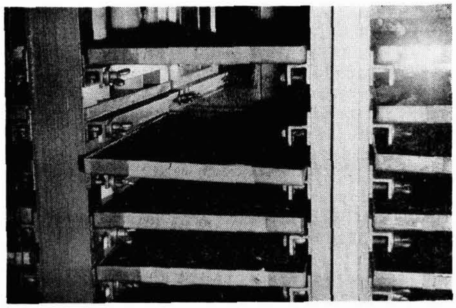


Fig. 12. Seedling trays at the Copersucar Technology Centre

In addition to the presentation of papers, a number of seminars—on germ plasm, the use of cane ripeners, etc.—were held during the Congress, and another feature was the exhibition of trade stands (Fig. 15) featuring a total of 54 companies, where ISSCT members were able to obtain information on the companies, their products and services, from representatives who were available throughout the meetings.

On the 17th September, a number of members, who had previously expressed a wish to visit a plant making the so-called "amorphous sugar"[1], were enabled to visit the São Paulo refinery of Cia. União dos Refinadores, which belongs to Copersucar. Here the members were able to see this process which is little known outside Brazil but which is used to produce some 1½ million tons a year. The raw material is a sulphitation sugar which needs no affination; this is received at a rate of about 840 tons per day at the refinery, melted, screened, heated to 85–90°C and treated with phosphoric acid, "Talofloc" and lime sucrate. Aeration produces a scum which is removed in a "Talo"-type clarifier and the clear liquor filtered using diatomaceous earth. It is then passed twice through bone char and twice through a decolorizing resin. The liquor is fed to an open pan where it is heat-

[1] *I.S.J.*, 1975, **77**, 155.

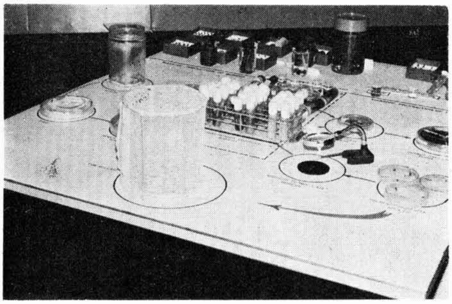


Fig. 13. Borer control scheme presentation at the Copersucar Technology Centre

ed to 120°C and quickly evaporated. Seed crystals are added and the masse discharged to a beater-mixer where the released heat of crystallization removes the residual moisture to give a very fine white product which is cooled, screened and packaged. The small particle size makes this sugar very quick to dissolve and it is very popular with Brazilian housewives for this reason, although it tends to cake in storage and it is not as pure as conventional granulated sugar since the impurities normally discharged as refinery molasses are retained in the amorphous sugar. The São Paulo refinery also uses vacuum pans to produce granulated sugar and this is also separated and packaged in the normal manner except that the handling lines are highly labour-intensive, largely as an employment-creating measure.

Another visit not on the official programme was that provided for some 200 members who were taken on Sunday 18th September to Usina Central do Paraná at Porecatú in Paraná State, the newest factory in Brazil (Fig. 16). After flying from São Paulo to Londrina, the visitors were taken by bus to the factory which some of the party inspected while the others examined the field system. Unfortunately, owing to heavy rain in the previous week—as well as during the visit—no cane was available and the factory was shut down. The company grows 95% of its cane supply, buying the rest from growers. It has 30,000 ha under cane and plans to expand this to 40,000 ha. Plant cane is given N-P-K fertilizer but ratoons only N; the yield falls from 80 $tons.ha^{-1}$ in plant cane to 50 $tons.ha^{-1}$ at 4th ratoons. About 2,000,000 tons is the cane estimate for 1977. Company cane is all burnt and then cut, with 35–40% as chopped cane cut mechanically and 60–65% as whole-stalk cane cut by hand; 9 Claas and 30 Santal harvesters are used. The cut cane is delivered to transloaders in the fields and put into a fleet of Randon 40-ton trailers, drawn by Scania tractor units, and 10-ton trucks. These are side-unloaded by tipper platforms (Fig. 17) at the factory which feed two cane tables per mill tandem and one storage bin holding 3000 tons of cane. Each of the two 7000 t.c.d. tandems includes a set of Copersucar-designed knife sets, a Copersucar shredder and six 42 × 90 in Fives-Cail Babcock self-regulating mills with feeder chutes (Fig. 18). An unusual feature is the boiler house which holds six 60 $tons.hr^{-1}$ boilers provided with extensive control automation (Fig. 19) giving steam at 900 psi and 400°C; this drives three Brown Boveri 10,000 kVA turbo-generators and produces exhaust steam at 240 psi which is used for the 1000-hp mill drive turbines, giving exhaust steam at 20 psi which is used for juice heating, etc. The remaining plant is conventional and produces three crops of sulphitation white sugar. However the crystallizers are unusual in that their drive employs eight hydraulic cylinders operating rams which act four at a time on a ratchet system (Fig. 20).

Photo: Paulo Roberto

Fig. 15

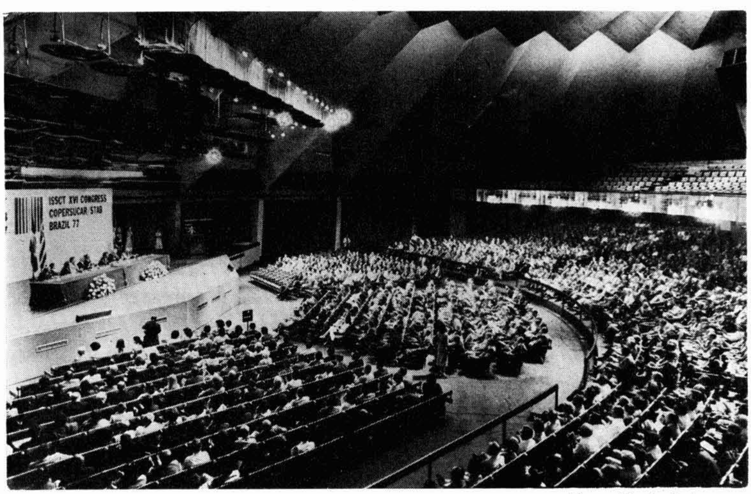


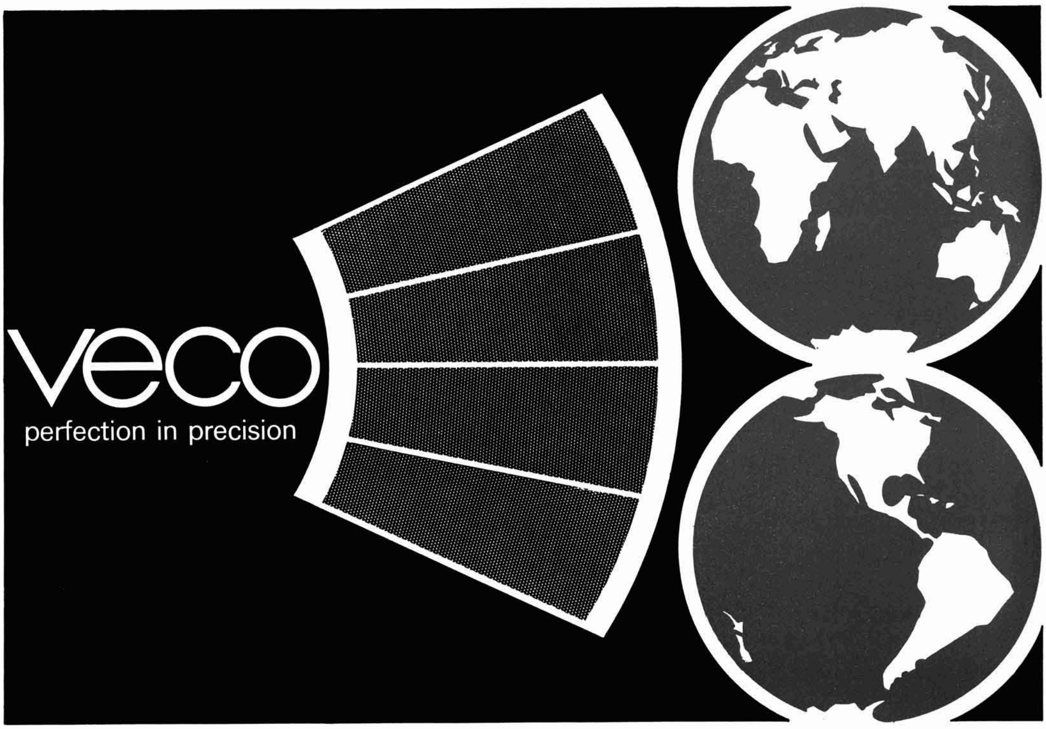
Photo: Paulo Roberto

Fig. 14

After the technical meetings were concluded, the last day of the Congress was taken up by the second plenary session on 20th September; reports were presented by the

sugar-centrifugal screens

all over the world continuous sugar-centrifugals of all types are equipped with Veco pure nickel chromeplated perforated sheets



technical data:

material nickel; also obtainable with chromium plating (900 DPN).

mirror smooth face

conical perforation, which means that Veco-segments feature a high discharge efficiency.

dimensions in accordance with specifications of centrifugal manufacturers.

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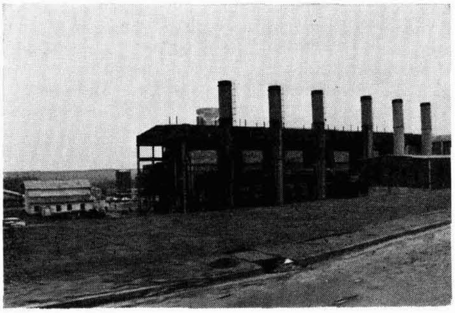


Fig. 16. Low-level boiler stacks at Usina Central do Paraná

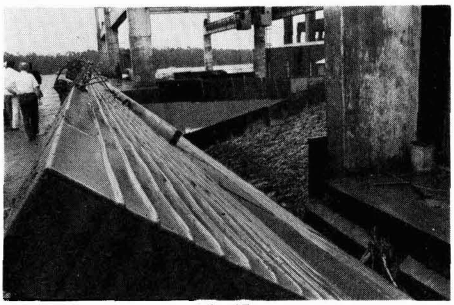


Fig. 17

General Secretary-Treasurer, Sr. S. B. PARANHOS and the Chairman of the Resolutions Committee, Dr. R. ANTOINE. Among information provided by the former was the fact that 2610 members had registered from 64 countries, of whom 1653 had attended the Congress. It was proposed by the leader of the Cuban delegation that the 1980 Congress be held in the Philippines and this was seconded by the Indonesian delegation leader, being carried by acclamation. The Philippine Ambassador to Brazil spoke of his country's pleasure at having its invitation accepted; names of officers for the 1980 Congress would be notified to members through their Regional Vice-Chairman as soon as possible.

Sr. J. W. ATALLA then addressed the Congress on further aspects of the Brazilian sugar industry and was followed by a speech from Sr. A. C. DE SA, Minister of Industry and Trade, on behalf of the President of Brazil. The General Chairman then closed the Congress and members were taken for the final luncheon at the Circulo Militar.

On the 21st, those members who had elected to do so embarked on the post-Congress visits to Argentina and to the north-west of Brazil. After flying to Buenos Aires and thence to Tucumán, the first group were taken to their hotels and in the evening were entertained to a cocktail party by the Tucumán Provincial Government and by the Centro Azucarero Regional, during which they were welcomed by representatives of the two bodies before returning to their hotels.

Owing to the lateness of this event, the start of the next day's programme was postponed but the visitors were able to visit Cruz Alta, Concepción and San Pablo sugar factories in the case of the factory group. The first is distinguished by its DDS diffuser installation which is preceded by preparation equipment and a primary juice mill and followed by a dewatering mill. The second factory is old and large, of 19,000 t.c.d. nominal capacity, with three tandems and has been expanded in stages over the years by accumulation of additional plant rather than replacement of smaller equipment with larger; as a consequence it has, for instance, 28 evaporator vessels and 56 centrigals. The three tandems have standardized 84 × 40 in rollers, however, and include a locally-made 6-mill unit, a McNeil 6-mill unit and a Fulton 5-mill unit. An annexed distillery produces 100,000 litres of alcohol per day. The San Pablo mill, of 6000 t.c.d. capacity, was by contrast a clean and more up-to-date factory, also producing white sugar (Fig. 22).

On the second day the factory group went to La Providencia (Fig. 23), a 6000 t.c.d. mill also producing sulphitation white sugar from all whole-stalk cane crushed in a 7-mill tandem. A visit was also made to Ingenio Nuñorco, a 6000 t.c.d. factory producing sulphitation white sugar and raw sugar for export; it has two 4-mill tandems and is a cooperative with control exercised by a board of five directors of whom three are cane growers, one represents the factory staff and one the factory labour force. An interesting feature is a method of boiling control being introduced whereby "Polaroid" photographs are taken for each strike during operation of the pans.

Between the two factories a brief halt was made so that members could visit EXPO 77, an exhibition of

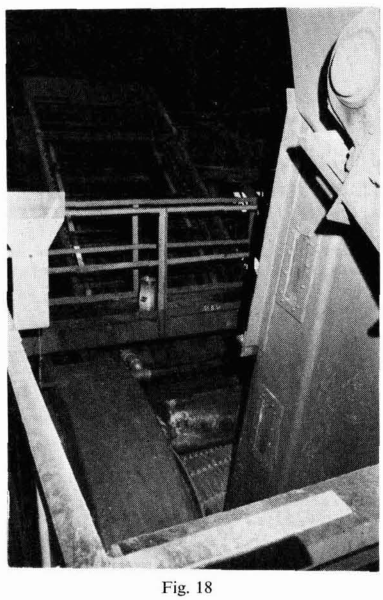


Fig. 18

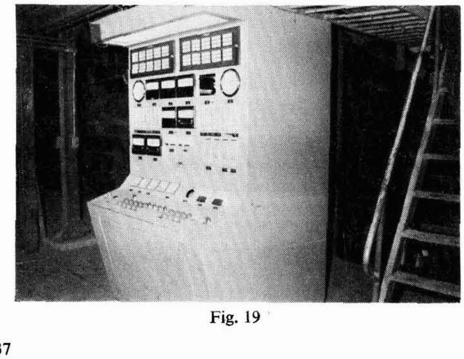


Fig. 19

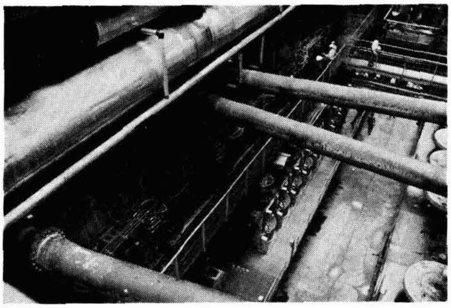


Fig. 20

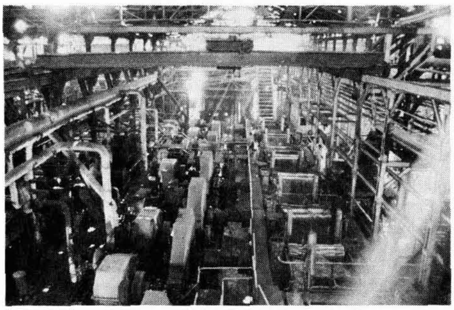


Fig. 21. One of the mill tandems at Ingenio Concepción

industry in the Tucumán area which, among the stands of interest to the group, included those of the Experiment Station, the J.A.V.A. company, John Deere, Massey-Ferguson, and a number of other suppliers of agricultural chemicals, etc. (Fig. 25).

The third and last day of the visit was a public holiday so that the factory of Rusco Hermanos, manufacturers of sugar machinery, was not in operation. Nevertheless, visitors from the factory group were able to see plant in the process of manufacture, including a full-size cane mill, a small mill used for juice recovery from bagacillo (Fig. 26), and several centrifugals in course of construction. The party then travelled to Ingenio La Fronterita, an impressively clean and well-run 6200 t.c.d. sugar factory producing raw sugar and sulphitation white sugar in two grades, the better being packaged in 1, 5 and 10-kg bags for domestic use. The care given to chemical control was evident in the well-equipped laboratory, where use is made of an automatic saccharimeter, to be linked next year to an IBM computer. Another striking aspect of the factory was the provision of safety equipment and measures (adequate handrails, clean steps, guarded machinery, etc.) which tended to be lacking at some of the other factories.

The field visits, like the factory tours, took place entirely within the Tucumán area and the delegates were shown, at different estates and on various soil types, each phase of the field operations. These included land preparation, planting, fertilizer and herbicide application, post-planting cultivation, harvesting and transport methods.

Of particular interest was the use of tractor-mounted cutting machines which lay the cane in continuous rows for subsequent hand cleaning, piling and mechanical grab loading. Many delegates were surprised to see a mechanical planter and two fully-mechanized cut-chop-load harvesters, all locally designed and manufactured in Tucumán. One harvester was seen in operation, producing a very clean sample of billets when cutting in green cane.

Very heavy rain on the second night of the tour resulted in the cancellation of further field demonstrations but served to indicate the requirements for improved drainage in many of the cane areas. Visits were made, however, to the production plant of J.A.V.A., one of the leading field equipment manufacturers and to the show ground of EXPO 77. Some delegates also were able to visit the Agricultural Experiment Station to see the research work being undertaken.

On the third day they joined forces with the factory group in the afternoon for a bus tour into the foothills of the Andes, high over the city of San Miguel de Tucumán, to which they returned in the evening, leaving the next morning for Buenos Aires and onward journeys.

About sixty members took part in the post-Congress tour to North-East Brazil, based in Recife. This area has about 450,000 hectares planted to cane and supports 5000 farms and 51 sugar factories. Annual output (1976/77) of 19,250,000 tons of cane and 1,584,000 metric tons of sugar represents about 37% of the total for Brazil; the North-East also produces 171,000,000 litres of alcohol. The three principal sugar-producing states of Pernambuco, Alagoas and Paraíba lie between 5° and 10° south of the Equator. Their tropical climate and hilly terrain contrast with that of São Paulo state 1000 miles to the south.

After lunch on the 21st, members were taken on a tour of Recife which included the bulk sugar terminal of the I.A.A. (Sugar and Alcohol Institute) and the Sugar Cane Museum. The terminal has a storage capacity of 200,000 tons of raw sugar and an annual throughput of about 600,000 tons. Incoming sugar is

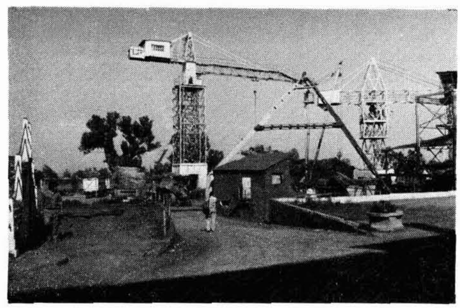


Fig. 23. Cane reception at Ingenio San Pablo

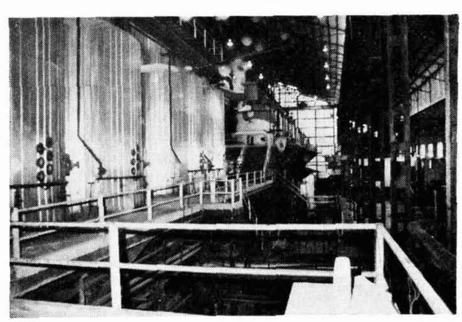


Fig. 23. Evaporators and pans at Ingenio La Providencia

Fig. 24. Cane yard at Ingenio Nuñorco

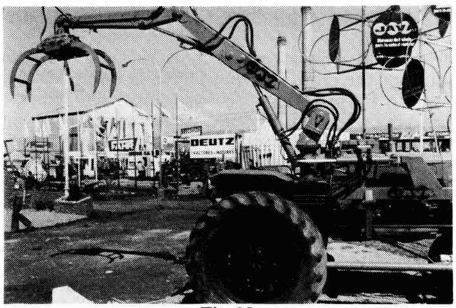


Fig. 25

unloaded from railcars or lorries onto underground conveyor belts and transported to four horizontal silos. It is reclaimed by an enormous Fives-Lille mobile bucket-wheel loader and conveyed above floor level to ships.

At the Sugar Cane Museum visitors were able to see the history of sugar manufacture in Brazil from its introduction in the early 16th Century to the present day, beautifully illustrated by tableaux, photographs, working models and original equipment. In the evening a special display of Indian folk-dancing was given outside the old town jail, now converted into a centre for sale of local hand-made crafts.

The following day, members travelled by coach to the Planalsucar-Conor Experimental Station at Carpina and were given detailed descriptions of the Station's activities and progress by the heads of the various sections, including cane breeding, entomology, plant pathology, fertility and nutrition, mechanization, plant physiology, agroclimatology and irrigation, and analysis. The Station was established by the I.A.A. in 1971 to improve the low productivity of sugar cane in northern Brazil. At present average yields in the region are only 55 tons of cane and 5·5–6 tons of sugar per hectare but new varieties bred at Carpina have yielded double these figures in preliminary trials. Significant improvements have also been made in the other sections; of particular interest is the successful application of biological control methods for the major insect pests—froghopper and cane borer. Aerial application of a fungus for froghopper control was demonstrated. After lunch members were then taken to visit Usina Petribu, a sulphitation white sugar factory having a single milling tandem.

Next morning an early start was made for a two-day trip to the area of Maceio. This included a visit to another Planalsucar Experimental Station where a car engine was demonstrated, running on a 50% ethanol:50% water mixture as fuel. After an overnight stay in Maceio, a visit was made to Usina Santo Antonio, a 6000 t.c.d. mill with two tandems and also producing sulphitation white sugar.

The next visit of the tour, to the Maciape autonomous distillery, was one of the most interesting, although also one of the most hazardous because, en route, members had to evacuate their buses in order to build up the road with stones after a landslide! The newly-built distillery is the only autonomous distillery operating in the North. It crushes 1200 tons of cane per day and produces 60,000 litres of alcohol/day by direct fermentation of cane juice. Screened but unclarified juice from the mill is flash-pasteurized, cooled and fed into twelve 100,000-litre open fermenters where it is inoculated with a special strain of yeast. Fermentation is complete after twelve hours at 30°C and the yeast is separated by Alfa-Laval continuous centrifuges for recycling. Alcohol is then removed from the wash by distillation, purified by rectification, and dehydrated. Yields are 90% of theoretical.

After lunch provided by the local Cooperative of Sugar Producers, the members concluded their exhausting but interesting tour with a visit to the firm of COSINOR who make sugar machinery for the region.

So ended an interesting Congress and post-Congress tours. Not everything went as hoped; much time was wasted in São Paulo by having to wait for validation of air tickets for the internal and Argentina flights and for recovery of amounts over-paid to the Society—and this prevented members from hearing papers presented. Some of the hotels were of poorer quality than others costing the same and a number of members were highly dissatisfied. A considerable number of papers were not pre-printed and will only be available on publication of the *Proceedings*, while in other cases the authors were not present to give their

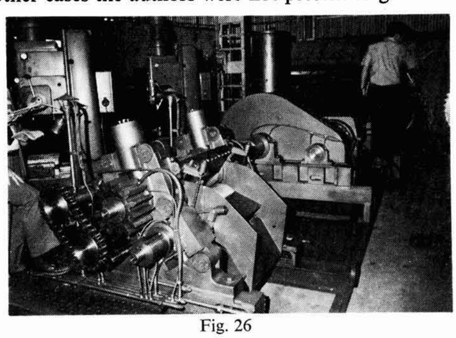


Fig. 26

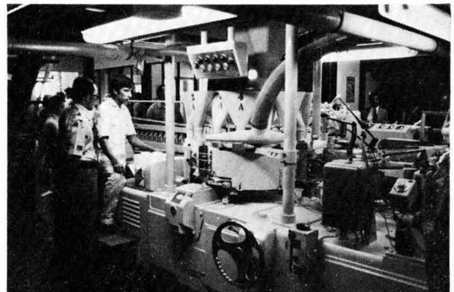


Fig. 27. Sugar packaging plant at Ingenio La Fronterita

papers and allow discussion. A major source of complaint was that Portuguese was used as the principal language of the Congress although it is not one of the Society's official languages and is not spoken by most of the members, while the interpretation facilities were inadequate. In Argentina, the lack of organization and excessively high cost were sources of complaint. Nevertheless, members were able to experience the vividness and excitement of both countries and to see for themselves unique aspects of their sugar industries as well as some beautiful and famous landmarks, while benefiting from the generosity and kindness of their hosts, to whom thanks are due.

Studies on ripening under low temperature conditions in North India

By R. S. KANWAR, O. SINGH and S. K. BATTA

(Sugarcane Research Station, Punjab Agricultural University, Jullundur)

Introduction

COOL dry weather is most favourable for the ripening of sugar cane. The best conditions for ripening are a temperature of 15°C minimum to 30°C maximum, with atmospheric humidity of 50–60%. In the north Indian sub-tropical cane-growing belt, comprising the states of Punjab, Haryana, Uttar Pradesh and Bihar, the sugar cane plant enters into its ripening phase in October and November after the hot and humid months of July, August and September which is the major growth period of the crop. During December and January, however, the crop may experience frost, the temperature dipping as low as —2·5°C during certain years. When this occurs, the normal ripening process is retarded, resulting in low sugar recovery. PANJE[1] reported that the ripening process under North Indian conditions comes to a standstill at 3°C. In the Punjab, which is the country's most northerly cane-growing state (32°N latitude), sugar recovery shows considerable fluctuation during the months of December and January. However, precise information on the reasons for this fluctuation has not been available. Studies were, therefore, carried out at the PAU Sugarcane Research Station, Jullundur, to study the effect of low temperature on ripening of sugar cane. The results of these studies are reported in this paper.

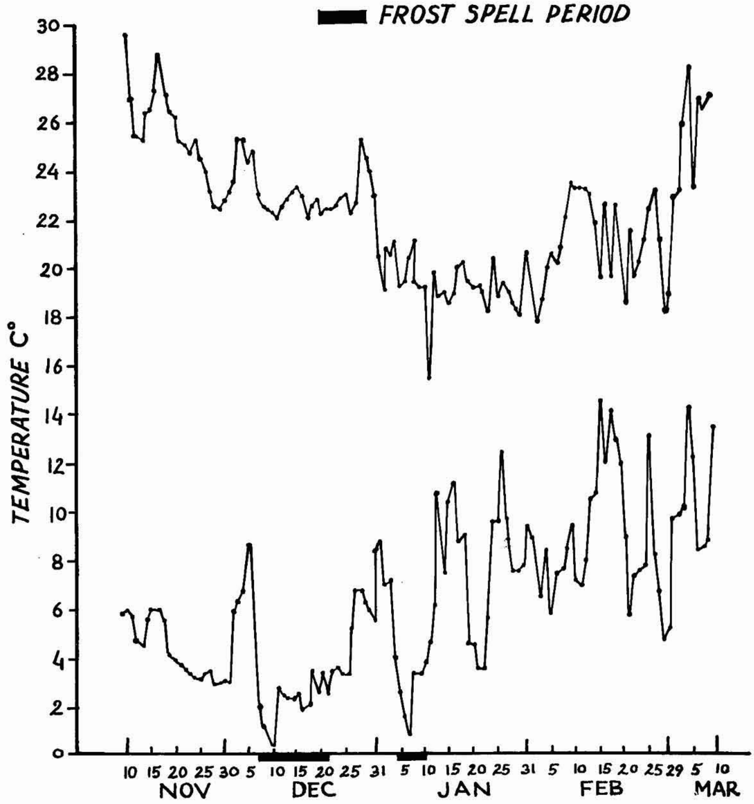


Fig. 1. Maximum-minimum temperatures in 1975-76

Materials and Methods

An experiment was conducted at the Sugarcane Research Station to study the effect of low temperature on ripening of four varieties, CoJ 64, CoJ 46, Co 1158 and Co 1148. The reactions of these varieties to low temperature along with their maturation classification are given in Table I.

During 1976–77, CoJ 64 variety could not be included in these studies.

The trial was laid out in a split-plot

[1] PANJE: *Tech. Bull. Indian Inst. Sugar Research.* (Lucknow) 1965, (1).

design with four replications and the plot size was 50 m². Cane samples comprising 25 stalks each were drawn at weekly intervals from November to March. The stalks were cut into three portions; 1/5th top, 3/5th mid and 1/5th bottom portion. The juice was extracted with a laboratory crusher and samples analysed for sucrose (polarization), juice purity, reducing sugars (by Fehling's method), electrical conductance, pH, titratable acidity (cm^3 of 0·1M NaOH needed to bring 50 cm^3 juice to pH 8·3) and gum content (by the method of FRILOUX *et al.*[2]).

Frost was experienced on the dates during 1975–76 and 1976–77 shown in Table II.

On the whole, the 1976–77 winter was more severe than that of 1975–76.

Results and Discussions

The data are presented in tables. In general there was improvement in the sucrose content and juice purity in all the four varieties with the advance in the age of the crop. Variety CoJ 64 recorded the highest sucrose content and juice purity followed by Co 1158, CoJ 46 and Co 1148. The bottom portion contained the highest sucrose content and juice purity followed by middle and top portions.

The maximum and minimum temperature data for 1975–76 are depicted in Fig. 1. During this year, there was a reduction in the sucrose content during the week ending 31st December 1975 in variety CoJ 64 in all three portions of the stalk. This depression came about 10 days after the first frosty spell of light intensity from 7th to 21st December 1975 (Fig. 1). There was thus no reduction in the sucrose content of this variety during the frost spell during which the temperature ranged from 0·8 to 3·5°C. On 4th February 1976 decreases in the sucrose content and juice purity were again recorded and came about 3 weeks after the second frosty spell from 4th to the 10th January 1976. In varieties CoJ 46 (mid-late) and Co 1148 (late), however, reduction in the sucrose content and juice purity was recorded during the period of frost from 7th to 21st December 1975, the depression being greater in the top portion. There

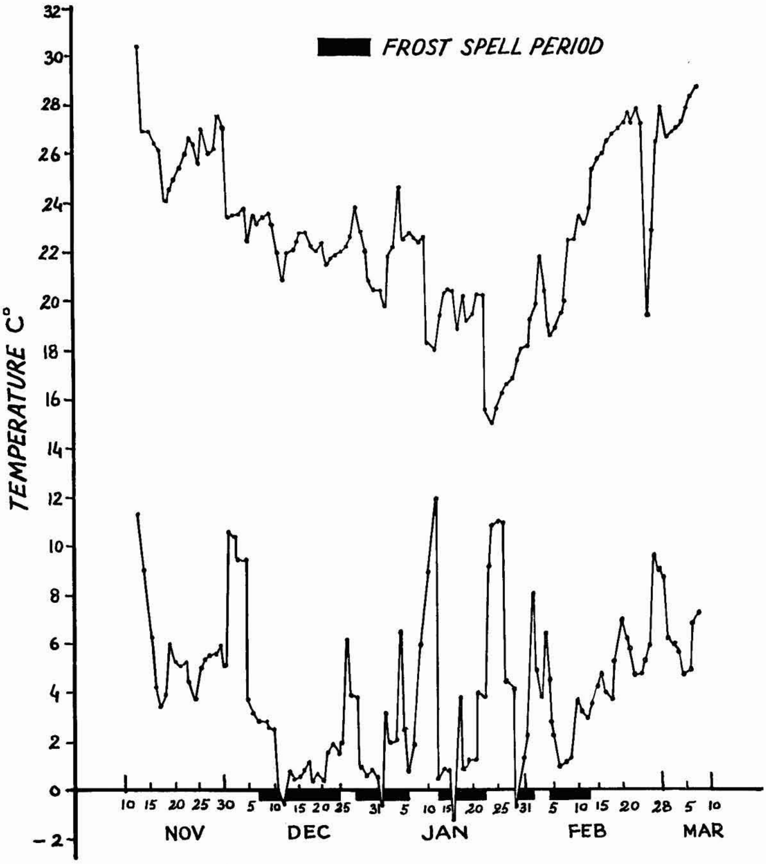


Fig. 2. Maximum-minimum temperatures in 1976-77

Table I

Variety	*Maturity group*	*Reaction to frost*
CoJ 64	Early-maturing high-sugar	Moderately resistant
Co 1158	Mid-season	Highly susceptible
CoJ 46	Mid-late	Moderately resistant
Co 1148	Late	Highly resistant

Table II

	Months		
Year	*December*	*January*	*February*
1975-76	(*A*) 7, 8, 9, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21	(*A*) 4, 5, 8, 9, 10	(*A*) Nil
	(*B*) 15, 16	(*B*) 6, 7,	(*B*) Nil
	(*C*) Nil	(*C*) Nil	(*C*) Nil
1976-77	(*A*) 7, 8, 9, 10	(*A*) 2, 4, 5, 14, 17, 21, 22, 30, 31	(*A*) 5, 6, 10, 11, 12, 13
	(*B*) 21, 22, 23, 27	(*B*) 3	(*B*) Nil
	(*C*) 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 28, 29	(*C*) 1, 6, 7, 12, 13, 15, 16, 18, 19, 20, 28	(*C*) 7, 8, 9

A = Light intensities of frost
B = Moderate ,, ,,
C = Severe ,, ,,

[2] FRILOUX, CASHEN & CAGENI: *Sugar y Azúcar*, 1965, **60,** (2), 43–46.

was no reduction in the sucrose content in these varieties during the second spell from 4th to 10th January 1976. The above results show that variety CoJ 64, which ripens very early, can bear low temperatures better and this is attributed to its higher sucrose content and low reducing sugars. The deterioration in the quality of juice after the frosty period in this variety can be attributed to increase in the rate of catabolic activities of the plant resulting in utilization of the accumulated sugar; this effects a reduction in the sucrose content during the low temperature period when there was corresponding increase in the reducing sugars of varieties CoJ 46 and Co 1148.

The maximum and minimum temperature data for 1976-77 are depicted in Fig. 2. In that season there was a sudden fall in the sucrose content and juice purity in the end of the 3rd week of December in all the three varieties. However, the drop was greater in varieties CoJ 46 and Co 1148—the late-maturing varieties—compared with that in Co 1158, a mid-season ripening cane. As in 1975–76, deterioration was greater in the top, immature portion, as compared with that in the middle and bottom portions. In variety Co 1158 there was improvement in the sucrose content and purity coefficient a week after this drop, but in varieties CoJ 46 and Co 1148 the ripening process remained almost static up to mid-January as shown by the sucrose content and juice purity during this period. Co 1158 was more susceptible to foliage injury due to low temperature than CoJ 46 or Co 1148 but there was less deterioration in the juice quality of this variety. However, in 1976/77 only minor frost injury to foliage was suffered by this variety. The fall in sucrose content and juice purity can be attributed to continued frost during the second and third weeks of December. The deleterious effect of low temperature on juice quality seems to be due to the stimulation of the activity of acid invertase under the low-temperature conditions which inhibits the synthesis of sucrose[3,4,5].

The electrical conductance, gums and titratable acidity were maximum in the frost-susceptible variety Co 1158, followed by the frost-resistant CoJ 46 and Co 1148 varieties. In general there were increases in the gum content and titratable acidity as effects of low temperature. The top immature portion of the stalk possessed higher gum content, titratable acidity and electric conductance than the mid- and bottom portions. There was not much variation in the pH of cane juice of different varieties and between the three portions of the stalks. These findings are in confirmation of the work reported earlier[4,6,7].

Summary

An experiment was conducted at the PAU Sugarcane Research Station, Jullundur, to study the effect of low temperature on the ripening of sugar cane. The results showed that there was no deterioration in the sucrose content of cane juice in variety CoJ 64—an early-maturing, high-sugar variety—during the low-temperature period. In CoJ 46 and Co 1148, two late-maturing varieties, however, there was considerable reduction in the sucrose content and juice purity during the frosty spell as a result of the immaturity of the cane. The maximum reduction in sucrose content and juice purity was recorded in the top immature portion with smaller reductions in the mid- and bottom portions of the cane stalk. Co 1158, a mid-season variety which is highly susceptible to foliage injury by frost, showed smaller drops in the sucrose content and juice purity. A corresponding increase in reducing sugars accompanied reduction in the sucrose content. Gum content, titratable acidity and electric conductance were higher in Co 1158—a frost-susceptible variety—as compared with CoJ 64, CoJ 46 and Co 1148, which are moderately resistant to frost.

[3] GLASZIOU, BULL, HATCH & WHITEMAN: *Aust. J. Biol. Sci.*, 1965, **18**, 53–66.
[4] HARTT: *Plant Physiol.*, 1966, **40**, 74–81.
[5] SUND: *Proc. 12th Congr. ISSCT*, 1965, 561–568.
[6] IRVINE & FRILOUX: *Sugar y Azúcar*, 1965, **60**, (1), 58–59.
[7] SINGH & SINGH: *I.S.J.*, 1975, **77**, 131–132.

Table I(a). Sucrose content (%) during low-temperature ripening of sugar cane, 1975/76

Variety	*Stalk portion*	*Date of juice analysis* 24.11.75	9.12.75	23.12.75	7.1.76	21.1.76	4.2.76	18.2.76	3.3.76
CoJ 64	Top	14·28	15·12	15·98	16·90	17·07	16·82	17·95	18·17
	Mid	17·66	17·24	17·36	17·76	18·13	17·76	18·66	18·74
	Bottom	17·68	17·65	17·87	18·63	18·38	18·28	18·86	19·07
	Mean	16·54	16·67	17·07	17·76	17·86	17·62	18·49	18·66
Co 1158	Top	11·84	11·67	11·64	13·59	13·71	14·13	15·11	16·21
	Mid	13·04	13·03	13·31	14·67	14·75	15·61	15·94	17·05
	Bottom	13·86	14·75	15·15	16·50	15·83	16·14	16·30	17·56
	Mean	12·91	13·15	13·37	14·92	14·76	15·29	15·45	16·94
CoJ 46	Top	11·02	9·57	9·70	11·34	11·24	12·04	13·21	13·89
	Mid	12·32	12·12	12·52	14·20	13·70	13·50	14·23	15·41
	Bottom	14·29	14·76	15·30	15·64	16·04	15·81	16·01	17·04
	Mean	12·54	12·15	12·51	13·73	13·66	13·78	14·48	15·45
Co 1148	Top	10·03	10·44	9·84	9·80	11·11	13·46	14·27	15·56
	Mid	11·47	11·76	11·88	11·56	17·33	14·55	14·94	16·49
	Bottom	13·15	13·85	14·29	14·22	15·54	16·31	16·38	16·92
	Mean	11·55	12·01	12·00	11·86	14·66	14·77	15·20	16·32
L.S.D. (P = 0·05)									
Varieties (V)		0·41	0·38	0·41	0·45	0·34	0·60	0·59	0·38
Portions (P)		0·62	0·23	0·27	0·37	0·24	0·24	0·29	0·23
Interactions (V × P)		1·20	0·46	0·54	0·74	0·47	0·47	0·62	1·44

Table I(b). Juice purity during low-temperature ripening of sugar cane, 1975/76

Variety	*Stalk portion*	24.11.75	9.12.75	23.12.75	7.1.76	21.1.76	4.2.76	18.2.76	3.3.76
		Date of juice analysis							
	Top	76·8	76·9	75·5	80·4	80·5	82·0	82·3	84·8
CoJ 64	Mid	83·0	82·7	84·1	84·7	84·8	85·3	84·4	86·0
	Bottom	86·0	85·4	85·5	86·5	86·4	84·1	86·5	87·4
	Mean	81·9	81·7	81·7	83·9	83·9	83·8	84·4	86·1
	Top	65·0	68·9	68·1	76·4	73·8	80·8	80·9	83·8
Co 1158	Mid	76·9	76·8	77·6	80·1	81·8	83·9	82·5	85·9
	Bottom	82·4	81·8	81·6	85·1	84·5	84·4	83·5	86·2
	Mean	74·8	75·8	75·8	80·5	80·0	82·7	82·3	85·7
	Top	66·6	59·0	57·1	61·1	65·8	66·9	74·6	75·5
CoJ 46	Mid	73·3	68·9	70·1	74·9	75·7	74·3	77·2	82·4
	Bottom	79·9	80·2	80·2	82·7	80·6	78·6	80·6	86·3
	Mean	73·3	69·4	69·1	72·9	75·0	73·3	77·5	81·4
	Top	63·3	60·9	57·3	60·8	61·9	72·2	78·0	78·9
Co 1148	Mid	71·0	67·6	68·3	67·4	70·6	76·1	80·0	81·8
	Bottom	76·9	77·0	77·0	75·9	80·6	83·6	81·7	86·0
	Mean	70·4	68·5	67·5	68·0	71·0	77·3	79·9	82·2
L.S.D. (P = 0·05)									
Varieties (V)		0·98	0·77	0·88	0·35	0·50	0·38	0·32	0·38
Portions (P)		0·35	0·41	0·41	0·29	0·45	0·58	0·35	0·35
Interactions (V × P)		0·71	0·83	0·76	0·58	0·89	0·13	0·68	0·22

Table I(c). Reducing sugars content (%) of sugar cane during low-temperature ripening, 1975/76

Varieties	*Stalk portions*	24.11.75	9.12.75	23.12.75	7.1.76	21.1.76	4.2.76	18.2.76	3.3.76
		Date of juice analysis							
	Top	0·80	0·77	0·72	0·46	0·42	0·25	0·18	0·25
CoJ 64	Mid	0·70	0·36	0·29	0·34	0·17	0·18	0·12	0·16
	Bottom	0·15	0·22	0·20	0·16	0·14	0·12	0·11	0·11
	Mean	0·55	0·45	0·40	0·32	0·24	0·18	0·14	0·17
	Top	1·41	1·73	1·89	1·05	0·91	0·44	0·34	0·19
Co 1158	Mid	1·55	1·14	1·08	0·75	0·71	0·37	0·26	0·17
	Bottom	0·85	0·57	0·61	0·40	0·40	0·31	0·22	0·15
	Mean	1·27	1·15	1·53	0·73	0·67	0·37	0·27	0·17
	Top	2·75	2·73	3·20	2·29	2·39	2·19	1·17	0·84
CoJ 46	Mid	2·33	2·09	2·19	1·83	1·57	1·54	1·04	0·56
	Bottom	1·62	0·95	0·90	0·81	0·52	0·87	0·56	0·44
	Mean	2·23	1·92	2·09	1·64	1·49	1·53	0·92	0·61
	Top	3·46	2·71	3·14	2·55	2·61	1·60	0·94	0·64
Co 1148	Mid	2·08	2·10	2·16	1·99	2·08	1·32	0·61	0·45
	Bottom	2·47	1·45	1·30	0·96	1·10	0·91	0·38	0·37
	Mean	2·47	2·09	2·20	1·83	1·93	1·28	0·64	0·49
L.S.D. (P = 0·05)									
Varieties (V)		0·57	0·20	0·20	0·27	0·13	0·03	0·03	0·03
Portions (P)		0·21	0·14	0·14	0·10	0·13	0·05	0·03	0·06
Interactions (V × P)		0·41	0·28	0·28	0·20	0·25	0·03	0·05	0·04

Table I(d). Gum content (ppm juice) during low-temperature ripening of sugar cane, 1975/76

Varieties	*Stalk portions*	24.11.75	9.12.75	23.12.75	7.1.76	21.1.76	4.2.76	18.2.76	3.3.76
		Date of juice analysis							
	Top	1·6	2·4	12·3	17·5	27·0	35·8	38·8	24·3
CoJ 64	Mid	2·0	3·0	14·3	16·3	24·0	26·8	38·0	24·0
	Bottom	2·6	3·9	15·0	15·3	34·3	30·5	38·3	22·8
	Mean	2·1	3·1	13·8	16·4	28·4	31·0	38·4	23·7
	Top	1·8	6·4	18·2	12·0	23·8	37·3	33·0	23·3
Co 1158	Mid	2·9	7·8	20·3	12·5	23·0	31·0	32·5	28·0
	Bottom	3·3	8·4	22·3	14·0	27·5	38·8	37·2	26·3
	Mean	2·7	7·5	20·2	12·8	24·8	35·7	34·2	27·5
	Top	1·8	4·1	16·1	11·5	31·3	36·9	35·6	24·5
CoJ 46	Mid	2·4	6·3	19·2	13·7	23·8	35·8	32·5	24·8
	Bottom	2·7	8·2	20·0	14·0	24·3	37·3	33·5	23·3
	Mean	2·3	6·2	18·4	12·8	26·4	36·5	33·9	24·2
	Top	1·5	2·5	8·8	14·0	20·5	34·5	39·3	29·3
Co 1148	Mid	1·8	3·6	11·0	12·5	20·3	22·8	37·5	25·3
	Bottom	1·9	3·8	11·3	11·7	24·3	24·3	34·8	24·5
	Mean	1·7	3·3	10·3	12·7	21·7	27·2	37·2	26·4
L.S.D. (P = 0·05)									
Varieties (V)		0·3	1·2	1·7	1·2	1·8	3·8	3·5	0·2
Portions (P)		0·2	0·3	1·4	0·9	0·5	2·4	N.S.	N.S.
Interactions (V × P)		0·2	0·5	0·6	1·2	0·7	3·4	N.S.	N.S.

Table I(e). Electric conductance ($mmho.cm^{-1}$) of juice during low-temperature ripening of sugar cane, 1975/76

Varieties	*Stalk portion*	*Date of juice analysis* 24.11.75	9.12.75	23.12.75	7.1.76	21.1.76	4.2.76	18.2.76	3.3.76
CoJ 64	Top	5·22	5·46	4·92	5·83	4·86	4·61	4·61	5·83
	Mid	4·73	4·43	4·49	5·46	4·31	4·13	3·95	5·28
	Bottom	4·13	4·31	4·25	5·22	3·95	3·88	3·64	4·67
	Mean	4·67	4·73	4·55	5·52	4·57	4·21	4·07	5·28
Co 1158	Top	5·71	5·95	5·52	6·56	5·40	4·92	4·92	6·37
	Mid	5·40	5·16	5·10	6·01	4·86	4·49	4·54	5·71
	Bottom	4·92	5·16	4·80	5·52	4·61	4·19	4·19	5·16
	Mean	5·34	5·40	5·16	6·01	4·98	4·55	4·55	5·77
CoJ 46	Top	5·01	5·83	5·04	5·40	5·22	4·10	5·16	5·89
	Mid	4·86	5·04	4·80	5·10	4·80	4·31	4·25	5·22
	Bottom	4·80	4·86	4·49	4·92	4·19	3·88	3·82	5·10
	Mean	4·89	5·22	4·78	5·16	4·73	4·43	4·43	5·40
Co 1148	Top	5·40	5·46	5·40	5·40	6·01	5·46	5·22	5·46
	Mid	4·37	4·86	4·92	5·34	5·16	4·49	4·49	5·22
	Bottom	4·55	4·73	4·80	5·34	4·80	4·13	3·82	4·80
	Mean	4·73	5·04	5·04	5·36	5·34	4·69	4·49	5·16
L.S.D. (P = 0·05)									
Varieties (V)		0·18	0·24	0·30	0·30	0·30	0·18	0·18	0·42
Portions (P)		0·18	0·12	0·18	0·79	0·12	0·12	0·18	0·18
Interactions (V × P)		N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Table II(a). Sucrose % cane juice, 1976/77

Varieties	*Stalk portion*	*Date of analysis* 1.12.76	15.12.76	29.12.76	12.1.77	26.1.77	9.2.77	23.2.77	Mean
Co 1158	Top	10·15	12·11	11·62	12·93	13·45	14·64	14·19	12·84
	Mid	11·52	13·28	12·87	14·23	14·80	14·91	14·80	13·95
	Bottom	13·02	15·01	15·14	15·73	15·39	15·77	15·86	15·22
	Mean	11·56	13·47	13·21	14·30	14·61	15·11	14·95	13·67
CoJ 46	Top	9·33	11·13	10·43	10·80	12·49	12·61	12·39	11·36
	Mid	10·49	12·84	12·55	13·01	13·01	14·32	14·23	12·93
	Bottom	12·55	13·93	14·69	14·80	13·84	16·19	14·90	14·55
	Mean	10·79	12·63	12·23	12·87	13·11	14·37	13·84	12·95
Co 1148	Top	10·03	11·00	10·42	11·06	12·02	12·62	14·08	11·83
	Mid	11·01	11·96	11·37	12·74	13·42	13·90	15·09	13·13
	Bottom	11·78	13·40	13·93	14·77	14·69	15·58	16·10	14·57
	Mean	10·94	12·12	11·90	12·86	13·38	14·03	15·09	13·18
L.S.D. (P = 0·05)									
Varieties (V)		N.S.	0·34	0·73	0·41	0·34	0·73	0·12	
Portions (P)		1·01	0·23	0·55	0·32	0·71	0·50	0·21	
Interactions (V × P)		N.S.	0·40	0·97	0·58	N.S.	0·88	N.S.	

Table II(b). Juice purity, 1976/77

Varieti	*Stalk portion*	*Date of analysis* 1.12.76	15.12.76	29.12.76	12.1.77	26.1.77	9.2.77	23.2.77	Mean
Co 1158	Top	65·3	76·1	72·7	77·5	78·1	72·5	78·1	74·7
	Mid	70·9	78·1	78·9	80·4	81·5	80·3	81·2	79·3
	Bottom	77·4	81·5	81·9	85·2	83·3	81·4	82·9	82·4
	Mean	71·2	78·6	77·8	81·0	81·0	78·1	80·7	78·8
CoJ 46	Top	59·7	67·3	62·9	67·7	73·0	70·6	72·6	67·9
	Mid	63·9	73·9	70·9	77·5	75·9	73·2	78·6	73·6
	Bottom	69·3	78·3	77·1	79·4	78·6	77·2	82·2	77·8
	Mean	64·3	73·2	70·3	74·9	75·8	73·7	77·8	73·1
Co 1148	Top	63·9	65·4	66·9	67·9	67·7	76·2	77·2	67·6
	Mid	66·8	67·8	70·7	77·9	75·8	77·2	82·2	74·7
	Bottom	71·4	73·3	73·7	79·5	79·9	80·8	83·6	78·7
	Mean	67·4	68·8	70·4	75·1	74·5	78·1	81·0	73·1
L.S.D. (P = 0·05)									
Varieties (V)		3·18	3·08	2·96	2·25	1·03	0·98	0·81	
Portions (P)		1·55	1·21	0·59	1·16	0·94	0·59	0·78	
Interactions (V × P)		N.S.	2·12	1·81	2·00	1·64	0·99	1·34	

Table II(c). Reducing sugars (%) in juice, 1976/77

Varieties	*Stalk portion*	1.12.76	15.12.76	29.12.76	12.1.77	26.1.77	9.2.77	23.2.77	Mean
		Date of analysis							
Co 1158	Top	1·26	1·14	1·64	1·04	0·91	0·86	0·89	1·12
	Mid	1·14	0·94	1·32	0·94	0·80	0·13	0·79	0·97
	Bottom	0·86	0·75	0·88	0·65	0·64	0·47	0·66	0·70
	Mean	1·09	0·93	1·38	0·87	0·78	0·69	0·78	0·93
CoJ 46	Top	2·03	2·04	2·09	1·97	1·82	1·47	1·84	1·85
	Mid	1·26	1·78	1·67	1·47	1·40	1·01	1·48	1·39
	Bottom	1·33	0·95	0·94	1·11	1·06	0·73	0·86	0·99
	Mean	1·54	1·59	1·57	1·52	1·43	1·07	1·45	1·41
Co 1148	Top	2·33	2·14	2·13	1·92	1·85	1·55	1·32	1·77
	Mid	2·05	1·81	1·70	1·48	1·48	1·18	1·17	1·43
	Bottom	1·41	0·99	1·17	1·18	1·02	0·86	0·93	1·03
	Mean	1·93	1·65	1·67	1·53	1·45	1·20	1·14	1·41
L.S.D. (P = 0·05)									
Varieties (V)		0·78	0·09	0·04	0·12	0·43	0·12	0·04	
Portions (P)		N.S.	0·05	0·17	0·13	1·02	0·07	0·02	
Interactions (V × P)		N.S.	0·09	0·29	0·23	N.S.	0·12	0·04	

Table II(d). Titratable acidity of cane juice, 1976/77

Varieties	*Stalk portions*	1.12.76	15.12.76	29.12.76	12.1.77	26.1.77	9.2.77	23.2.77	Mean
		Date of analysis							
Co 1158	Top	8·20	11·37	11·87	14·95	12·10	11·50	12·95	12·28
	Mid	7·10	10·75	9·40	11·05	8·20	8·23	10·10	9·57
	Bottom	6·17	10·00	8·70	9·05	7·32	7·35	8·75	8·64
	Mean	7·16	10·71	9·99	11·68	9·21	9·09	10·60	10·16
CoJ 46	Top	7·70	10·62	10·10	9·17	8·00	10·15	11·87	10·14
	Mid	6·87	9·87	7·77	7·85	7·12	7·95	10·00	8·57
	Bottom	6·00	9·50	6·95	6·50	6·25	6·15	8·22	7·53
	Mean	6·86	10·00	8·27	7·84	7·12	8·08	10·03	8·75
Co 1148	Top	8·27	9·62	7·97	9·12	8·42	7·95	9·30	8·86
	Mid	6·45	8·87	7·27	8·17	6·22	6·90	8·77	7·60
	Bottom	5·92	8·37	6·82	7·65	5·72	6·25	8·37	7·04
	Mean	6·88	8·95	7·35	8·31	6·82	7·03	8·81	7·83
L.S.D. (P = 0·05)									
Varieties (V)		0·19	0·61	1·34	0·08	0·42	0·05	0·29	
Portions		0·03	0·42	0·25	0·04	0·42	0·03	0·21	
Interactions (V × P)		N.S.	N.S.	0·44	0·07	0·76	0·16	0·31	

Table II(e). Gum content in juice (ppm), 1976/77

Varieties	*Stalk portion*	1.12.76	15.12.76	29.12.76	12.1.77	26.1.77	9.2.77	23.2.77	Mean
		Date of analysis							
Co 1158	Top	18·8	27·8	37·0	29·2	32·0	34·7	39·5	32·5
	Mid	17·1	26·0	35·0	28·2	30·8	32·5	38·5	30·8
	Bottom	10·8	25·0	32·7	20·5	29·8	30·8	37·3	28·7
	Mean	15·5	26·3	34·9	25·9	30·9	32·7	38·4	30·3
CoJ 46	Top	12·3	21·5	26·0	19·5	24·5	26·8	33·3	24·5
	Mid	10·5	20·3	23·8	18·7	22·5	25·0	32·5	22·8
	Bottom	10·0	19·3	23·0	16·3	20·0	23·0	30·8	21·1
	Mean	10·9	20·4	24·3	18·2	22·3	24·9	32·2	22·8
Co 1148	Top	13·9	17·5	18·7	19·6	21·3	23·5	26·3	20·6
	Mid	11·0	15·5	17·5	17·3	20·0	21·2	24·2	18·5
	Bottom	10·7	15·5	15·5	15·0	18·8	19·5	20·7	17·1
	Mean	11·9	16·2	17·2	17·3	20·0	21·4	23·7	18·7
L.S.D. (P = 0·05)									
Varieties		N.S.	1·3	0·8	0·6	6·7	2·2	2·2	
Portions		2·9	0·7	N.S.	0·5	1·7	0·8	0·6	
Interactions (V × P)		N.S.	N.S.	N.S.	0·8	N.S.	1·3	0·9	

Table II(f). Electric conductance of cane juice (mmho.cm^{-1}), 1976/77

Varieties	*Stalk portion*	1.12.76	15.12.76	29.12.76	12.1.77	26.1.77	9.2.77	23.2.77	Mean
		Date of analysis							
	Top	5·73	6·04	5·25	5·86	5·61	5·25	5·55	5·76
Co 1158	Mid	5·24	5·49	4·94	5·25	5·00	5·00	5·12	5·30
	Bottom	5·18	5·12	5·69	5·00	4·51	4·58	4·88	4·97
	Mean	5·38	5·55	4·89	5·37	5·04	4·94	5·18	5·34
	Top	5·55	5·49	4·88	4·58	5·31	5·00	4·88	5·23
CoJ 46	Mid	5·12	5·00	4·69	4·88	4·51	4·88	4·82	4·96
	Bottom	4·94	4·82	4·64	4·82	3·90	4·33	4·58	4·72
	Mean	5·20	5·10	4·74	4·76	4·57	4·74	4·76	4·97
	Top	6·04	5·49	5·12	5·18	5·49	4·69	4·94	5·17
Co 1148	Mid	5·31	5·12	4·94	4·88	4·51	4·33	4·64	4·80
	Bottom	5·00	4·69	4·82	4·69	3·90	4·21	4·51	4·52
	Mean	5·45	5·10	4·96	4·92	4·60	4·41	4·70	4·83
L.S.D. (P = 0·05)									
Varieties (V)		N.S.	0·29	N.S.	0·29	N.S.	0·15	0·01	
Portions (P)		0·19	0·18	N.S.	0·18	0·29	0·09	0·12	
Interactions (V × P)		N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	

Table II(g). pH of cane juice, 1976/77

Varieties	*Stalk portion*	1.12.76	15.12.76	29.12.76	12.1.77	26.1.77	9.2.77	23.2.77	Mean
		Date of analysis							
	Top	5·40	5·32	5·30	5·30	5·35	5·35	5·32	5·18
Co 1158	Mid	5·45	5·37	5·35	5·45	5·47	5·40	5·37	5·25
	Bottom	5·58	5·47	5·42	5·50	5·55	5·50	5·47	5·36
	Mean	5·48	5·39	5·69	5·42	5·46	5·42	5·39	5·26
	Top	5·10	5·02	5·40	5·45	5·37	5·25	5·25	5·15
CoJ 46	Mid	5·45	5·07	5·45	5·57	5·47	5·40	5·35	5·26
	Bottom	5·60	5·17	5·52	5·67	5·62	5·50	5·45	5·35
	Mean	5·38	5·09	5·46	5·56	5·49	5·38	5·35	5·25
	Top	5·40	5·05	5·35	5·50	5·35	5·32	5·25	5·21
Co 1148	Mid	5·45	5·10	5·42	5·57	5·52	5·45	5·37	5·30
	Bottom	5·60	5·20	5·50	5·67	5·67	5·57	5·50	5·41
	Mean	5·50	5·15	5·42	5·58	5·51	5·45	5·37	5·34
L.S.D. (P = 0·05)									
Varieties (V)		0·08	0·15	0·06	0·03	N.S.	0·05	N.S.	
Portions (P)		0·07	0·54	0·06	N.S.	0·02	0·03	N.S.	
Interactions (V × P)		N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	

The sugar industry in Brazil

By PEDRO DUARTE

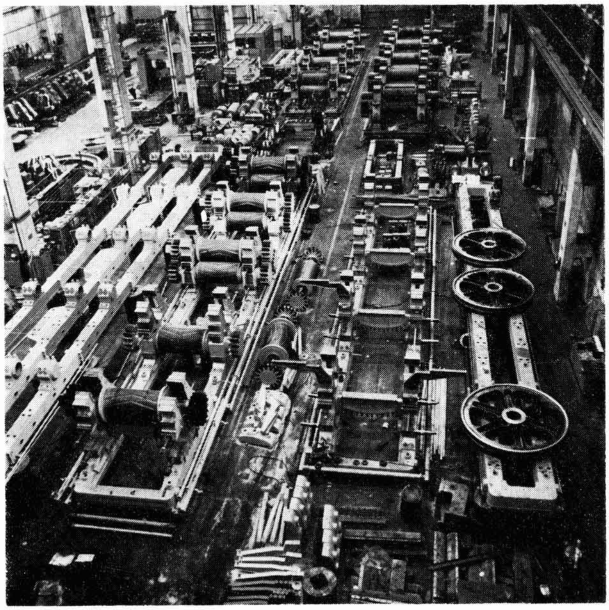
(Marketing Vice-President, M. Dedini S.A. Metalúrgica)

BRAZIL is today the largest centrifugal cane sugar producer in the world. Playing an important role in the economic development of the country, this leadership had its origin in the early years of the discovery of Brazil in 1500.

The eastern coast of Brazil presented an entirely different picture from that of Spanish America. Here none of the cultural advancements or artistic treasures of the great Aztec and Inca empires were to be found. In Brazil all was still wild, untamed, primitive. Unlike the Spaniards who had immediately stumbled upon works of art in gold and silver of Mexico and Peru, the Portuguese colonizers in South America had to cultivate the land they had discovered. "Let axes and hoes and other tools be given to those who will settle in Brazil", said Dom Manuel I of Portugal in 1516. By virtue of its territorial extent, fertile soil and the excellent geographical and climatic conditions for sugar cane cultivation, a new era began for the country with the cultivation and expansion of this rich source of nourishment capable of complementing the diet of millions of people and satisfying the desire of most people for sweet things.

Sugar cane was first introduced into Brazil by the Portuguese who brought it from the Island of Madeira. The work of DUARTE COELHO deserves special mention because of his extraordinary performance in connexion with the development and expansion of sugar cane cultivation in his province, formerly known as Nova Lusitania (presently comprising the States of Pernambuco and Alagoas). Fitting out his own fleet and bringing with him some of his former comrades-in-arms and many experienced farmers with their implements and tools, he arrived at Pernambuco in March 1535, establishing himself first at Igaraçu and later at Olinda. The soil was rich and the climate warm but agreeable because of the trade-winds and the abundant rains. Native food and fruits were plentiful. Experiments were carried out with various crops; everything grew profusely, except for wheat for which the climate was too hot. The question of food being thus easily solved, DUARTE COELHO decided to develop the cultivation of sugar cane on a national basis. In 1540 he travelled to Europe in order to hire specialized sugar workers and when he returned he also had with him experts from the advanced sugar cane plantations of Madeira and, what was also very important, the necessary machinery for the installation of sugar mills.

By 1546 the first sugar mills which had been installed in Pernambuco were producing abundantly. However, the hard and unpleasant work associated with cane plantations and the running of primitive mills and boilers which, incidentally, were causing a great devastation of Brazilian forests, were not in the least attractive to the European colonizers. A new element was therefore introduced into the process of cultivating cane and producing sugar: slave labour. First the native Indians and later African negroes were the work-force responsible for the ever-increasing expansion of Brazilian sugar production.

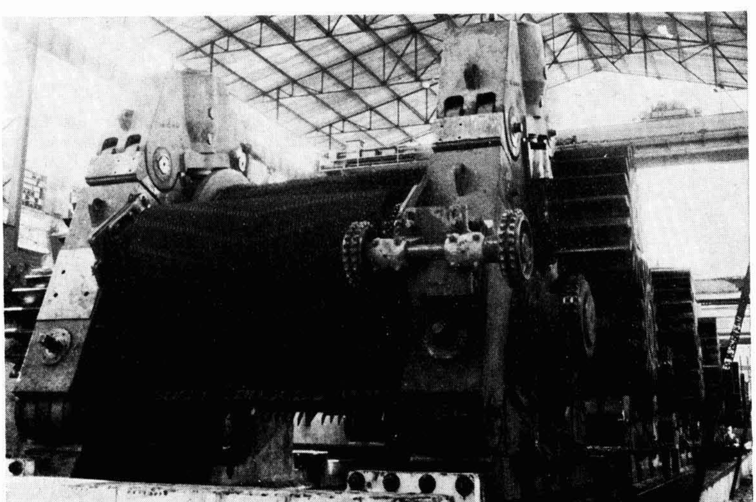


Partial view of workshops of M. Dedini S.A. Metalúrgica

Sugar cane cultivation also developed and expanded rapidly in Bahia and other provinces, together with cotton and rice, so that sugar soon became Brazil's staple commodity and principal source of wealth until the end of the 18th century, never losing its lead over the precious metals and diamonds which were also being exported.

By the turn of the century a period of stagnation which lasted until 1880 resulted in a gradual loss of Brazil's leading position in sugar production as other countries expanded sugar cane plantations in their own colonies and Europe began rapid development of the beet sugar industry, accounting in 1880 for almost half of world consumption.

During the 19th century Brazil faced bitter competition from other sugar producing areas such as Cuba which had increased its production from 76,000 metric tons in 1830 to 538,000 metric tons by 1880. During the same period, Asia, led by Java and the Philippines, increased production to 426,000 tons. By then Brazil's participation in world sugar trade had been reduced to a mere 11·2%.

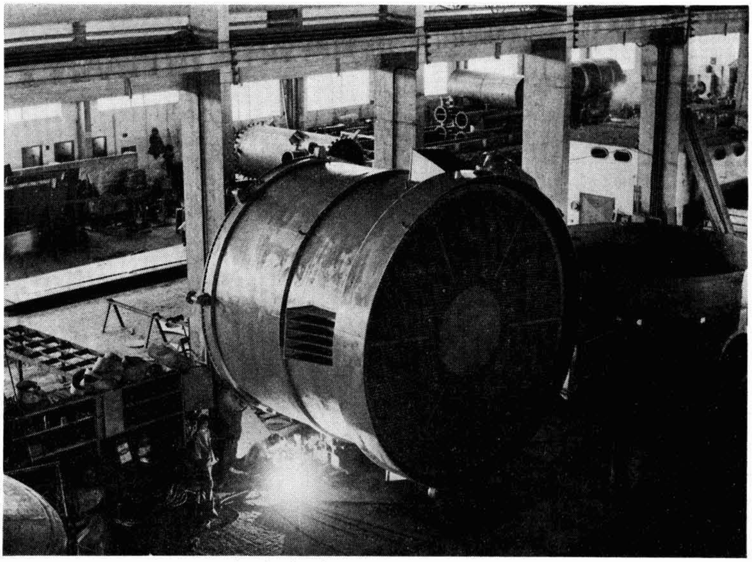


Type D–72 7-unit 42 in. × 84 in. milling tandem furnished to Usina da Barra, Barra Bonita, São Paulo

A spectacular reaction, however, took place towards the end of the 19th century and Brazil began slowly to recover its outstanding position on the international market. At that time, the whole of the Brazilian sugar industry was dependent on imported machinery and parts for its sugar mills.

In 1920, two brothers —ARMANDO CESARE and MARIO DEDINI—installed in Piracicaba a small mechanical and carpentry workshop. Their time was dedicated to the manufacture and repair of small sugar cane mills, boilers and other equipment used by the mills and distilleries around the São Paula area.

The efficiency and durability of this equipment brought many orders from the whole country for the supply of parts, equipment and even complete installations. Dedini was the embryo of today's ever-growing agro-industry in Brazil, while at the same time Brazilians were becoming aware of the importance of sugar in the economy of the nation.



3,500 cm² calandria for evaporator supplied to Usina Sta. Adelaide, São Paulo

The creation, in 1933, of the I.A.A. (the Brazilian Sugar and Alcohol Institute), a Government Agency under the Ministry of Industry and Commerce, responsible for the implementation of agro-industrial sugar policy in Brazil, strengthened the sector, aiming at higher agricultural yields.

Sugar production has been increasing steadily since then and during the last decade (1966–1976) output has increased in volume by more than half (Table I).

Table I

Season	*Production, tons*
1966/67	4,113,000
1967/68	4,215,000
1968/69	4,112,000
1969/70	4,410,000
1970/71	5,120,000
1971/72	5,386,000
1972/73	5,929,000
1973/74	6,683,000
1974/75	6,748,000
1975/76	6,488,000

Installation of boilers exported to Central Santa Maria, Venezuela

Other industrial groups followed the initiative of Dedini and were established to help develop this important area of Brazilian economic activity, represented today by more than 1·7 million hectares (4·3 million acres) of cane plantations and over 200 independent mills throughout the country.

The size and importance of the sugar machinery industry in the country can be best measured by the present production capacity of machinery and equipment for its sugar mills and distilleries and, in recent years, for export to other countries (Table II).

Another measure of the solid expansion of this market is the emphasis which the Government has been giving to a programme aimed at improving the productivity of cane culture in Brazil.

In spite of favourable soil and climatic conditions, the productivity per acre of the Brazilian sugar industry is still low as compared with other sugar cane producing countries. In order to correct this deficiency, an 8-year National Sugar Cane Improvement Plan was created in 1972, embracing integrated research projects in genetics, plant health and agronomy, including the breeding and selection of new varieties of sugar cane, especially adapted to environment and with high agricultural and in-

Table II

Manufacturer	*Product*	*Standard sizes*	*Units/year*
Dedini	Milling tandems	up to 42 in × 90¾ in	84
Zanini	Milling tandems	up to 40 in × 84 in	60
Fives-Cail	Milling tandems	up to 36 in × 84 in	34
Dedini	Steam turbines	up to 6800 h.p.	360
Zanini	Steam turbines	up to 1000 h.p.	35
Dedini	Steam boilers	up to 60 $tons.hr^{-1}$	72
Zanini	Steam boilers	up to 1800 m^2	22
Others	Steam boilers	up to 1800 m^2	51
Dedini/Codistil	Complete distilleries	up to 250,000 litres/24hr	45
Zanini/Conger	Complete distilleries	up to 100,000 litres/24 hr	12
Fives-Cail	Complete distilleries	up to 100,000 litres/24 hr	10
Mausa	Cranes	10–30 tons	60
Villares	Cranes	15–100 tons	350
Bardella	Cranes	15–30 tons	80

dustrial yields, and the introduction of new national agricultural practices.

Concomitantly with this project, attention has been given to transportation, storing and handling facilities, including the construction of bulk sugar terminals at various parts in the country. More than US$1,500,000,000 has already been invested in these various projects.

In addition to a programme of such magnitude a brand new market has been recently opened to Brazilian manufacturers of machinery and equipment. Being a great consumer of petroleum in its various forms, Brazil is endeavouring to achieve self-sufficiency in this area but, in spite of the efforts of Petrobrás, the Government-owned oil company, Brazil's imports of crude oil still weigh heavily in its balance of payments. By 1980 motor fuel consumption will have reached some 5·3 billion US gallons, most of which will still be produced from imported crudes.

A recent decision of the Brazilian Government to increase the production of anhydrous alcohol to be used as fuel, mixed with gasoline, has had an enthusiastic reception on the part of the Brazilian sugar industry. Under the new policy, which proposes a blend of gasoline with 20% of anhydrous alcohol, more than 1,000,000,000 US gallons of alcohol will have to be produced by 1980, mostly by independent distilleries, to be installed in new sugar cane growing areas with government support in the form of special financial schemes, but also by existing distilleries at the sugar mills at present producing residual alcohol.

Regarding the feasibility of the National Alcohol Production Programme, MELVIN CALVIN, Nobel Prize winner in Chemistry, has stated: "Brazil is the only country in the world capable of executing a workable plan for the exploitation of energy from cane, not as a substitute for petroleum, but as an additive, though it may replace it within a century".

The present installed capacity of the various alcohol distilleries is in the region of 370 million US gallons per year. To be able to cope with this programme in addition to the estimated requirement of 210 million US gallons for the chemical industries, a total production capacity of 850 million US gallons will be required by 1980, corresponding to 170 additional distilleries assuming an average standard size of 5·3 million US gallons per unit per year. This challenging programme offers enormous market opportunities for the existing sugar mills and for the manufacturers of machinery and equipment in Brazil.

These targets may seem to be set rather high but, when it is considered that they are based on a realistic evaluation of the country's requirements on the one hand and on the capacity of local manufacturers' facilities as well as on Government investment programmes and the country's self-financing capacity on the other, it may reasonably be assumed that Brazil should be able to reach them within the deadlines fixed in the plan. Precious amounts of foreign exchange will be saved for Brazil, resulting in stimulation of its economic development. Production of sugar cane will be increased and the whole Brazilian sugar industry will be made more flexible and less dependent on world sugar markets by having an important alternative use for sugar cane.

A source of pride to Brazil, and a demonstration of the complete confidence in the position of this country among the sugar producers in the world, has been the selection of Brazil as the venue for the XVI Congress of the International Society of Sugar Cane Technologists in September 1977.

On this occasion Brazil has received guests from all over the world with all the warmth and friendship which this country, continental in size, has long cultivated. The problems that Brazilian agro-industry presents to modern technology are also of continental proportions. The interchange of ideas and experience that take place with the great international sugar family during such Congresses will certainly help Brazil formulate new agricultural and industrial procedures and improve her economic efficiency.

It is also certain that all the participating sugar producing countries of the world will benefit directly from the results of this Congress and will be more capable of contributing towards the fight against the growing threat of humanity's food shortage.

Kenya cane area expansion plans[1].—The Associated Sugar Co. Ltd., at Ramisi has embarked on an ambitious development programme to increase the area under sugar cane in order to provide sufficient cane to run the factory at full capacity. It is planned to increase the present 12,000 acres under cane to 19,000 acres and also to construct a dam to store 5 million gallons of water to supplement the present 6 million gallon dam used for irrigation. With both dams the company will be able to irrigate more than 3000 acres of cane. The company has approached the World Bank for financial assistance for the expansion programme.

* * *

Costa Rica sugar expansion[2].—The Corporación Costarricense de Desarrollo (CODESA) have announced that construction is to begin of two sugar factories costing approximately $58,000,000, to be located at Borica, near the border with Panama, and at Guanacaste. Production will be destined for export.

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Bagasse paper in Egypt[3].—It has been decided to establish a factory for the production of paper from bagasse in Egypt. The plant will cost £E76 million ($108,600,000) of which £E22,200,000 will be foreign funds and 30% will be provided by the Egyptian sugar company. The plant will produce 90,000 tons of paper per year and a study group has been formed to study the technical and economical planning of the project over a period of three months and at a cost of £E20,000.

[1] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (25), 11.
[2] *Correo Económico*; through *Amerop Noticias*, 1977, (45), 12.
[3] *Amerop Noticias*, 1977, (45), 12.

Sugar cane agriculture

Unless otherwise stated, English is the language of the original articles from which the abstracts in this section have been taken.

The practice of chemical weed control on the Natal Estates Limited. S. Rau and P. J. M. de Robillard. *Rev. Agric. Sucr. Maurice*, 1976, **55**, 139–150.—Details are given of the mechanical and chemical weed control programme used on the 8500-ha area of Natal Estates Ltd. in South Africa. The basic herbicide mixture used is "Diuron" + "Ioxynil" + 2,4-D, although several other combinations are used for specific tasks. Cane damage caused by herbicides, particularly "Diuron" + "Ioxynil" and "Paraquat" + "Ioxynil" + 2,4-D is short-lived and of little consequence. Blanketing the soil surface with trash has proved beneficial in restricting or even completely preventing weed growth, provided it is evenly spread and there is enough of it. However, if there is insufficient and weeds do grow, the trash severely hinders manual or mechanical weeding. Moreover, despite the advantages of trash blankets, it has been found necessary to burn cane grown on wind-blown coastal sand in order to allow nematicide to be re-applied to ratoon cane, although generally all ratoon cane to be harvested during the peak weed growth months of December and January is covered with trash. Attempts at complete weed control by mechanical means failed; in all cases, subsequent herbicide spraying was needed within two months in order to curb the prolific weed growth. Manual weeding has been drastically reduced, and the weed control system described has resulted in considerable savings in labour and costs.

* * *

Systemic infection of sugar cane by the bacterium associated with symptoms of ratoon stunting disease. C. Ricaud, S. Sullivan and J. C. Autrey. *Rev. Agric. Sucr. Maurice*, 1976, **55**, 159–162.—A coryneform bacterium observed in Mauritius in centrifuged diffusates from cane showing typical mature node symptoms of ratoon stunting disease was not present in healthy, symptomless cane originating from cuttings which had been treated in hot water at 50°C for 2 hours. From its morphology, the bacterium is considered probably the same as that found associated with RSD elsewhere. The fact that it was obtained from mature nodes, internodes, apical tissues of mature stalks, young tillers and leaves suggests systemic infection rather than a passive, localized saprophytic infection through wounds or leaf scars. The bacterium was not found in stalks affected by chlorotic streak, gumming disease or leaf scald; diffusates from cane infected with the last two diseases mentioned yielded bacteria morphologically quite distinct from that associated with RSD. Examination with phase contrast microscopy using nigrosine staining showed that this method would be suitable for routine diagnosis of the disease once association of the specific bacterium was confirmed. Electron microscopy, also used in the investigations, is essential for detection of the structures peculiar to the bacterium in order to verify its presence in different countries.

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The introduction of a relative cane payment system in the South African sugar industry. E. J. Buchanan. *Rev. Agric. Sucr. Maurice*, 1976, **55**, 216–223.—Relative cane payment was introduced in Queensland to allow for the adverse effect of rain on cane grown in the north relative to the conditions in the south of the state and to cater for the less frequently delivered but larger tonnages of cane as a result of mechanical harvesting. A similar system has been introduced on a trial basis at Pongola and Umfolozi in South Africa, whereby the actual cane sucrose content is adjusted to a relative cane sucrose content by adding to the true content the difference between the factory seasonal average and the weekly average content. Hence, growers receive a fixed evaluation every week, so that the price paid for their cane is independent of the period at which the cane is delivered. The initial estimate of the factory seasonal average is usually based on an arithmetic average of the four preceding seasons, although a value may be selected by the local Mill Group Board if experience suggests this to be preferable. Interim adjustments may also be made should the established mean diverge widely from the expected mean. Advantages of the system and the results from two months' trials are discussed.

* * *

Varietal resistance in sugar cane to *Meloidogyne incognita*. L. Anzalone and W. Birchfield. *Plant Disease Reporter*, 1977, **61**, 190–191.—Genetic material used in the Louisiana cane breeding programme as well as a few Canal Point (Florida) varieties were screened for resistance to the root-knot nematode *M. incognita*, the test plants being mostly young seedlings grown from true seeds of controlled crosses involving *Saccharum* spp. hybrids. Of the original seedling population tested, 37% were found to be resistant to the nematode, while more than 14% of advanced L 1974 varieties were also resistant.

* * *

Healthy seed cane is essential. W. A. C. Webb. *Cane Growers' Quarterly Bull.*, 1977, **40**, 140–141.—Adequate care in growing and selection of seed cane is one of the most important means of ensuring a good stand of plant cane, and the author discusses various aspects of the subject, including hot water treatment of selected cane, selection of a block for seed cane planting, equipment sterilization, fertilization and weed control of the seed cane, and inspection of the seed cane before it is planted.

Sugar beet agriculture

Unless otherwise stated, English is the language of the original articles from which the abstracts in this section have been taken.

Field mouse damage. ANON. *Le Betteravier*, 1977, **11**, (108), 11 (*French*).—Renewed outbreaks of beet seed damage by *Apodemus sylvaticus* (which removes the seed and eats the kernel) are reported in Belgium as well as other countries. Evidence is a small hole in the soil and debris from the outer seed envelope scattered around it. Baits treated with an anticoagulant are recommended; they should be placed in different parts of the field, preferably under tiles, etc. where the mice can move freely while other animals cannot gain easy access to the bait.

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Post-emergence weed control in sugar beet. J. M. BELIEN and J. F. SALEMBIER. *Le Betteravier*, 1977, **11**, (108), 12–13 (*French*).—Details are given of recommended post-emergence herbicides and their dosage rates. While treatment straight after sowing as a complement to pre-emergence herbicide application will normally give good results and is economically sound, there are occasions when, through no fault of the farmer, the beet field is invaded by numerous weeds which are already well developed; under these conditions, mixtures of post-emergence herbicides have to be applied at such high dosage rates that they become uneconomical and there is a high risk of phytotoxicity. Also recommended is application of "Betanal" contact herbicide in split fractions, the initial fraction (half of the complete dose) being applied as soon as the first weeds appear, irrespective of the stage of growth of the beet plants, while the second fraction plus a systemic herbicide are applied when new weeds appear. Conditions under which maximum effectiveness of post-emergence treatment is obtained are listed.

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Electrostatic spraying. ANON. *British Farmer & Stockbreeder*, 1977, **6**, (148), 50.—Exposure of sprayed droplets to high-voltage static electricity has been found to increase their attraction to plants and to enhance their sticking power. Trials have been conducted with a number of crops, including sugar beet, aphid control in which was 54% better (on lower leaf) and 31% better (on upper leaf) than when applying an aphicide with a conventional sprayer. When the sprayer was operated normally in a 15-mph wind, there was clear drifting, whereas when the current was switched on, the spray appeared to "home in" directly onto the crop. A more even spread of chemical is also claimed for the electrostatic technique; the surface tension of the spray droplet is altered when it receives the electric charge, and as it leaves the sprayer and starts to evaporate, the charge in it tends to make it explode, resulting in 4–5 times as many droplets as before.

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The growth, pests and diseases of sugar beet in Belgium in 1975. L. VAN STEYVOORT. *Publ. Trimest. Inst. Belge Amél. Betterave*, 1976, **44**, (4), 203–220 (*French*).—A survey is presented of the title subject in 1975, in which an extremely wet winter was followed by very late drilling in soils of poor structure. A very dry period immediately after sowing was followed by a wet and very warm summer. Abundant falls of rain in September prevented achievement of even "normal" sugar contents, which averaged 15·06% for the country, while the average beet yield was 41·07 metric tons.ha^{-1}. Abnormally high concentrations of salts on the soil surface and the adverse weather conditions led to plant losses and a vascular disorder in June caused by *Pythium* sp. Leaves yellowed, then turned brown and finally died, while the roots appeared to be healthy; however, when cut, they revealed blackening of the vascular rings. Affected beet regained their health after July and subsequently showed no symptoms of the disorder. The poor weather also led, from the end of August, to an early onset of powdery mildew, which in some cases caused a 5–8% reduction in sugar yield. While fungicide treatment had no effect once the disease was well established, the September rains caused the symptoms to disappear rapidly. Beet pests had no marked effect on beet, while losses from virus yellows were lower than in the previous year and than those caused by poor soil structure.

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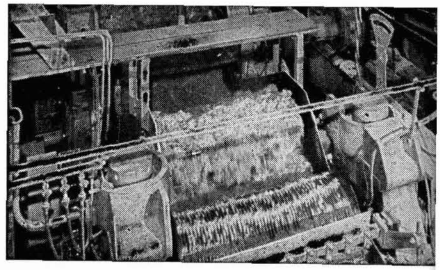
New occurences of powdery mildew and curly top on sugar beet in Michigan in 1975. C. L. SCHNEIDER and G. J. HOGABOAM. *Plant Disease Reporter*, 1977, **61**, 88–89.—Mention is made of the first occurrence of powdery mildew in Michigan in 1975. It is thought that the outbreak could have been associated with the 1974 and 1975 spread of the disease in western beet areas of the USA. There was no evidence of economic loss caused by the disease in Michigan, but the susceptibility of the commercial beet variety USH20 and the ability of the disease to spread over a large area with great rapidity indicate the possible need for prompt control measures in the future. USH20 was also found to be infected with curly top within a small area. The involvement of relatively few vectors is suggested. However, the nearest known permanent breeding grounds of the leafhopper *Circulifer tenellus* (found in tests to be a major vector of the disease) are about 1700 km from the location in Michigan where the outbreak occurred; the apparent movement of the pest over a great distance indicates that other leafhopper-borne beet diseases such as yellow wilt might also spread into new areas.

Cane sugar manufacture



Unless otherwise stated, English is the language of the original articles from which the abstracts in this section have been taken.

Colloids in the sugar manufacturing process. M. Darias P. and M. Quincoses S. *ATAC*, 1976, **35**, (5), 10–21 (*Spanish*).—The conventional estimation of proteins in sugar cane products by multiplying the N content by a factor of 6·25 gives values which are too high, since much of the N is in the form of non-protein compounds including free amino-acids. A method has been developed whereby samples are screened, homogenized and centrifuged, and then filtered through paper to give an insolubles-free solution which is brought to 12°Bx, the colloidal fraction separated across "Sephadex G-50" and proteins determined by the microbiuret method[1]. Calibration curves are prepared using sero-albumin and ovo-albumin and the method tested by multiple analyses of samples; the maximum relative error in four series of tests was 7·3% over 15 determinations. Analysis of protein in filtered juice showed a variation between 208 and 1057 ppm, while analyses were made of protein levels in various products during sugar manufacture. These are indicated in graph form and show a drop from mixed juice to limed and clear juice, increase in massecuites (as a result of molasses recirculation) and concentration in the molasses. The protein content in sugar depends largely on the work of the centrifugals. While the protein content influences that of colloids, it appears not to be the determining factor.

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An attempt at a simplified approach to milling control. H. C. Chen. *Taiwan Sugar*, 1976, **23**, 232–237.—In Taiwan factories pol % cane P_c is calculated but not determined directly as are cane weight and sugar weight and pol; the calculation may be based on mixed juice weight, whereby mixed juice pol % cane (P_{mc}) can have a major effect on the value of P_c in the formula used, or it may involve the Brix factor M_f (absolute juice Brix:1st expressed juice Brix), cane fibre % f_c and purities of 1st expressed juice, mixed juice and last mill juice, where again errors may arise. It is pointed out that because of the possible errors, the extraction and recovery values for mills, calculated in terms of unreliable factors, may appear good whereas the true efficiency is unsatisfactory. Hence, it is suggested that a more suitable criterion is the standard pol ratio (mixed juice pol % cane at a standard extraction of 95% and a standard cane fibre content of 12·5%) which is given by $K(1 - 1{\cdot}4\,\frac{f_c}{100})$, where $K = M_f \times Pt_f$, Pt_f being the ratio between absolute juice purity and 1st expressed juice purity. The standard pol ratio is compared with the actual pol ratio $\left(\frac{P_{mc}}{P_c}\right)$ and milling efficiency gauged from the magnitude of the difference between them. Tables are given showing the differences between the two pol ratios as well as values of other parameters involved in milling efficiency calculation for two seasons at a white sugar factory.

* * *

The capacity of clarifier flash tanks. J. P. Lamusse. *S. African Sugar J.*, 1977, **61**, 103.—Unless juice is properly flashed, air bubbles released in clarifiers will cause process difficulties, particularly in the case of short-retention clarifiers. There are no data available in the literature on clarifier flash tank capacities, and in many cases the size of a flash tank has not been changed in proportion to increases in clarifier capacity, so that juice has overflowed from the tank or been entrained up vent pipes; pressure build-up in the flash tank has resulted from under-dimensioned vent pipes. Formulae have been derived for calculation of the contact area required for juice flashing and of the vent pipe size at which flashing can take place at atmospheric pressure and elimination of entrainment permitted. The formulae have been checked by calculating the areas and vent pipe diameters of flash tanks operating satisfactorily without entrainment. Good agreement was also found between actual and calculated values, with a tendency towards over-dimensioning when the formulae are used (possibly because the area available for flashing is taken as the cross-sectional area, while no allowance is made for increase in surface of contact between air and juice as a result of vortex flow in tangentially fed flash tanks). An example of flash tank calculation is given.

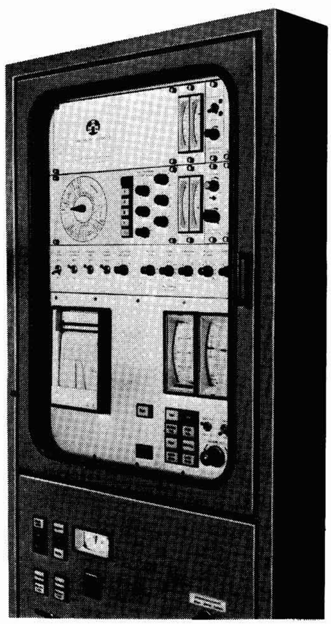
* * *

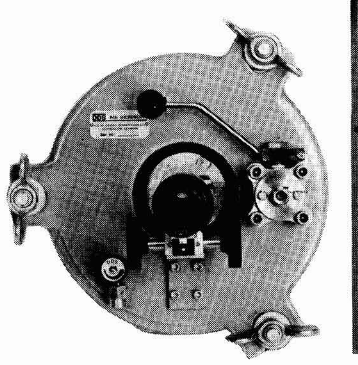
Magnesium oxide in sugar factories. A. A. Delgado and N. A. da Glória. *Brasil Açuc.*, 1976, **88**, 464–473 (*Portuguese*).—The use of "Magox HG", magnesite and hydrodolomite (a mineral comprising a mixture of calcium and magnesium oxides) was examined for treatment of cane juice, pure MgO and lime being used as controls. The best results were obtained with "Magox HG" and the controls; the other two minerals gave unsatisfactory results and would need treatment to improve their purity before they could be used in sugar processing.

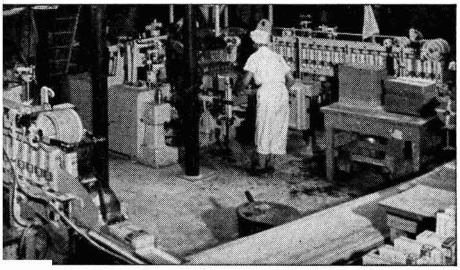
* * *

Observations on Louisiana factory operations. H. S. Birkett. *Sugar J.*, 1977, (39), **10**, 25–27.—The brief observations are on cane sampling, cane washing, milling, vacuum pan instrumentation, boiler operation and bagasse drying, factory steam consumption, air and water pollution, and chemical control. Latest trends are indicated, and some problems examined.

[1] Bailey: "Techniques in protein chemistry" (Elsevier, London) 1967, p. 341.







Sugar refining

Unless otherwise stated, English is the language of the original articles from which the abstracts in this section have been taken.

California and Hawaiian Sugar Company: a cane sugar cooperative which operates the world's largest refinery. ANON. *Sugar y Azúcar*, 1977, **72**, (5), 29–32.—A brief history is given of California and Hawaiian Sugar Co., set up in 1906 by Hawaiian raw sugar producers in order to provide a means of refining and marketing their sugar on the US mainland. Apart from a small proportion which is refined at the company's refinery at Aiea on the island of Oahu, the bulk of the raw sugar is refined at Crockett refinery which has a daily melt capacity of 4000 tons, while any raw sugar not required for refining is sold to other refiners. A brief description is given of the processes at Crockett refinery, and of the Hawaiian sugar industry.

* * *

Amorphous refined sugar. ANON. *Sugar y Azúcar*, 1977, **72**, (5), 55–57.—Information is given on the characteristics of amorphous sugar as produced by Cia. União dos Refinadores in São Paulo, Brazil, and on the processes used for its production, comparison being made with those for granulated sugar manufacture. (See also *I.S.J.*, 1975, **77**, 155.)

* * *

Powdered activated carbon an adsorbent for treating sugar melts. A. R. DOMINGUEZ and A. Y. HYNDSHAW. *Proc. 35th Meeting Sugar Ind. Tech.*, 1976, 68–73. Comparative tests showed that Suchar "Nuchar FF 34" active carbon, produced by a new activation method, removed more iron from char liquor at a New York refinery than did process carbon and had a greater decolorization efficiency in the treatment of diluted clarified melt at a Venezuelan refinery. Moreover, the new carbon permitted the subsequent filter cycle to be doubled by comparison with process carbon, while consumption of both carbon and filter aid was reduced. An estimated 3·5 gal of water per ft^2 was needed to sluice filter cake of ¾ inch average thickness. Details are given of a thermal regeneration method for which a Westvaco Corp. unit of 10 tons/day carbon capacity has been developed.

* * *

Modifications in the recovery process at Savannah Sugar Refinery. J. E. HAMILTON. *Proc. 35th Meeting Sugar Ind. Tech.*, 1976, 74–86.—Details are given of the modifications to the pan, crystallizer and continuous centrifugal stations at Savannah. The *B* and *C* pans used to boil No. 3 remelt massecuite were replaced with a single pan, for which the entire pan station had to adopt a modified scheme in order that the *B* pan could be replaced with the new one without need to stop operations. The batch crystallizers were converted to a continuous system after a suitable massecuite route had been selected. Reasons for the decision to use continuous machines for 3rd remelt massecuite curing are listed. Results of 12 days' operation of the modified stations showed that in boiling, the primary difference was in the temperature, which fell from 74° to 62°C as a consequence of improved vacuum. Extending the boiling time from 4½ to 7 hours prevented false grain formation, which had created problems in centrifugalling and caused higher molasses purity. Experiments are to be carried out on seeding of the massecuite in the pan rather than using a seed footing from the *A* pan. At crystallizer temperatures in the range 40–50°C there was 42% reduction in the difference between actual and ideal total sugars to an average of +1·5 units by comparison with batch crystallization. The rate of massecuite curing in the continuous centrifugal averaged 135 $ft^3.hr^{-1}$, although rates as high as 185 $ft^3.hr^{-1}$ were attained, the maximum being about 43% greater than the capacity of 6 batch machines operating on a 25-minute cycle.

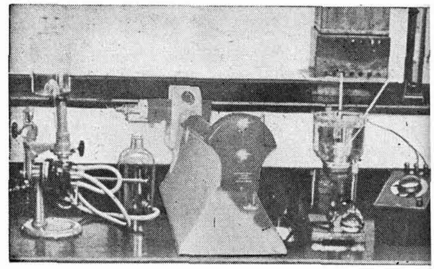
* * *

Sugar losses during refining of raw beet sugar and 2nd crop syrup at Tirlemont Refinery. J. DEGEEST. *Proc. 35th Meeting Sugar Ind. Tech.*, 1976, 88–89.—An extremely high pol loss of 2·7% was recorded in 1975 at Tirlemont, which processes a wide range of raw materials, including thick juice, syrup and low-quality white sugar as well as raw sugar. The major cause was found to be lack of conformity of the syrups and raw sugars to criteria for maximum thermal stability. Moreover, because of too low a pH, the syrups had to be treated with sodium carbonate and lime before boiling, which further increased losses in the form of molasses sugar. Mention is also made of the excessive N fertilization practised by beet growers in Belgium; this, plus mechanical harvesting, has contributed to a fall in purity over a 10-year period, which in turn has led to a fall in thick juice purity by 1·75 units.

* * *

Sorption mechanism of large organic ions on carbons with different chemical nature of surface. F. P. ALEKSEENKO, L. S. IVANOVA and I. L. ZDANOVICH. *Adsorptsiya i Absorbenty*, 1974, **2**, 21–22; through *S.I.A.*, 1977, **39**, Abs. 77–439.—Experiments showed that salts with large organic anions were better adsorbed by carbon with anion exchange capacity than by carbon with cation exchange capacity, while the reverse was true for salts of weak organic bases with mineral acids. Alkaline degradation products of invert sugar, melanoidins, refinery colouring matter and recovery house colouring matter were all adsorbed by the platinized carbon AG-5 better in an atmosphere of air than in one of H_2, which produces cation exchange capacity; sorption of anions therefore contributes to adsorption of colorants by carbons.

Laboratory methods & Chemical reports



Unless otherwise stated, English is the language of the original articles from which the abstracts in this section have been taken.

Computer control and automation of a sugar factory laboratory. P. W. VAN DER POEL, N. H. M. DE VISSER, C. C. BLEYENBERG and J. KONINGS. *Sucr. Belge*, 1977, **96**, 79–86 (*French*).—See *I.S.J.*, 1977, **79**, 85.

* * *

Determination of total and basic lead in clarifying agents based on a lead salt. G. RENS. *Sucr. Belge*, 1977, **96**, 87–90 (*French*).—The two methods recently described for total and basic lead determination in clarifying agents[1,2] were applied to lead nitrate used as clarifying agent for molasses sucrose determination by the Clerget method, both the solid used to make up the solution and the solution itself being subjected to analysis. The basic lead was determined by titration with 0·1N NaOH in the presence of an amount of EDTA stoichiometrically equivalent to the total lead content. Results showed that the lead nitrate was of 99·55% purity in the solid state, while the solution made up from it contained 336·2 g nitrate per litre in contrast to 340 g as stipulated. Basicity was found to be practically zero, the residual volume of —0·04 cm³ being within experimental error for titration. Total and basic lead were determined in lead acetate in both solid and solution form. Nitric acid was compared with acetic acid in preparation of the test solutions for titration, slightly less 1N HNO_3 than IN HOAc being required to give a clear solution. Tabulated results show that the maximum difference in total lead content of the solutions between the two acids was +1·58%, in basic lead —2·78% and in basicity —3·34%. In all except one case, use of the nitric acid gave a lower determined lead content.

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Methods of analysis of wastes from sugar factories and distilleries. N. A. DA GLORIA and A. G. SANTA ANA. *Rev. Agric.* (São Paulo), 1975, **50**, (1–2), 29–44; through *S.I.A.*, 1977, **39**, Abs. 77–351.—Methods used for the determination of organic C, Ca, Mg, K, P, S, acidity and pH in vinasse, filter mud and waste waters are described; no results are given.

* * *

Formation of inclusions in sugar crystals. D. L. MACKINTOSH and E. T. WHITE. *A.I.Ch.E. Symp. Ser.*, 1976, **72**, (153), 11–20; through *S.I.A.*, 1977, **39**, Abs. 77–374.—The formation of enclave inclusions in sugar crystals was studied further. Water present in the crystals was determined by the Karl Fischer method, which is considered more accurate than the dye tracer method previously used. Crystals containing up to 0·4 vol % inclusions were obtained; under factory conditions, <0·2% is usual. The amount of inclusion increased with the rate of regrowth of the crystal and decreased with increasing temperature. Smaller crystals contained more inclusions per unit mass of crystal than larger ones. The greater the extent of dissolution, within limits, the greater was the amount of inclusion formed subsequently.

* * *

Sugar laboratory research in South Africa. *Ann. Rpt. Sugar Milling Research Inst.* (University of Natal), 1976.

Determination of soil in cane and bagasse: To determine the extent of soil contamination in a factory, an ashing method was developed in which the ash content of a 50-g shredded cane or bagasse sample was taken as a measure of the soil content. The incineration temperature had to be sufficiently high for ashing to be complete within 1 hr. However, while 800°C was found to be suitable when a stainless steel container was used (the most stable of various metals tested at this temperature), comparison of the results with a more time-consuming laboratory micro-method showed that the new method gave consistently higher results, found to be a result of loss in weight of the container itself. Substitution of a "Vitreosil" basin necessitated raising the temperature to 850°C, but preliminary results showed that the new method was of similar accuracy to the micro-method, both methods having a precision of ±7%.

Removal of calcium from solutions to be used in the Lane & Eynon titration: Investigations showed that no significant difference existed in reducing sugars or sucrose content between final molasses solutions for which potassium oxalate or EDTA was used as decalcifying agent, so that the ICUMSA-recommended EDTA method, being simple and short, is preferred. Moreover, EDTA was found to reduce the colour significantly and improve the titration end-point. Recommended concentrations of EDTA have been established where it is used as a calcium sequestering agent in molasses and massecuites, but further work is needed with mixed juice, clarified juice and syrup before recommendations can be made.

Sucrose determination by GLC: Determination of sucrose as its trimethylsilyl derivative in a 40 m × 0·5 mm open tubular column coated with OV17 was investigated, whereby it was found that all operating parameters studied (inlet and oven temperature, carrier gas flow rate, size of sample injected and weight of sample treated with a given volume of reagent) caused variations in the value of reaction constant *K*. However, despite these possible sources of error, highly reproducible data were obtainable provided proper care was taken. Under optimum conditions, the precision of the method, as measured by the relative standard deviation, varied between 0·01% and 0·1%.

[1] *I.S.J.*, 1977, **79**, 234.
[2] *ibid.*, 296.

Brix determination: After a Paar Model DMA 02D density meter had proved unsuitable for Brix measurement in various factory products, a different model (DMA 45), provided with a fully-automatic sampling system and not as sensitive as the previous model, was tested. Readings obtained were found to be in close agreement with pycnometer density measurements; it gave higher values than a Bausch & Lomb refractometer (because of suspended matter included in true density measurements), although the actual differences were constant for any Brix range and fell with decreasing Brix. In refractometric determination of final molasses Brix, Whatman No. 42 is the filter paper recommended, but it is slow filtering. Comparison was therefore made between it and Whatman No. 6, which has about the same pore size as No. 42 but is faster filtering. Statistical analysis showed no significant differences between the Brix values obtained with the two types of filter paper, so that Whatman No. 6 is considered preferable, taking less than half the time to give the required quantity of filtrate than did Whatman No. 42.

Experiments into removal of polysaccharides from molasses by special ion exchange resins: In experiments on removal of polysaccharides from molasses, the latter was diluted to 30°Bx and loaded onto a resin column. After elution with distilled water, the eluate was concentrated to 10°Bx and the polysaccharide content determined by precipitation with ethanol, either the total eluate being collected or 25-cm^3 fractions collected and each analysed. Neither Permutit WRL 200 cellulose anion exchange resin (used at room temperature and at 70°C as recommended by the supplier) nor Rohm & Haas XAD 2 polystyrene adsorbent resin (used at ambient temperature) removed significant amounts of polysaccharides from the molasses.

Automated analysis of sucrose in molasses: Molasses glucose and sucrose were determined by a "Cenco" automatic system using a method based on glucose oxidation by glucose oxidase after sucrose inversion by β-fructosidase; the glucose oxidase reaction produces colour which is then measured. A Beckman glucose analyser, based on the same reaction but in which the amount of oxygen released is measured by an electrode system and shown on a digital display, was also used, while gas-liquid chromatography, isotope dilution and the Lane & Eynon method were also tested for sucrose content. Tabulated results for 10 molasses samples showed that the Beckman analyser gave considerably higher glucose values than did the "Cenco" system, both systems generally giving higher sucrose values than did the Lane & Eynon method. The "Cenco" analyser gave scattered values relative to isotope dilution values, while the best agreement was obtained between isotope dilution and GLC, with the latter giving lower values in all cases. Since analysis of purified sucrose used in isotope dilution counting showed it to be free of kestoses, a previous explanation for the bias found in comparison of the GLC and ID values appears to be invalid.

Polarization of raw sugar—an interlaboratory comparison: An investigation involving raw sugar sellers', buyers' and third laboratories as well as the SMRI and Durban bulk terminal laboratories was instituted after significant differences had been found in the pol values obtained by the various laboratories for sugar exported to Japan. Three samples of export sugar were carefully divided by an independent body into 25 sub-samples which were distributed to the five laboratories. Results showed no major differences in the pol and moisture contents, although the third laboratory gave somewhat lower values than the other laboratories. It is therefore apparent that, provided attention is paid to the analytical procedure, good agreement is possible between laboratories. Since the investigation, the earlier differences have almost disappeared.

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Some properties of caramels and their interaction with anion exchange resins. V. F. Selemenev, G. A. Chikin and I. P. Shamritskaya. *Sakhar. Prom.*, 1977, (4), 23–27 (*Russian*).—Interaction of AV-16G resin in OH^- form with a caramel solution was studied under static and dynamic conditions, the latter involving contact in a column for a specified time followed by elution with distilled water and HCl and NaOH (as regenerants), respectively; the eluates were adjusted to pH 7 and examined by paper chromatography and paper electrophoresis. Absorption spectra were also established of the initial solution and the eluates, as well as a fraction treated with NaOH for 12 hours in the absence of resin. While the curves for the initial solution were of similar configuration to those of the curves for the eluates obtained with water and HCl, the curves of the eluate obtained with NaOH and of the alkali-treated fraction were very similar in configuration but differed from those of the first three eluates mentioned. It was found that in the absence of resin NaOH had no noticeable effect on the caramelization products until after 8 hours' contact, when decomposition of the caramels was observed; in the presence of resin, alkali had a much more rapid degradation effect on the caramels. Hence, in alkaline medium the colour of the solution rose, despite the adsorption properties of the resin, by comparison with the initial colour. This indicates the impossibility of attaining complete decolorization of sugar solutions by treatment with resins in OH^- form where NaOH is used as regenerant. Use of HCl or NH_4Cl for regeneration is suitable, but better still is use of a macroporous resin in Cl^- form, one of which achieved 58% reduction in caramel solution colour.

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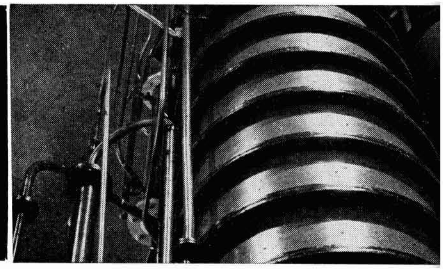
Change in the colour of yellow sugar solutions during heating. I. P. Orobinskii, T. S. Kondrashova and L. D. Dmitrieva. *Sakhar. Prom.*, 1977, (4), 28–29 (*Russian*).—The effects were studied of K and Na carbonates and sulphites on affined and unaffined yellow sugar solution colour during 2, 4, 6 or 8 hours' heating at 60 or 100°C. The solutions were adjusted to pH 8 and the individual non-sugars added at the rate of 0·04 mole. $litre^{-1}$ before heating. After every 2 hours the solutions were cooled, their pH determined and adjusted to 7, the Brix determined and optical density measured photocolorimetrically. Tabulated results showed that carbonate caused a colour rise at both temperatures of heating by comparison with controls (without additive), although the higher temperature increased the colour still further. On the other hand, sulphite caused a colour reduction by comparison with the controls. In all cases, the colour of the affined sugar was much lower than that of the unaffined sugar, so that the benefits of affination and sulphitation are confirmed.

By-products



Unless otherwise stated, English is the language of the original articles from which the abstracts in this section have been taken.

Cane and beet molasses and cultivation media for the production of Torula yeast. P. HERNANDEZ S. and M. AGUILA P. *Centro Azúcar* (Rev. Consejo Cient. Azúcar y Deriv. Univ. Central Las Villas, Cuba), 1975, **2**, (1), 89–103 (*Spanish*).—A survey is made of literature on the importance of yeast production as a partial solution to nutrient problems, and the characteristics of cane and beet molasses, in respect of their constituents, are analysed in relation to their use as cultivation media. Methods for supplementing the nutrients and reducing fermentation inhibitors to adequate levels are recommended.

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Keeping 600 cattle and 1000 sheep happy on beet tops. D. CHARLESWORTH. *British Sugar Beet Rev.*, 1977, **45**, (1), 45–46.—Details are given of the management and feeding of the beef cattle and sheep units on a farm in Lincolnshire where in 1976 all the tops from 90 ha of beet fields were fed to the animals *ad libitum*. The area under beet has since been extended to 121 ha.

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A study on sugar-modified melamine resin for water-soluble enamels. H. C. HUANG. *Taiwan Sugar*, 1976, **23**, 239–240.—In experiments with water-based enamel coating prepared from melamine resin and a water-dispersible alkyd resin, incorporation of sugar in the melamine resin gave physical properties to the cured enamels which were close to those of enamels formulated with unmodified melamine resin. The sugar would therefore be a suitable substitute for a more expensive raw material, it is suggested.

* * *

An improvement on the continuous fermentation process for Torula yeast production. M. C. CHUNG. *Taiwan Sugar*, 1976, **23**, 241–242.—Reference is made to modifications in the operation of the fermenters, including replacement of cane molasses with slop, whereby steady-state fermentation for Torula yeast manufacture can be prolonged, in contrast to the normal system where harmful bacteria cause coagulation which hinders normal yeast propagation.

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Potential for industrial uses for sucrose. A. J. VLITOS. *Proc. 35th Meeting Sugar Ind. Tech.*, 1976, 108–120. See *I.S.J.*, 1975, **77**, 323–326.

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Mini paper plant based on surplus bagasse. M. K. PATIL. *Sugar News* (India), 1977, **8**, (9), 7–11.—After a brief examination of bagasse composition and characteristics of individual components, the author describes bagasse storage practices and gives details of machinery for pulp and paper manufacture based on that used at a paper mill in Maharashtra. For a bagasse paper factory of 25 tons/day production capacity, it is calculated that investment would be paid for in 3–4 years.

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Utilization of waste by-products as ruminant feedstuffs. O. WAYMAN, C. M. CAMPBELL, L. D. KAMSTRA *et al.* *Misc. Publ. Cooperative Extension Service* (University of Hawaii), 1973, (110), 102–107; through *S.I.A.*, 1977, **39**, Abs. 77–322.—Treatment of bagasse with steam at 440 $lb.in^{-2}$ at 231°C for 45 sec impairs the digestibility (to sheep) of residual holocellulose, destroys most of the hemicellulose, and generates alcohol-extractable compounds, particularly phenols, which inhibit the growth of rumen micro-organisms. This leads to low feed intake and loss of condition. The higher apparent digestibility observed is of no real value, since low feed intake biases these figures upwards.

* * *

Bleached bagasse cellulose: commercial quality (technical report). E. J. VILLAVICENCIO. *Papel*, 1974, **35**, (Feb.), 33–40; through *S.I.A.*, 1977, **39**, Abs. 77–324. Studies directed by Peadco are reported with tabulated results. Reaching an Elrepho brightness of 90 by CEHD bleaching involved serious degradation of fibre, colour reversion and low yields from cooking and bleaching; a CEDH procedure was more satisfactory, and this was further improved by adding some ClO_2 during chlorination. The DcEDH procedure gave higher final brightness and viscosity, with decreased reversion and lower total consumption of reagents. When bagasse was cooked in alkaline sulphite instead of caustic soda or kraft liquor, the yield was much higher, e.g. 75% instead of approx. 55%; viscosity, brightness and some strength parameters were also higher. Compared with bleached cellulose from hardwoods, that derived from sulphite cooked bagasse showed higher breaking length and burst factor, above-average opacity (82%), but fairly low tear factor; soda-cooked bagasse gave average breaking length and low burst factor.

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Newspaper made from bagasse. W. ROBINSON. *Papel*, 1974, **35**, (Feb.), 41–46; through *S.I.A.*, 1977, **39**, Abs. 77–325.—Experience of the Bowater and Grace companies in this field is summarized. Mechanical and physical properties of newspaper made from bagasse and from wood are compared, and a cost analysis is given for bagasse newspaper manufacture at Trupal factory in Peru; it is considered economically viable.

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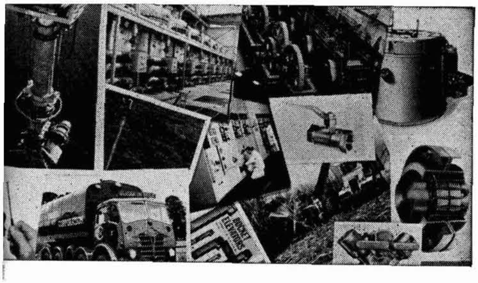

Trade notices

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Evaporator scale reduction. Fabcon International, 1275 Columbus Avenue, San Francisco, CA, USA 94133.

Details are available of a new anti-scale programme involving the use of I-12 ST, a formulation of organic polymers, protective colloids and a dispersant which complexes calcium and other polyvalent salts, coats tiny salt precipitates, silica and other colloidal particles and holds them in suspension to prevent their growth into hard, dense scale, and sharply increases the turbulence of boiling liquors, particularly in final stages of evaporation, where otherwise the syrup would exhibit very laminar flow at the heat transfer surfaces. Generally, one-third of the I-12 ST is added to clarified juice, and one-third each to the last and last-but-one evaporator effects. Its use has been found to extend pan operation by about 50%; some I-12 ST addition to the pans (or continuously to syrup) may be desirable to match the pan and evaporator cycles between cleaning. Evidence has shown that evaporator cycles can be prolonged up to 4 times the normal when evaporators are completely freed of scale at cleaning, with syrup Brix averaging more than 65°. Regularly scheduled stops for cleaning may be eliminated by use of 7-10 ppm I-12 ST. Where a very small amount of deposit forms, use of Fabcon "Scalex" is of advantage, since it penetrates the scale rapidly and softens it during cleaning with NaOH and/or soda ash. It reduces the time taken for boiling with NaOH and frequently eliminates the need for subsequent acid cleaning or manual brushing.

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PUBLICATIONS RECEIVED

SAFETY PRACTICES IN ION EXCHANGE TECHNOLOGY. Rohm & Haas Co., Philadelphia, PA, USA 19105; Rohm & Haas (U.K.) Ltd., Lennig House, 2 Mason's Avenue, Croydon, England CR9 3NB.

This is the title of a paper appearing in "Amber-Hi-Lites", 1976, (153), which has been written by Dr. Robert Kunin, Consultant to Rohm & Haas Co. He examines the potential hazards involved in ion exchange technology in both the laboratory and commercial operations, and suggests in detail the practical precautions which should be taken. The paper is based on some 40 years spent by the author in development of the technology.

* * *

RENOLD CHAIN APPLICATIONS. Renold Ltd., Renold House, Styal Road, Wythenshawe, Manchester, England M22 5WL.

Two major applications of Renold chains in sugar industry equipment are described in recent editions of "Renold Review of Power Transmission". Issue No. 2, 1977, gives details of their use in drives of the Ransomes, Sims & Jefferies Ltd. "Hunter" two-row beet harvester which, in 1976, was awarded the silver medal of the Royal Agricultural Society of England. Issue No. 3, 1977, gives information on the use of Renold drives for each of five rotary bagasse feeders incorporated in a John Thompson boiler recently installed in the Belle Vue Mauricia SE cane sugar factory in Mauritius. Renold worm reduction gears are also used for the drive of a bagasse carrier which conveys the fuel to the feeders.

* * *

CHEMICAL FEED AND MIXING EQUIPMENT. Neptune Chemical Pump Co., Division of R. A. Industries Inc., Lansdale, PA, USA 19446.

Neptune Chemical Pump Co. and Neptune Mixer Co., both divisions of R. A. Industries Inc., have published a new 4-page catalogue (Bulletin 477) illustrating their complete lines. Neptune Chemical is represented by Series 500 and 600 "dia-Pumps" diaphragm pumps, standard and custom chemical feed systems, piston pumps and related accessories such as bypass feeders, relief valves, corporation stops and portable pump stands; Neptune Mixer products illustrated include air- and electric-powered economy and heavy-duty mixers, bung entering mixers and custom tanks.

* * *

"SATURNE" CANE DIFFUSER. Sucatlan Engineering, 18 Avenue Matignon, Paris, France 75008.

A well-produced brochure is available from Sucatlan describing the "Saturne" counter-current cane diffuser. Apart from the maceration system used and the major advantages of the diffuser, the booklet gives information on the controls used and quotes actual results obtained in South Africa and Mauritius; while the diffuser in South Africa achieved some of the highest extraction rates ever attained in that country, at Saint-Antoine in Mauritius the effect on raw sugar filtrability of the diffuser's performance was such that the factory was able to sell its raw sugar to the refiner without having to pay any allowance. Power requirements of the diffuser and process economics are indicated, and information is given on installation of the equipment. A list of factories where the diffuser is in operation or for which it has been ordered is appended.

* * *

BMA EQUIPMENT. Braunschweigische Maschinenbauanstalt, Postfach 3225, Braunschweig, Germany D-3300.

A 30-page brochure lavishly illustrated with colour photographs gives information on the equipment manufactured by BMA and its subsidiaries for various industries, including equipment for complete beet and cane sugar factories and refineries, for the fermentation, food and chemical industries and for airports (including transporters and baggage and freight handling equipment). A subsidiary, Starcosa GmbH, designs and constructs plants for starch and dextrin manufacture and for starch syrup production as well as liquid, solid and gaseous CO_2 manufacture, and equipment for sludge dewatering and drying (plus special machinery for wet separation and wet screening); BALCO-Filtertechnik, another subsidiary company, specializes in the manufacture of high-quality fine screens from pure nickel, such as are used in centrifugals.

* * *

ROTARY PUMPS. Howard Pneumatic Engineering Co. Ltd., Fort Rd., Eastbourne, Sussex, England.

Howard stainless steel rotary pumps are featured in a 19-page brochure; they have the advantage of mounting versatility and a large number of variants for specific applications. The pumps can handle an extremely wide range of liquids, including very viscous solutions such as molasses and syrups. The company also manufactures a range of metering pumps of varying duties and applications.

World sugar production estimates 1977/78[1]

BEET SUGAR	1977/78	1976/77	1975/76
	(metric tons, raw value)		
EUROPE			
Belgium/Luxembourg	740,000	732,000	716,000
Denmark	516,000	416,000	423,000
France	4,000,000	2,962,000	3,239,000
Germany, West	2,772,000	2,733,000	2,540,000
Holland	790,000	945,000	915,000
Ireland	201,000	189,000	203,000
Italy	1,360,000	1,747,000	1,467,000
United Kingdom	1,000,000	756,000	697,000
Total EEC	*11,379,000*	*10,480,000*	*10,200,000*
Austria	435,000	416,000	512,000
Finland	80,000	77,000	88,000
Greece	300,000	386,000	313,000
Spain	1,200,000	1,387,000	917,000
Sweden	320,000	302,000	277,000
Switzerland	82,000	83,000	65,000
Turkey	1,260,000	1,284,000	986,000
Yugoslavia	728,000	650,000	483,000
Total West Europe	*15,784,000*	*15,065,000*	*13,841,000*
Albania	20,000	20,000	18,000
Bulgaria	260,000	240,000	157,000
Czechoslovakia	790,000	620,000	780,000
Germany, East	660,000	560,000	665,000
Hungary	410,000	400,000	331,000
Poland	1,900,000	1,801,000	1,840,000
Rumania	700,000	670,000	561,000
USSR	9,100,000	7,350,000	7,702,000
Total East Europe	*13,840,000*	*11,661,000*	*12,054,000*
Total Europe	29,624,000	26,726,000	25,895,000
OTHER CONTINENTS			
Afghanistan	14,000	12,000	14,000
Algeria	10,000	10,000	8,000
Azores	7,000	7,000	7,000
Canada	120,000	163,000	133,000
Chile	230,000	307,000	319,000
China	1,000,000	1,100,000	960,000
Iran	650,000	717,000	625,000
Iraq	13,000	11,000	10,000
Israel	38,000	39,000	39,000
Japan	315,000	327,000	244,000
Lebanon	20,000	15,000	4,000
Morocco	340,000	310,000	255,000
Pakistan	36,000	38,000	27,000
Syria	30,000	24,000	25,000
Tunisia	12,000	12,000	9,000
United States	2,855,000	3,522,000	3,646,000
Uruguay	90,000	70,000	100,000
Total Other Continents	5,780,000	6,684,000	6,425,000
TOTAL BEET SUGAR	35,404,000	33,410,000	32,320,000
CANE SUGAR			
EUROPE			
Spain	20,000	22,000	19,000
NORTH & CENTRAL AMERICA			
Barbados	110,000	123,000	106,000
Belize	120,000	98,000	63,000
Costa Rica	190,000	180,000	173,000
Cuba	6,000,000	5,500,000	5,700,000
Dominican Republic	1,300,000	1,270,000	1,267,000
Guadeloupe	92,000	97,000	96,000
Guatemala	615,000	532,000	549,000
Haiti	55,000	54,000	60,000
Honduras	190,000	113,000	88,000
Jamaica	330,000	295,000	369,000
Martinique	15,000	15,000	14,000
Mexico	2,800,000	2,715,000	2,725,000
Nicaragua	270,000	248,000	246,000
Panama	250,000	176,000	143,000
Puerto Rico	250,000	248,000	279,000
St. Kitts	40,000	43,000	36,000
El Salvador	330,000	296,000	261,000
Trinidad	190,000	178,000	205,000
USA—Mainland	1,530,000	1,517,000	1,657,000
Hawaii	1,000,000	980,000	953,000
Total N. & C. America	15,677,000	14,678,000	14,990,000
SOUTH AMERICA			
Argentina	1,550,000	1,559,000	1,353,000
Bolivia	270,000	282,000	213,000
Brazil	8,500,000	7,598,000	6,180,000
Colombia	930,000	870,000	935,000
Ecuador	310,000	305,000	287,000
Guyana	330,000	310,000	343,000
Paraguay	65,000	57,000	52,000
Peru	940,000	928,000	956,000
Surinam	12,000	11,000	11,000
Uruguay	35,000	21,000	30,000
Venezuela	533,000	513,000	486,000
Total South America	13,475,000	12,454,000	10,846,000
AFRICA			
Angola	60,000	50,000	40,000
Cameroun	35,000	33,000	30,000
Congo (Brazzaville)	35,000	33,000	31,000
Egypt	700,000	655,000	626,000
Ethiopia	160,000	135,000	134,000
Ghana	15,000	13,000	13,000
Ivory Coast	40,000	35,000	23,000
Kenya	180,000	179,000	173,000
Madeira	2,000	2,000	2,000
Malagasy Republic	105,000	114,000	121,000
Malawi	100,000	97,000	69,000
Mali	15,000	15,000	14,000
Mauritius	715,000	731,000	496,000
Morocco	15,000	8,000	4,000
Mozambique	250,000	260,000	240,000
Nigeria	40,000	38,000	35,000
Réunion	260,000	250,000	226,000
Rhodesia	290,000	270,000	260,000
Somalia	40,000	39,000	29,000
South Africa	2,250,000	2,204,000	1,934,000
Sudan	210,000	163,000	125,000
Swaziland	235,000	220,000	224,000
Tanzania	120,000	114,000	106,000
Uganda	25,000	23,000	21,000
Zaire	70,000	50,000	69,000
Zambia	90,000	80,000	85,000
Total Africa	6,057,000	5,811,000	5,130,000
ASIA			
Bangladesh	176,000	152,000	95,000
Burma	90,000	70,000	8,0000
China	2,700,000	2,750,000	2,650,000
India	5,300,000	5,250,000	4,630,000
Indonesia	1,200,000	1,137,000	1,126,000
Iran	85,000	98,000	89,000
Iraq	20,000	15,000	10,000
Japan	220,000	220,000	223,000
Malaysia	105,000	50,000	47,000
Nepal	25,000	20,000	12,000
Pakistan	720,000	746,000	641,000
Philippines	2,400,000	2,685,000	2,850,000
Sri Lanka	38,000	30,000	25,000
Taiwan	750,000	1,123,000	817,000
Thailand	1,760,000	2,294,000	1,757,000
Total Asia	15,589,000	16,640,000	15,052,000
OCEANIA			
Australia	3,400,000	3,390,000	2,933,000
Fiji	335,000	307,000	283,000
Total Oceania	3,735,000	3,697,000	3,216,000
TOTAL CANE SUGAR	54,553,000	53,302,000	49,253,000
TOTAL BEET SUGAR	35,404,000	33,410,000	32,320,000
TOTAL SUGAR PRODUCTION	89,957,000	86,712,000	81,573,000

[1] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (27), 1–5.

India sugar statistics[1]

	1976	1975	1974
	metric tons, raw value		
Initial stock ..	1,237,148	1,096,231	934,120
Production ..	5,033,400	5,047,579	4,488,694
	6,270,548	6,143,810	5,422,814
Consumption	4,016,087	3,858,801	3,790,295
Exports:			
Afghanistan	11,390	10,848	0
Algeria ..	1,085	0	0
Egypt......	83,745	184,086	12,529
Hungary ..	0	12,529	0
Indonesia	167,571	48,325	80,458
Iran	135,127	416,311	141,598
Iraq	9,763	0	0
Jordan	11,933	9,852	25,058
Maldives ..	380	434	1,519
Morocco ..	0	0	24,407
Nepal......	4,696	2,897	0
Portugal ..	13,126	0	0
Qatar	0	1,627	0
Rumania ..	68,450	0	0
Somalia ..	22,780	0	0
Sri Lanka ..	13,668	10,750	22,572
Sudan	114,232	84,350	71,422
Tanzania ..	11,933	0	0
Tunisia ..	6,617	12,366	0
UK	29,940	38,076	26,781
USA	152,534	178,365	78,794
Yemen	55,937	23,919	12,529
Yemen Dem. Rep.	0	13,126	38,621
	914,907	1,047,861	536,288
Final stock ..	1,339,554	1,237,148	1,096,231

Pakistan sugar production 1976/77[2].—According to official sources, sugar cane production in 1976/77 reached 27·7 million tons, which compares with 25·72 million tons in the previous season. The area devoted to sugar cane increased from 1·67 million acres in 1975/76 to 1·8 million acres in 1976/77. A record sugar production of 738,702 metric tons was achieved, as against 623,000 tons in 1975/76. The outlook for the October 1977/September 1978 crop is considered excellent.

* * *

Dominican Republic sugar crop, 1976/77.—The Dominican Republic sugar crop is estimated this year at 929,874 metric tons[3]; production in 1975/76 is recorded by the International Sugar Organization[4] as 1,267,727 tons.

* * *

Afghanistan sugar factory proposal[5].—Sugar production in Afghanistan meets only between 8000 and 13,000 tons of annual consumption of 55,000 tons, and, to save foreign exchange, it is proposed to erect a further sugar factory, to start operating in 1978 with an annual capacity of 27,000 tons, the project to cost $45,000,000.

* * *

New Spanish sugar factory[6].—The ACOR cooperative, which operates the two Polish-built factories at Olmedo and Valladolid, is promoting the cultivation of beets in Valladolid Province and plans the erection of a new sugar factory.

* * *

Brazil sugar refinery[7].—A sugar refinery is to be set up in Barra Bonita, São Paulo, with an investment of more than 226 million cruzeiros. Production has been estimated at about 3,375,000 million bags (202,500 metric tons) a year.

* * *

Philippine sugar industry expansion[8].—Of the five new mills approved by the Government's National Economic and Development Authority[9], one is under construction for Cagayan Sugar Corporation at Santo Domingo, Piat, Cagayan. It is to be operational from November 1977 with a daily rated capacity of 4000 tons of raw sugar and 250 tons of refined sugar. Two other mills are to be set up in Negros Oriental while the remaining two will be established in Bukidnon and Cotabato.

Brevities

Nigeria sugar expansion[10].—Annual consumption of sugar in Nigeria is in the neighbourhood of 200,000 metric tons, white value, but only 35,000 tons are produced locally by Bacita Sugar Estate, in Kwara State. It is estimated that consumption will reach 300,000 tons by 1984/85. The Federal Government wants to reduce further dependence on sugar imports as much as possible, especially as the ships carrying sugar add to the problems of Nigerian ports. Three sugar projects have been embarked upon; the Savannah Sugar Estate in Gongola State was started in 1970/71 by the Federal Ministry of Industries with the Commonwealth Development Corporation as technical partners and managers. The project, which is based on a capacity of 100,000 tons of refined sugar per annum, is expected to be completed in 1978. In addition to the well-established Bacita Estate, Kwara State is to have the Lafiaga Sugar Estate, while Sunti Sugar is to be established in Niger State. The Sunti project should be ready in 1981 with an initial output of 50,000 tons.

* * *

Thailand drought[11].—Sugar cane production for the 1977/78 crop is likely to drop to 23 million tons, yielding 2 million tons of sugar, on account of the recent drought, as compared with the previous season's crop of 26·5 million tons producing 2,210,000 tons of sugar. Pricing of the sugar cane on the c.c.s. (commercial cane sugar) basis is to be introduced gradually in conjunction with a drive to improve cane quality.

* * *

Syria sugar factory[12].—Construction has begun of a sugar factory at Mehardeh for the state-owned General Organization for Sugar. Work on the factory, which will have a capacity of 4000 tons of beet per day, is being supervised by COMING, a subsidiary of the Italian state-owned Ente Nazionale Idrocarburi (ENI). COMING also designed the factory and supplied all the material and equipment. Technical consultancy services are being provided by a company identified as SSECI of Italy.

* * *

Jamaica sugar production 1977[13].—Jamaica's 1977 sugar crop, at 291,154 metric tons, is the lowest for 30 years and down by 68,000 tons on 1976. Production reached a peak of 500,000 tons during 1965/66. The main reason for the current low crop is cited as the drought which affected some of the main cane-growing areas. Heavy rain in others reduced the sucrose content, lowering the yield.

* * *

Morocco sugar factory[14].—It is reported that tenders are being invited concerning the establishment of another beet sugar factory capable of processing 7000 tons of beet a day.

* * *

French sugar factory closures[15].—The Solesmes sugar factory was closed after the 1975/76 campaign and that of 1976/77 was the last for the factories at Bolbec-Nointot, Laneuvilleroy and Us.

[1] *I.S.O. Stat. Bull.*, 1977, **36**, (6), 57.
[2] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (10), 12; *Standard Chartered Review*, October 1977, 22.
[3] *Reuter's Sugar Rpt.*, 19th July 1977.
[4] *Stat. Bull.*, 1977, **36**, (7), 37.
[5] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (23), 14.
[6] *Zeitsch. Zuckerind.*, 1977, **102**, 556.
[7] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (18), 9.
[8] *Sugar News* (Philippines), 1977, **53**, (4/5), 99, 100, 105.
[9] *I.S.J.*, 1977, **79**, 268.
[10] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (26), 14.
[11] *Standard Chartered Review*, September 1977, 32.
[12] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (26), 16.
[13] *Public Ledger*, 17th September 1977.
[14] F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (25),11.
[15] *Zeitsch. Zuckerind.*, 1977, **102**, 618.

Brevities

Burma sugar industry expansion[1].—The existing sugar factories at Pyinmana and Zeyawaddy are to be expanded and modernized and a new factory, said to be of 15,000 t.c.d. processing capacity, is to be erected with the financial help of the Asian Development Bank.

* * *

Puerto Rico sugar production decline[2].—Production of sugar in Puerto Rico used regularly to be in the region of 900,000 tons/year but, for various reasons, output fell steadily throughout the 1960's so that during the past several years output has been in the range 200,000–300,000 metric tons. A further fall is now to be envisaged following an announcement by the Governor of the island that production will be gradually reduced over a period of six years to a level only a little in excess of domestic needs which are currently in the range 150,000–160,000 tons. Commenting on this decision the Governor stated that local costs were in the region of 26 cents per lb and a government subsidy had to be provided on all sugar shipped from the island.

* * *

New beet sugar factory for Iran[3].—The Czechoslovakian firm Zavody Vitezneho Unora, of Hradec Kralove, has started installation of a new sugar factory in the Iranian town of Dezful. The factory will slice 5000 tons of beet per day.

* * *

Bulgarian sugar industry expansion.—It is reported[4] that Bulgaria plans to treble her sugar production by 1980. A new factory under construction near Pleven will have a rated daily beet slice of 3000 tons; built by Polish and Czechoslovakian concerns (with the Poles providing 70% of the equipment), the factory will be erected in two phases. Another factory having a daily slice of 5000 tons of beet (the biggest in Bulgaria) is to be built near Kameno in collaboration with Polish concerns.

* * *

New Polish sugar factory[5].—A new sugar factory is to be erected at Glinojeck, in the province of Ciechanow, north of Warsaw. This will be the country's 79th sugar factory and will have a daily processing capacity of 6000 tons. The factory is expected to come on stream in summer 1979.

* * *

Tasmanian beet sugar study report[6].—The Tasmanian Government has received the report of the feasibility study into the potential of a beet sugar industry in the state carried out by Beet Sugar Developments Ltd. Insufficient information about future price trends makes immediate major investment in the industry unattractive but, in view of potential benefits to Tasmania, the Government should hold detailed discussions with the Australian Federal Government and representatives of the existing cane sugar industry to determine future domestic prices. An immediate start is recommended on cultivation trials in suitable agricultural areas and, if these are successful and future price trends offer a sufficient return, a large factory should be set up in the Cressy-Longford area in north Tasmania, capable of producing 80,000 tons a year of which some 55,000 tons could be exported to mainland states by 1982, as well as beet pulp and molasses. The factory would cost $A56 million at present-day prices and, projecting present-day prices to 1982, a 7·1% return would be obtained from a sugar price of $275 per metric tons; the Federal Bureau of Agricultural Economics forecast recently, however, that domestic sugar prices would have to rise to $300 per ton by 1982 if the existing cane sugar industry is to remain viable, when the return on capital for the Tasmanian project would reach 14%.

Hong Kong sugar market[7].—The Hong Kong Commodity Exchange has announced that trading in its new Raw Sugar Contract was to commence on 15th November. Trading in cotton began in May 1977, rather later than had been anticipated earlier[8]. The sugar contract, in terms broadly similar to those of the New York No. 11 Contract, at the time of the announcement awaiting the approval of the Hong Kong Commodities Trading Commission, calls for delivery of raw sugar on f.o.b. and stowed terms from a wide range of origins including China and Cuba but excluding Taiwan. Quotations will be in US cents per lb and the first quotation will be for March 1978 delivery.

* * *

New Pakistan sugar factory[9].—A sugar factory has been set up at Kot Biji in Sind Province at a cost of more than 150 million rupees. The machinery was imported from France at a cost of 100 million rupees and the mill has a cane crushing capacity of 1500 t.c.d.

* * *

New Fletcher and Stewart foundry.—On 20th October 1977 Sir George Bishop, Chairman of Booker McConnell Ltd., formally opened a new foundry at the Derby works of Fletcher and Stewart Ltd., which marks the culmination of a modernization and expansion programme begun in 1973. The programme has included extension and rebuilding of workshops and erection of new offices and the new foundry, with a capacity of 3000 tons per annum, embodies advances such as the latest twin-blast type of cupola and a highly-effective dust emission control system. An important part of the foundry output will be cast mill roller shells, and it is estimated that the old foundry, which operated for more than a century before its closure last September, provided more than 15,000 shells to customers throughout the cane sugar world.

* * *

Sugar-based surfactants manufacture in the UK.—Talres Development Ltd., a wholly-owned subsidiary of Tate & Lyle Ltd., has announced plans for a special chemical complex to be built on a 20-acre site near Liverpool. In the first phase of production of the complex, which will cost more than £10 million, sucrose surfactants and microbial polysaccharides will be produced, with plant commissioning due in February 1979. Initial plant capacity will be 5500 tons per annum with a possible ultimate capacity four times this. The surfactants are based on natural materials—sugar and oils or fats—so that they are non-toxic, non-allergic and biodegradable. The microbial polysaccharide plant will initially produce xanthan gums for the food and petroleum industries.

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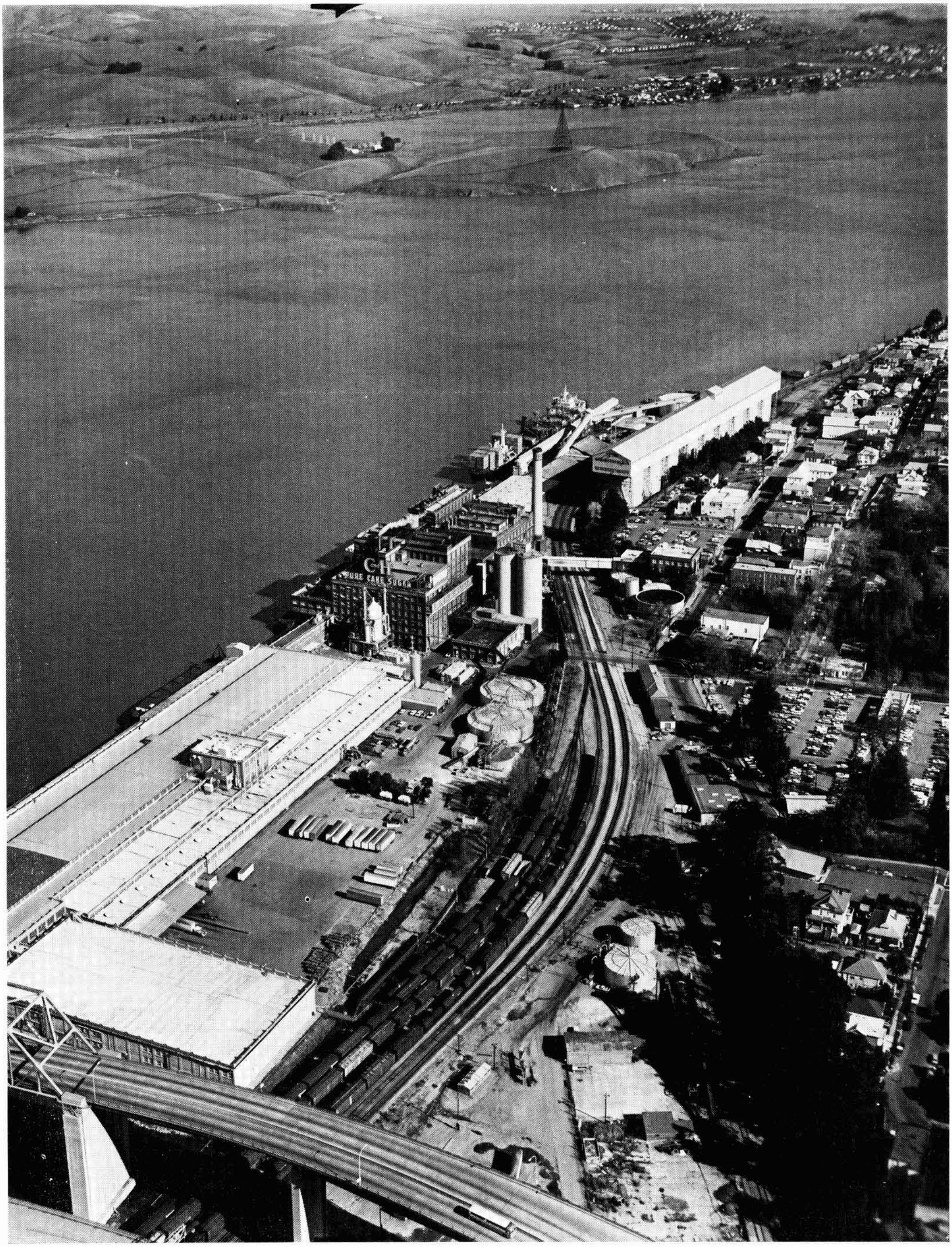
1 F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (25), 12.
2 C. Czarnikow Ltd., *Sugar Review*, 1977, (1351), 145.
3 F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (25), 12.
4 *Die Lebensmittelind.*, 1977, **24**, 380.
5 F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (26), 13.
6 *Australian Sugar J.*, 1977, **69**, 247.
7 C. Czarnikow Ltd., *Sugar Review*, 1977, (1358), 173.
8 *I.S.J.*, 1976, **78**, 30.
9 F. O. Licht, *International Sugar Rpt.*, 1977, **109**, (25), 12.

Index to Advertisers



(Photo: Courtesy California & Hawiian Sugar Co.)

Crockett sugar refinery

THE INTERNATIONAL SUGAR JOURNAL

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D. LEIGHTON, B.Sc., F.R.I.C
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PANEL OF REFEREES

ERRATA AND CORRIGENDA

Page 17. Line 26 of Column 2. Read "BAR-" for "CAR-".
Page 73. Line 29 of Column 2. Read "(2)" for "(1)".
Page 73. Line 40 of Column 2. Read "(2)" for "(1)".
Page 112. Line 18 of Column 1. Read "**spiral**" for "**coil**".
Page 118. Line 58 of Column 1. Read "**Sudan**" for "**Egypt**".
Page 144. Line 48 of Column 2. Read "169–176" for "169–172".
Page 147. Line 29 of Column 1. Read "**glucopyranosyl**" for "**glycopyranosyl**".
Page 196. Line 31 of Column 2. Read "S. C. JHA" for "C. S. JHA".
Page 229. Line 14 of Column 2. Read "to the nematicide" for "of the nematicide".
Page 229. Line 15 of Column 2. Read "of beet" for "to beet".
Page 258. Line 10 of Column 1. Read "pesticide" for "herbicide".
Page 286. Line 59 of Column 2. Read "1977, **79**" for "1976, **78**".

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INDEX TO VOLUME LXXIX

SOME REMARKS ON ITS USE

In using this Index it should be noted that the principal entries cover the several stages of production: CULTIVATION (*see* Beet; Cane; Diseases; Fertilizers; Irrigation; Mechanization; Pests; Soils; Transport; Varieties; Weeds, etc.); SUGAR PROCESSING (*see* Bagasse; Boilers; Boiling; Carbonatation; Centrifugals; Clarification; Crystallization; Diffusion; Evaporators; Filters; Massecuite; Milling; Mills; Molasses; Pans, Vacuum; Scale; Sucrose; Sugar; Sulphitation; Water, etc.); REFINING (*see* Bone Char; Carbon; Refining; etc.); and BY-PRODUCTS (*see* Alcohol; Animal Fodder; By-Products; Fermentation; Paper; Pulp; Yeast, etc.).

Subjects covered separately include Ash; Bulk handling and storage; Colour; Control, Automatic and Chemical; Countries; Ion exchange; Juice; Micro-organisms; pH; Polarization; Transport; Weighing, etc. Glucose and Fructose are to be found under Dextrose and Levulose. Obituaries, Statistics and Trade Notices are collected together under those headings. "Sucrose" implies the pure chemical; "Sugar" the commercial product; and "Sugars" the chemical family, rather than grades of sugar. When looking under the author's name, it should be remembered that the surname may be the penultimate in Spanish. Names starting with "Mc" are treated as if they start with "MAC", and the next letter in the name after the "c" will determine the position in the author index. Where a name includes the prefix "AL", "EL", "D", "DA", "DE", "DEL", "EL", "LA", "VAN" or "VON" it is indexed under A, E, D, L or V, respectively. Where a name begins with the abbreviation "ST." or "STO." it is indexed as if this were spelt in full.

(Abs.) indicates *Abstract;* (Brev.), *Brevity;* (Corr.), *Correspondence;* (N.B.), *New Books;* (N.C.), *Note and Comment;* (Stat.), *Statistics;* (T.N.), *Trade Notice.*

SUBJECT MATTER

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

NAMES

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

Suma Products

DRYING EQUIPMENT

MOISTURE BALANCE—TYPE D

The moisture balance type D illustrated is essentially the same as the type CB excepting that it can take samples from 100 to 1000 grm depending on the density of the product. In the case of bagasse the weight of sample possible is 100 grm contained in a dish 250 mm long × 200 mm wide × 22 mm deep.

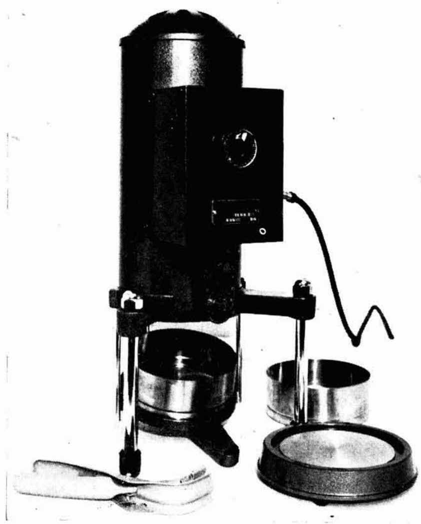
The scale range is graduated 0/100% moisture and the maximum temperature of determination is 200°C controllable by a resistance knob.

The accuracy of the scale for 100 grm is ±0.5% or 0.05% on 1000 grm samples of material. The power required for operation is 1 kW. A timer 0/60 minutes is fitted as standard.

Additional extras which can be fitted if required are:

1. Pyrometer. 2. Voltage stabiliser.

Please state single phase voltage and frequency when ordering.

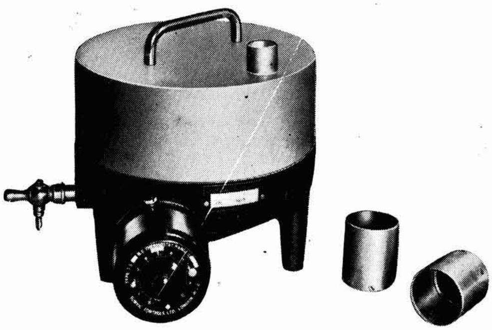


MOISTURE TELLER ▶

Work carried out in South Africa using this type of dryer gave excellent results in drying bagasse. Experiments revealed that 100 g of bagasse could be dried in 20 minutes at a temperature of 266°F, which agreed very closely with laboratory oven determinations at 225°F for 20 hours. Such rapidity of determination is a great benefit to the engineer.

The equipment consists essentially of a fan which draws in air, passes it over heating elements and then through the bagasse. A time switch and thermostat are provided so that any temperature between 90° and 150°C can be maintained with a time of operation between 0 and 60 minutes.

Please state single phase voltage and frequency when ordering.



LABORATORY SUGAR DRYER

For the rapid estimation of moisture in sugars, a comparatively large volume of heated air should be passed over and through the sample. Care should be taken in these estimations, however, as it is essential to know the conditions of temperature and time of drying during which period no decomposition takes place. Once these conditions have been established for a particular type of sugar estimations become routine thereafter and results can be obtained in about 10 to 15 min.

This oven is fitted with a thermostat type TS.2, which gives temperature control of ±0.25°C over a range of ±60° from a central adjusted temperature.

Four sample containers are provided to fit into recesses in the body of the oven, and two additional containers are provided as spares.

This type of oven must be used in conjunction with a vacuum pump or the factory vacuum line, if available, for drawing the air over the heating element, through the sample and into the vacuum line or pump trap. A time device can also be supplied as an extra with a re-set push-button so that, simply by pushing the button for making contact, a whole series of rapid determinations can be made under the predetermined conditions of time, temperature and air volume, the whole process being automatic once the cycle is set in operation.

The Sugar Manufacturers' Supply Co. Ltd.

196-204 BERMONDSEY STREET, LONDON, SE1 3TP, ENGLAND

Telephone: 01 - 407 5422 *Cables:* "Sumasuco, London S.E.1"

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