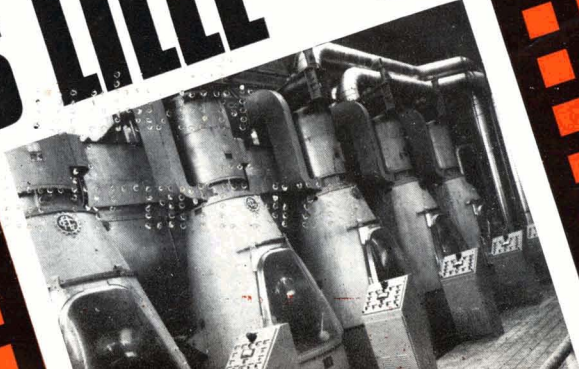
THE International Sugar Journal

DECEMBER 1972

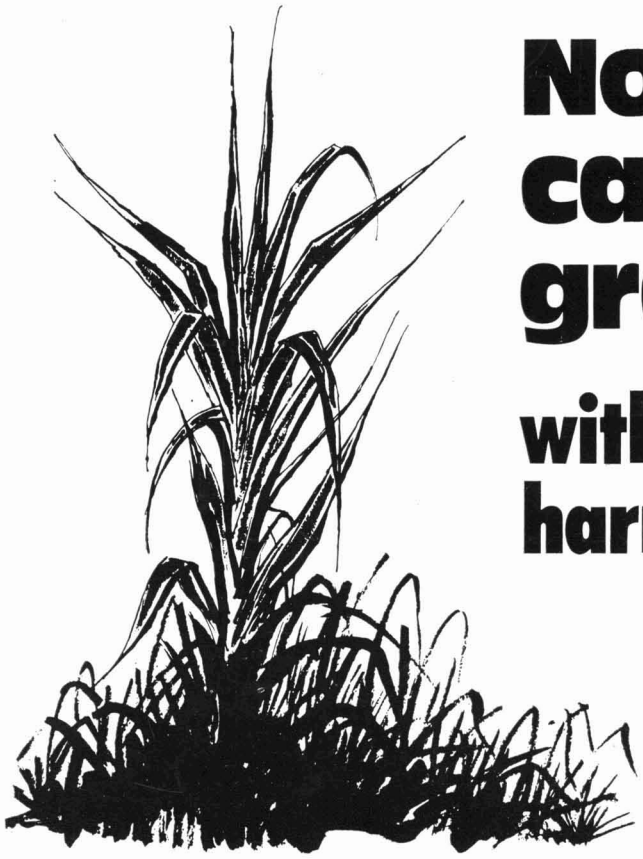
at all stages of sugar manufacture

- 150 years of experience in the construction of sugar machinery
- a large number of complete plants (cane and beet) installed in the whole world
- machinery whose sturdiness has acquired a world wide fame
- technological back-up of an important Research Centre

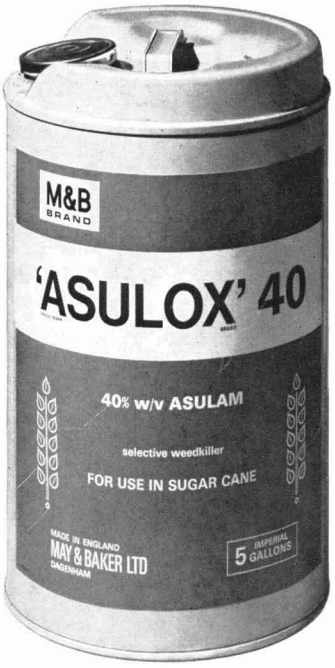
FIVES LILLE - CAIL



SUBSIDIARIES IN BELGIUM, SPAIN AND BRAZIL
AGENTS THROUGHOUT THE WORLD
7, rue Montalivet, 75 - PARIS 8e
Phone : 265.22.01 and 742.21.19
Telex : FIVCAIL 65.328



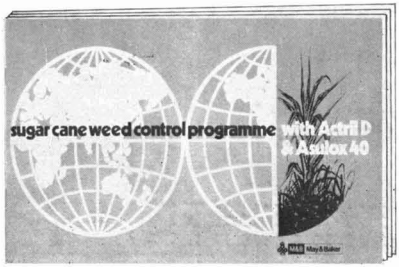
Now you can kill grasses without harming cane!



'ASULOX' 40 IS THE NEW HARD-HITTING KILLER FOR TOUGH GRASSES, SUCH AS *SORGHUM HALEPENSE* (johnsongrass) AND *PANICUM PURPURASCENS*.

. . . and the perfect partner for 'Asulox' 40 to give a complete programme of weed control is 'Actril' D – which gives rapid knockdown of the toughest broadleaved weeds.

SEND FOR FULL DETAILS OF THESE OUTSTANDING WEEDKILLERS NOW!



To May & Baker Ltd Dagenham Essex RM10 7XS England
PLEASE SEND INFORMATION ON 'ASULOX' 40 AND 'ACTRIL' D

Name .....

Position ..... Company/Estate .....

Address .....

.....

.....

ISJ 10

M&B May & Baker

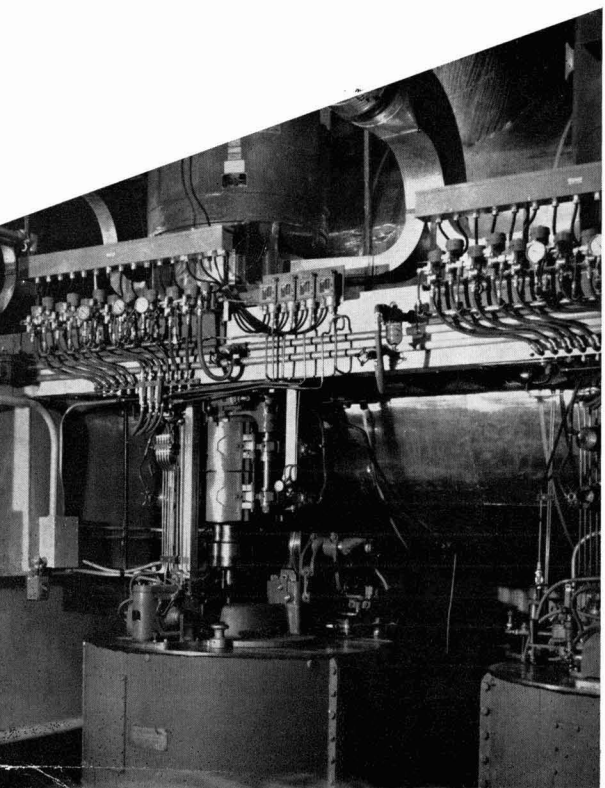
'Asulox' and 'Actril' are trade marks of May & Baker Ltd

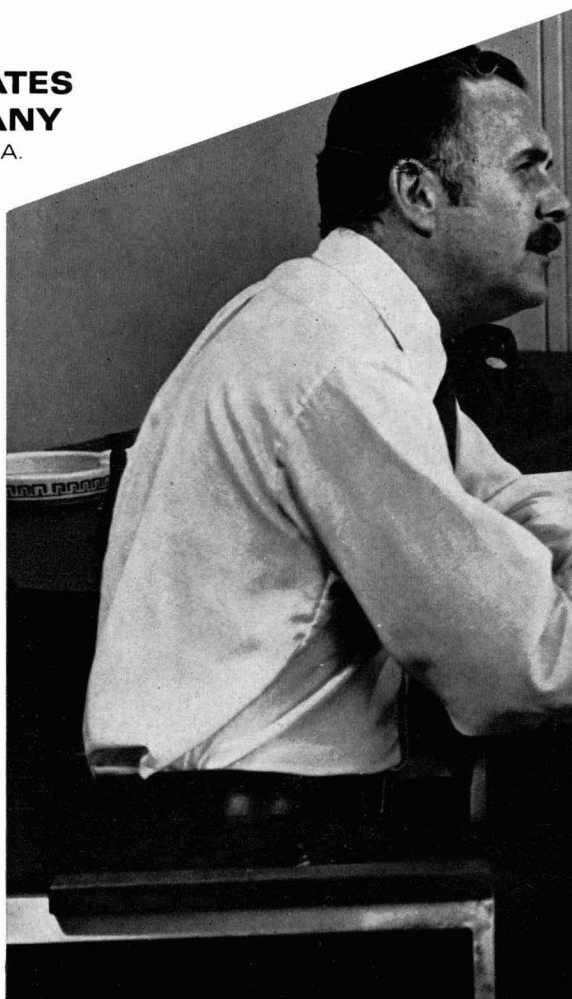
Western States has a unique capability to help you increase sugar processing efficiency

ROBERTS STEVENS

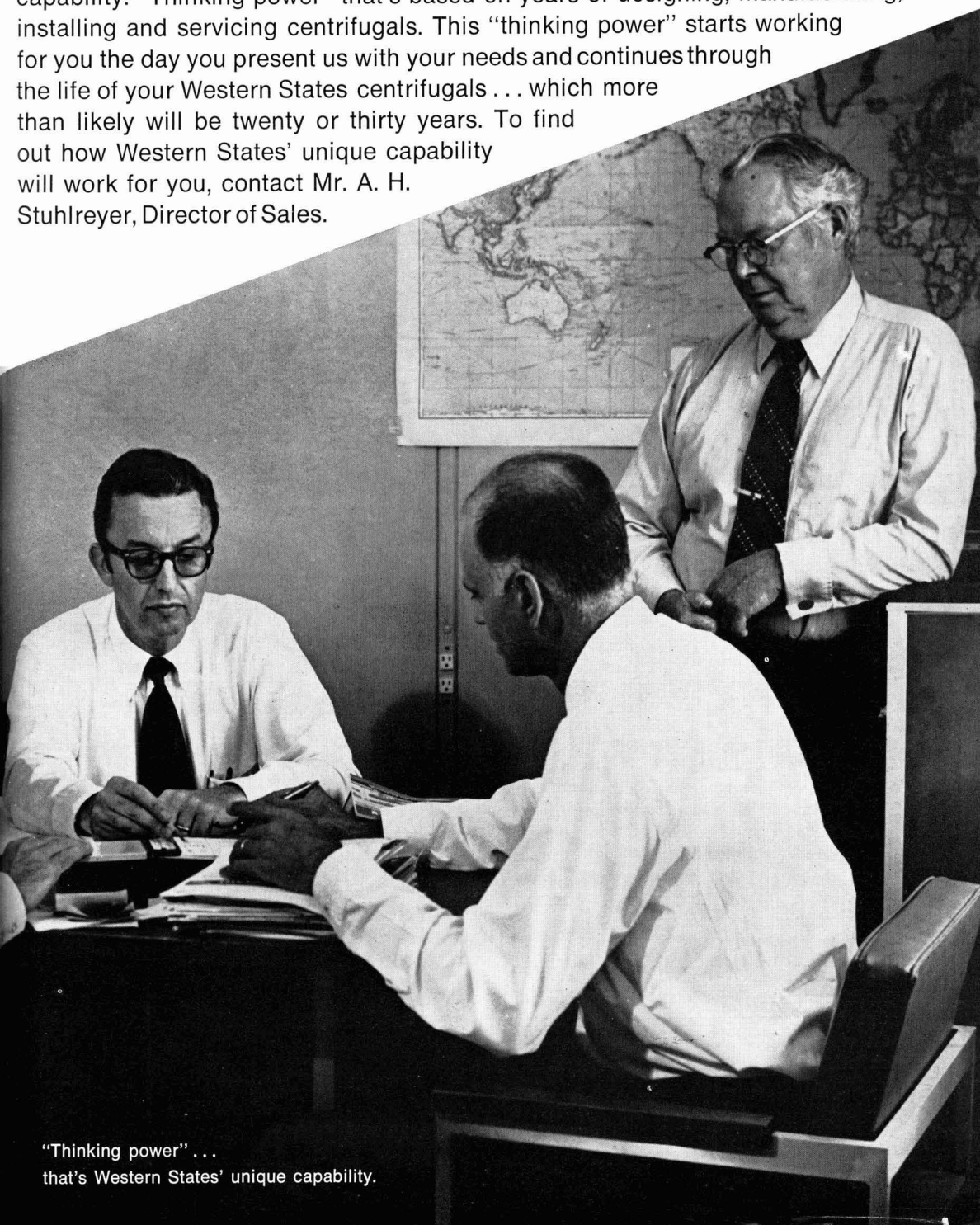
THE WESTERN STATES MACHINE COMPANY

Hamilton, Ohio 45012 U.S.A.

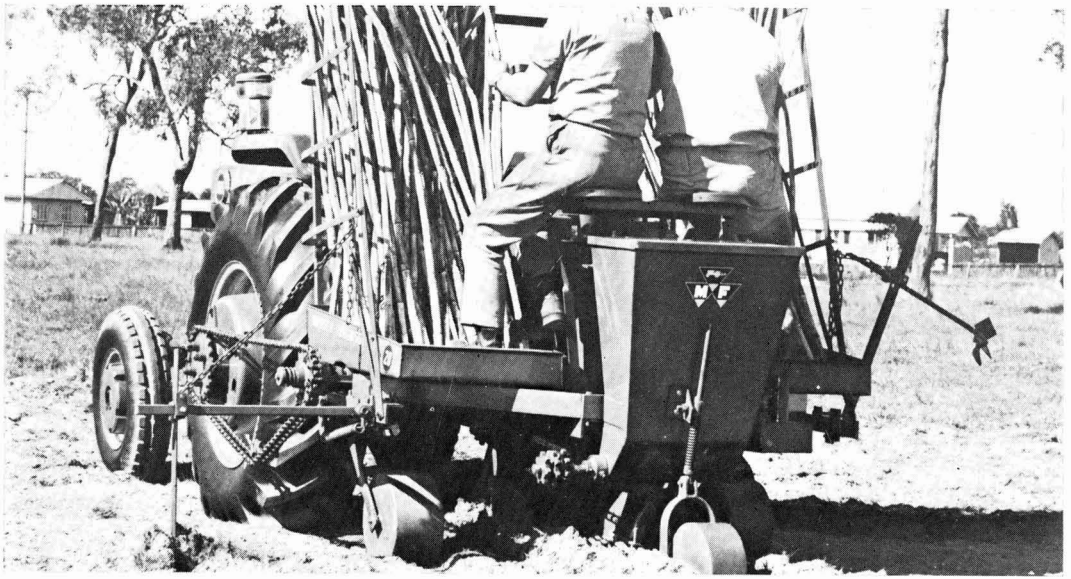


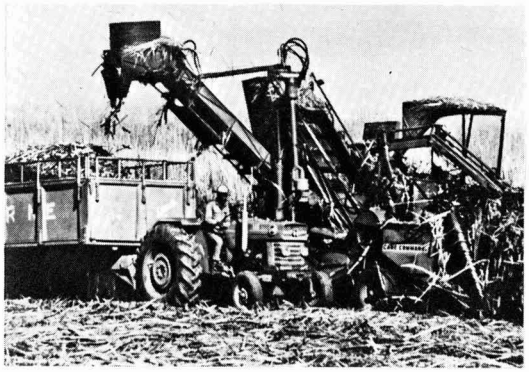


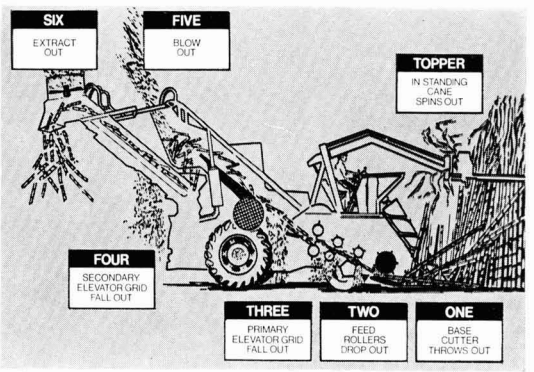
Getting the most out of a centrifugal installation is determined, to a large extent, by the initial "thinking power" that goes into it. That's Western States' unique capability. "Thinking power" that's based on years of designing, manufacturing, installing and servicing centrifugals. This "thinking power" starts working for you the day you present us with your needs and continues through the life of your Western States centrifugals . . . which more than likely will be twenty or thirty years. To find out how Western States' unique capability will work for you, contact Mr. A. H. Stuhlreyer, Director of Sales.



"Thinking power" . . .
that's Western States' unique capability.







MF's exclusive 6-stage cleaning cycle ensures maximum return of clean chopped cane

Great cane harvests start and finish with Massey-Ferguson

The MF sugar cane system provides you with methods and equipment to take you from land clearance and field preparation, through tillage and planting, to harvesting and transportation. The MF system, with the giant MF 201 cane harvester, gives improved productivity, beats labour shortages, and cuts down harvesting costs.

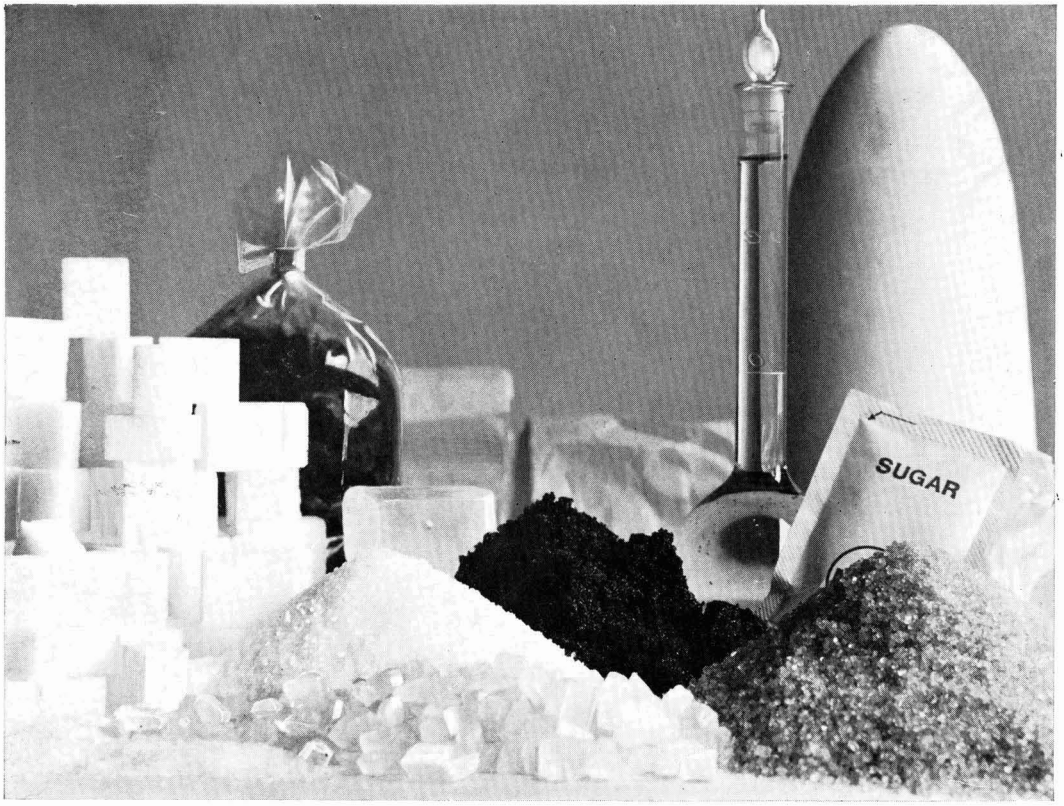
MF 20 cane planter—does six jobs at once. This machine opens the furrow, cuts the cane into lengths, dips them in protective fungicide, and then places them in the soil. At the same time, it sows fertiliser on both sides of the furrow, close enough to ensure healthy growth, but far enough to prevent the setts being scorched. Lastly, the MF 20 covers the setts with soil and presses it down. A single rotor MF 20 can plant up to 2 hectares per day; a two-man double rotor machine up to 4 hectares a day. (See top picture.)

MF 201—ton-a-minute cane harvester. This is the ultimate cane harvesting machine. Over 400 have been built in Australia and are now harvesting cane throughout the world, recording outputs up to 500 tons a day for as little as US $0.60 per ton.

Write for more information now. If you would like to know how the MF sugar cane system can help you increase productivity and overcome labour shortages, contact your nearest MF dealer or write to: Marketing Development Department, Massey-Ferguson (Export) Ltd., P.O. Box 62B, Banner Lane, Coventry, CV4 9GF, England.

They will send you copies of the MF Systems Manual, literature on the MF 20 and MF 201, and the latest edition of Cane News.

MF
Massey Ferguson



Whatever you want

No matter what you start from:
sugar cane, sugar beet or raw sugar.
No matter what you want to make:
granulated sugar, brown sugar, white sugar, crystal sugar, liquid sugar, powdered sugar, soft sugar, rock candy, sugar loaves, sugar cubes or castor sugar.

For more than 100 years we have engineered and built the most advanced and reliable sugar equipment, ranging from a simple vessel to the most sophisticated process installations.
Besides, we erect a great many complete factories all over the world.
Just name it, we build it.

STORK-WERKSPOOR SUGAR

sugar industry engineers
P.O. Box 147 Hengelo (O) - the Netherlands

Member of VMF/Stork-Werkspoor
Cables: Stowesugar Telex: 44485 Tel.: 05400 - 54321

FS can help you...

Why should Fletcher and Stewart have earned contracts for no less than six complete sugar factories since 1968? And why, one might also ask, do they receive so many requests from other manufacturers to enter into licensing agreements?

The answer lies, of course, in the vast amount of know-how that Fletcher and Stewart have accumulated during more than 130 years of specialised service to the sugar industry, and the unique experience that they have acquired through their membership of a group of companies which owns and operates nine sugar factories and manages others.

THIRD — EXPERIENCE AND KNOW-HOW

In other words, Fletchers have a commodity to sell which is rare among the many people who claim to serve the sugar industry: Fletchers are technologists in sugar production and it shows in the equipment that they make and the factories that they build which are designed for efficiency, reliability and ease of operation.

Fletchers build factories to meet the needs of twentieth century sugar operators who demand the best.

It is not possible to stop people, who without even understanding their design, try to copy Fletcher and Stewart products, nor can they be stopped from marketing factories which lack the latest technology, but what discerning buyer would purchase such a substitute if he could afford the real thing.

When you think of sugar machinery—think of FS.

FS

FLETCHER AND STEWART LIMITED

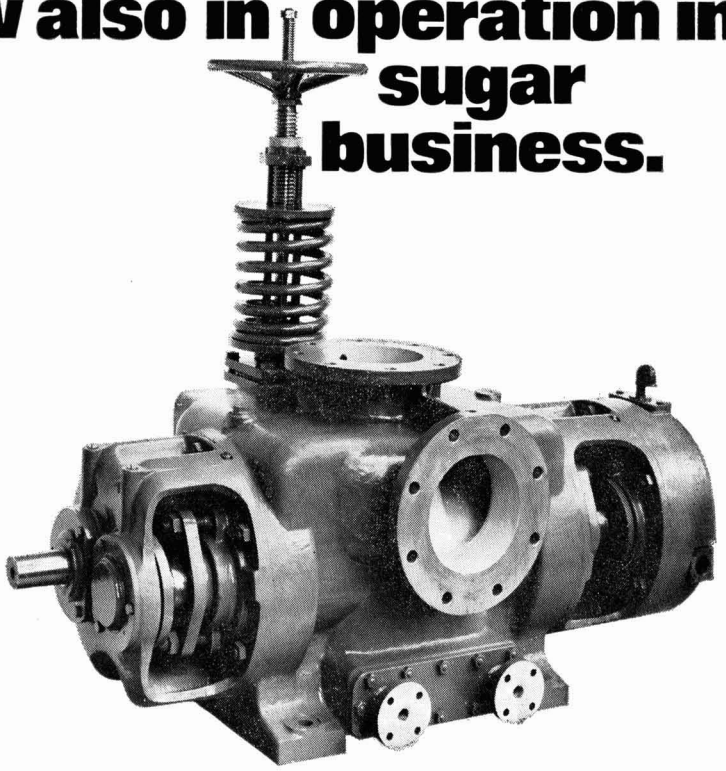
A member of the Booker Group

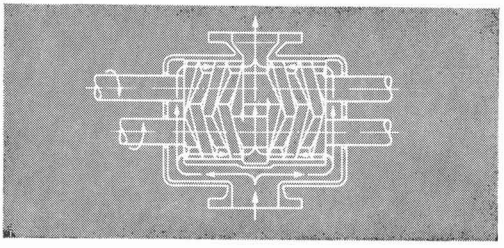
DERBY · ENGLAND · DE2 8AB

1966 1972
THE QUEEN'S AWARD TO INDUSTRY

Tel: Derby 40261 **Telex: 37514** **Cables: "Amarilla" Derby Telex**

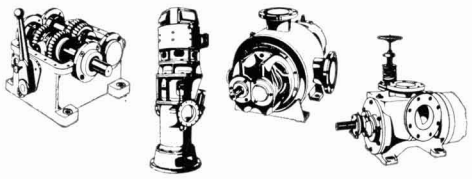
Houttuin screw pumps now also in operation in sugar business.





The two screws that provide the drive for Houttuin positive rotary displacement pumps, intermesh smoothly without metal to metal contact.

Features:
Selfpriming even under the most unfavourable conditions. Can handle all kind of liquids, including heavy juice, run offs, melts, molasses. Extremely suitable for pumping thin liquids to settling stations and filter presses because of the virtually pulseless flow. Versatile and suitable for all temperatures and capacities encountered in the sugar industry. All liquid contact points can be made from materials carefully selected to suit the liquid you want to pump. Wear resistant even on saturated juices (sulphitation, carbonatation, etc.).
Like to know more? Send for our comprehensive catalogue.



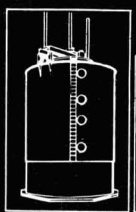
HM houttuin pompen

Sophialaan 4, Utrecht, The Netherlands, tel. 441644, telex 47280

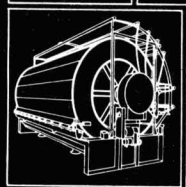
Machinery with "Machismo"

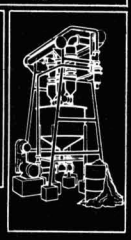
Dorr Oliver separates profit from cane.

RAPIDORR® 444 CANE JUICE CLARIFIER Requires no costly chemicals, gives greater throughput with less retention time. Four individual compartments each with separate feed, clear juice take-off, and mud withdrawal. Has an impressive list of design improvements to simplify operation and make it more efficient.



OLIVER-CAMPBELL® CANE MUD FILTER with Dorr-Oliver designed components, stainless steel and polypropylene construction to reduce maintenance, large-diameter piping and filtrate valve that give it greater hydraulic capacity.





DORR-OLIVER DSM® SCREENS combine high capacity with high efficiency, have no moving parts, require no operator, no special foundation and have a rugged self-cleaning stainless-steel or bronze screen element construction that makes them practically maintenance-free.

DORR-OLIVER DORRCLONE® DESANDING SYSTEM, two stage systems with automatically controlled discharge provide maximum sand removal with minimum sugar losses.

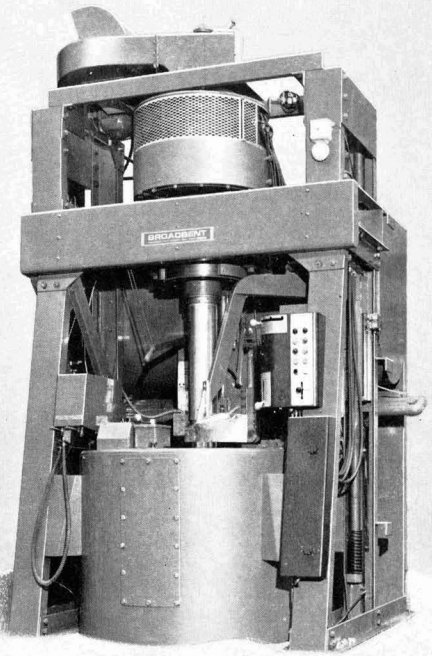
For more information about our machinery and systems with "machismo", call or write Dorr-Oliver Incorporated, 77 Havemeyer Lane, Stamford, Connecticut 06904

DORR OLIVER

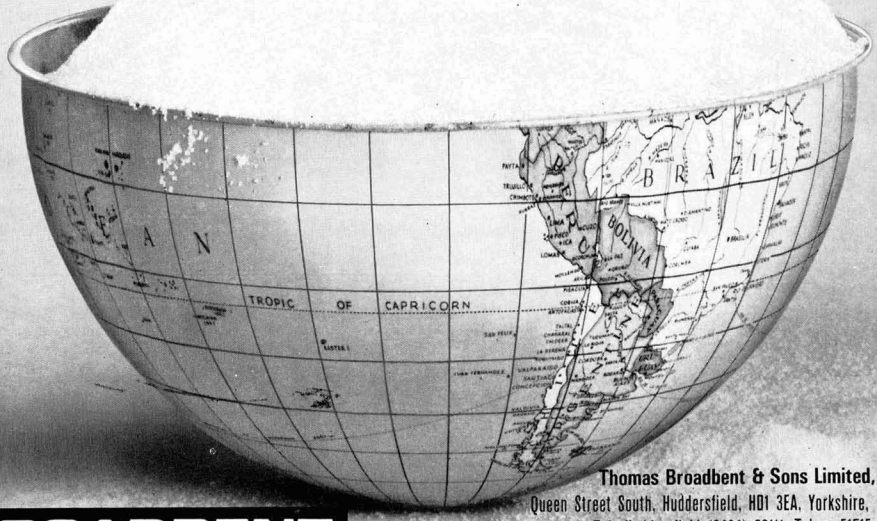
SEPARATES THE GOOD FROM THE BAD

Broadbent Centrifuges operating in.....

Angola
Argentina
Australia
Barbados
Belgium
British Honduras
Chile
Colombia
Costa Rica
Cuba
El Salvador
Ethiopia
France
Guyana
Holland
Honduras
India
Indonesia
Iran
Italy
Jamaica



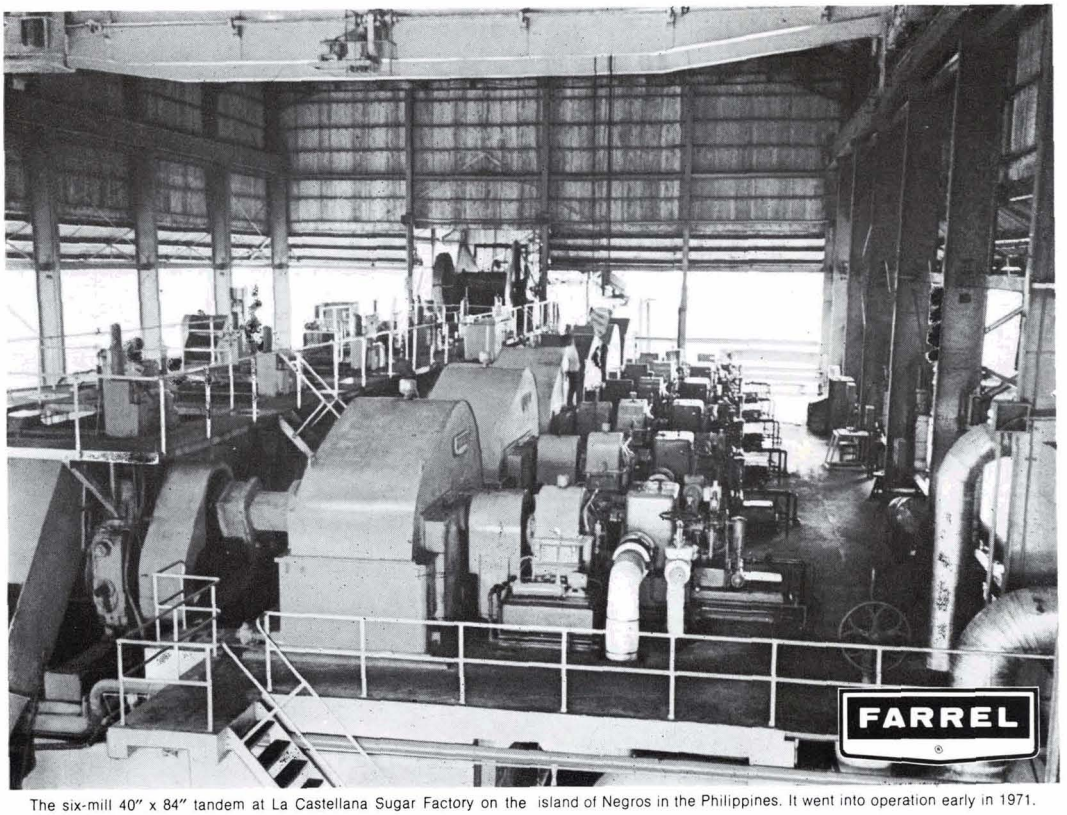
Kenya
Malaysia
Malawi
Mauritius
Mexico
Mozambique
Nicaragua
Pakistan
Philippines
Portugal
South Africa
Swaziland
Taiwan
Tanzania
Trinidad
Thailand
Uganda
United Kingdom
U.S.A.
U.S.S.R.
Venezuela
Zambia



BROADBENT

Thomas Broadbent & Sons Limited,
Queen Street South, Huddersfield, HD1 3EA, Yorkshire,
Tel: Huddersfield (0484) 22111, Telex: 51515,
Cables: BROADBENT, Huddersfield.

CW 20712



The six-mill 40″ x 84″ tandem at La Castellana Sugar Factory on the island of Negros in the Philippines. It went into operation early in 1971.

New Farrel milling tandem more than doubles output of Philippine sugar factory

By installing Farrel cane grinding equipment, the La Castellana Division of Central Azucarera de La Carlota in the Philippines increased capacity from 6,500 metric tons per day to over 14,000 for the total installation.

This new tandem was completed ahead of schedule and well "tuned" by Farrel technicians by the time the sugar crop was available, so that less than two months after start-up La Castellana was grinding over 8,000 MTD. Such performance is just one reason why leading sugar factories turn to Farrel for the equipment, installation and operating assistance which add up to more profitable processing.

For this installation Farrel furnished two knife sets, cane conveyors, six three-roll 40″ x 84″ mills, individually driven by Farrel DRB-4571 slow-speed double reduction gear reducers, DR-39 high-speed double reduction gear reducers, and single stage steam turbines.

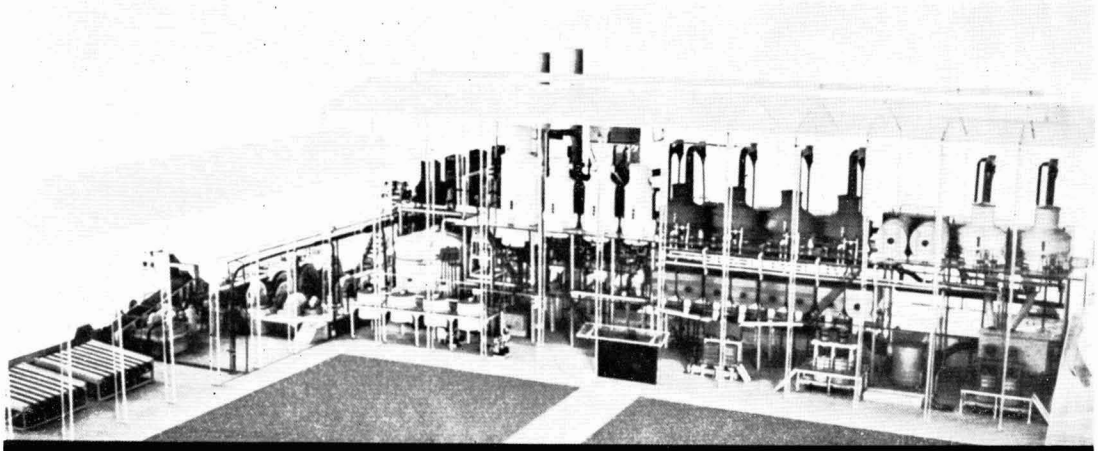
Included are many mill design refinements pioneered by Farrel: hydraulic mechanisms that maintain uniform roll pressure and free float for the top rolls; automatic lubrication of roll journals; side and top cap designs which permit fast, vertical removal of all rolls; and safeguards against corrosion. In terms of production these and many other Farrel features mean increased sucrose extraction, lower operating costs, simplified maintenance and improved reliability.

If you are interested in a new sugar cane milling tandem, make Farrel's grinding systems and equipment the standard against which you make your buying decision. For complete information on all Farrel sugar machinery, write Farrel Company Division, USM Corporation, Ansonia, Conn. 06401, U.S.A.

Farrel
Machinery
Group
USM Corporation

A-1-23

Plants: Ansonia and Derby, Conn.; Rochester, N.Y.
Regional Offices: Farrel Mexicana, S.A., Apartado Postal 48 Bis, Mexico 1, D.F.



IT IS BEING ASSEMBLING IN VENEZUELA ONE OF THE MOST MODERN SUGAR CANE PLANT. WHO DID BUILD IT? M.DEDINI DID.

After an international bid for the construction of "Central Santa Maria C.A.", in Venezuela, M. Dedini built a complete Sugar Cane Plant, turn-key sistem.

Also in other countries, like Argentina, Bolivia, Paraguay and El Salvador there are in operation several Sugar Cane Plants equipped by M. Dedini.

These Dedini's achievements are becoming Brazil so known, that Dr. Emile Hugot, a famous sugar technician, due to his works on sugar technology, declared: "I have the great pleasure to certify that Brazil is also able furnish a complete Sugar Cane Plants, among the world competitors."

M.DEDINI S.A. METALÚRGICA

- an interprise of Mario Dedini Industrial Group
Av. Mario Dedini, 201 - Phone: PABX 2-3080
Piracicaba - SP - Brazil - São Paulo Office: Rua Tagipuru, 235 - 13th floor - Phones: 51-2034, 51-5649, 51-5316, 52-0582 e 52-7663 - Guanabara Office: Avenida Presidente Vargas, 542 22nd floor - Phone: 223-9949.

International agreements:

GHH (Gutehoffnungshütte Sterkrade Aktiengesellschaft), West Germany
ERIE CITY ENERGY DIVISION (Zurn Inc.), U.S.A.
ATELIERS DES CHARMILLES, Switzerland
ATELIERS BELGES REUNIS (ABR Engineering), Belgium

KASTEL is the registered trade mark of the ion exchange resins produced by Montedison in a wide range covering all fields of application. The following types of exchangers are available:

For industrial water treatment

KASTEL C 100 weakly acidic exchanger with carboxylic active groups

KASTEL C 101 weakly acidic cation exchanger with carboxylic active groups, and higher exchange capacity

KASTEL C 300 strongly acidic exchanger with sulphonic active groups

KASTEL C 300 P porous strongly acidic exchanger with sulphonic active groups

KASTEL C 300 AGR porous highly crosslinked exchanger with sulphonic active groups

KASTEL C 300 AGR/P porous highly crosslinked exchanger with sulphonic active groups

KASTEL A 101 highly porous, weakly basic anion exchanger, monofunctional (tertiary amine active groups)

KASTEL A 300 strongly basic exchanger (type II) with dialkyl-alkanol amine active groups

KASTEL A 300 P porous strongly basic exchanger (type II) with dialkyl-alkanol amine active groups

KASTEL A 500 strongly basic exchanger (type I) with trialkylamine active groups

KASTEL A 500 P porous strongly basic exchanger (type I) with trialkylamine active groups

KASTEL A 510 highly absorbent resin with strongly porous matrix and strongly basic active groups: specially recommended as scavenger

KASTEL®

For sugar juices treatment

KASTEL C 300 strongly acidic exchanger with sulphonic active groups

KASTEL C 300 AGR porous highly crosslinked exchanger with sulphonic active groups

KASTEL A 105 weakly basic exchanger with tertiary amine active groups

KASTEL A 501 D decolourizing resin with a highly porous matrix and strongly basic active groups

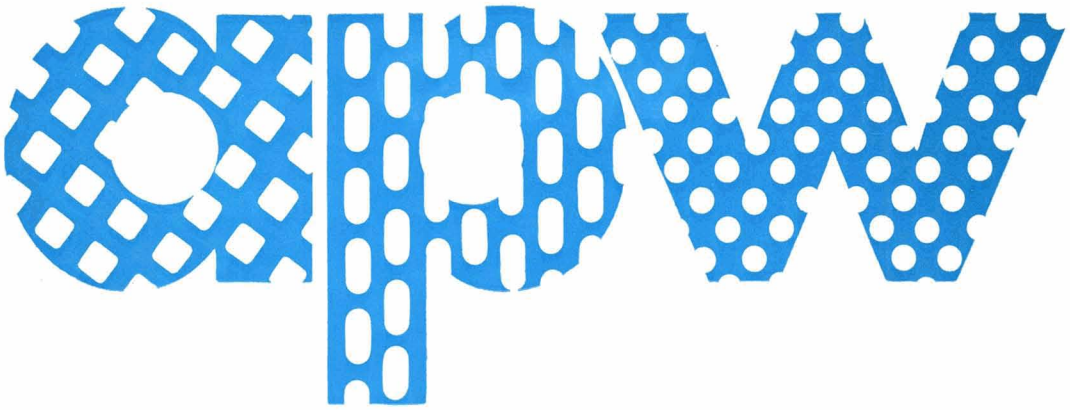
The Technical staff of Montedison, with their wide experience in both the laboratory and industrial fields, are available for consultation and collaboration on the various problems which may be encountered by end users and engineers in the application of these products.

For further information please apply to:

MONTEDISON

Divisione Prodotti Industria - Vendite Resine Kastel - Piazza della Repubblica, 14/16 - 20124 Milano (Italy)
Tel. 6333 - Telex 31679 Montedis

or to the General Representative
Joseph Weil & Son Ltd. - 11A West Halkin Street - London SWIX 8LF - Tel. 01-235 8642/50 - Telex 918743
Inland Telegrams: London Telex 918743 - Overseas Cables: Ullubrossa London



The only name you need to know in perforated metals

Associated Perforators & Weavers Limited are experts in their field. They produce every kind of perforation, from ·012″ to 1″ thick, (0·3mm to 25mm).

In a wide range of materials–mild steel, high tensile steel, stainless steel, tinplate and most non-ferrous metals. APW also perforate precious metals and many non-metallic materials such as hardboard, rubber and rubber laminates.

Perforating that can be purely functional or totally decorative. But it is always precisely made to meet your requirements.

Try them out for your company, discuss your particular need with them. You will find them friendly, helpful and expert no matter how big or small the job.

Write to:
Associated Perforators & Weavers Ltd.,
Woolwich Road, London, SE7 7RS.
Telephone: 01-858 6401 Telex: 896648

Northern Office and Works,
P.O. Box 161, Warrington WA1 2SU. Lancs.
Telephone: 0925 34119 Telex: 62508

apw

A JOINT HARVEY Locker ENTERPRISE

Published by
The International Sugar Journal Ltd.
23a Easton Street, High Wycombe.
Bucks., England.
Telephone: High Wycombe 29408
Cable: Sugaphilos, High Wycombe

* * *

Annual Subscription: £3.00 or $10.00 post free

Single Copies: 40p or $1 post free

International Sugar Journal

December 1972

Contents

SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

THE
INTERNATIONAL
SUGAR JOURNAL

VOL. LXXIV DECEMBER 1972 No. 888

Notes & Comments

World sugar supplies and prices

Over the past month to the time of writing, prices of raw sugar on the London Market have been fairly stable at £75–£78 in spite of the return of Brazil as a supplier after three months' interval. In contrast to her sales in July, prices sought have been such as to make her entry to the market a bull factor since, when offering 1,450,000 tons of raws for January/June shipment, she rejected several bids for large blocks which, although higher than current market levels (7.15 cents/lb), were not high enough. Later she made two sales of 100,000 tons each on a basis of 8·00 cents per lb for half and half on a pricing basis.

C. Czarnikow Ltd. comment[1]: "For several years Brazil was plagued with a surplus of sugar and heavy stocks were carried forward from one crop to the next. The tight statistical position which has applied during 1972 has enabled Brazil to divest herself of this surplus and indeed to increase her output target. From the point of view of the world market it would, of course, have been catastrophic if these stocks had not existed in Brazil. There is now no country which will carry forward so large a surplus and, although a substantial increase in production is anticipated in 1972/73, stocks have been reduced to such an extent that no cushion now exists and any crop failure in an important supplying country could have a disastrous effect on the availability for world market outlets."

The French trade house Sucres et Denrées, in its latest review[2], agrees that sugar available in 1972/73 will be almost entirely from current production, and that stocks at the end of the crop year 1971/72 will have become at least 3 million tons lower than a year earlier, to reach their lowest level since 1963. It points out that the renegotiation of the International Sugar Agreement in 1973 has encouraged all ISA exporting members to sell maximum tonnages in order to obtain higher quotas next year. It mentions Brazil in this context as having sold about 1·8 million tons on the world market in the first ten months of 1972 compared with around 600,000 tons for all of 1971.

Other factors indicating the likelihood of firm prices are that the USA will require higher quantities of sugar imports in 1973, and developing importer countries will generally have to buy more regularly in view of their depleted stocks. The USSR approaches the new year with adequate stocks but certainly no surplus and, while the EEC has increased its stocks in 1972 by about 100,000 tons, they will not be sold whatever the world price.

* * *

Cuban sugar production

Although the Cuban 1971/72 campaign was completed a few months ago, no official details of final output have yet been released. However, under the provisions of the International Sugar Agreement, this information has to be submitted to the International Sugar Organization, and details of output to the end of March have now been published in the Interim Monthly Statistics of the ISO.

Total production from the commencement of the campaign to end-March 1972 amounted to 2,872,661 metric tons, raw value, compared with 3,603,034 tons to 31st March 1971. The latter figure represented 60·8% of the final production in the 1970/71 season and on a straight pro-rata basis one could calculate an output in 1971/72 of about 4·7 million tons[3]. In fact, Sr. RAÚL LEÓN TORRAS, Cuba's vice-Foreign Minister, has been quoted[4] as saying in Tokyo recently that drought in two consecutive years had reduced the 1972 crop to about 4·4 million tons, which compares with trade estimates of 4·0 million tons or even below.

The ISO statistics show that Cuban consumption in the first quarter of this year amounted to 125,276 tons, compared with 169,354 tons in January/March 1971. This presumably reflects the tighter ration in Cuba this year. It will be recalled that the reduced ration was introduced by the Cuban Government specifically to enable more sugar to be available for export.

[1] *Sugar Review*, 1972, (1099), 197.
[2] *The Times*, 6th November 1972.
[3] C. Czarnikow Ltd., *Sugar Review*, 1972, (1094), 171.
[4] *The Times*, 23rd October 1972.

European sugar production, 1972/73

On the 18th October F. O. Licht K.G. published their second estimate of European beet sugar production for the current campaign[1]. The total figure for Europe is now set at just under the 1971/72 crop of 26 million tons as against the increase of 300,000 tons anticipated earlier. Since their first estimates were published at the beginning of September beet test results have been disappointing and in most countries Licht expects a lower output, except for West Germany, Denmark and Sweden, and Albania and Poland among the East European countries. The Soviet crop is set 200,000 tons lower than the first estimate, at 9,200,000.

Although the East German sugar beet crop is expected to reach a high level which could yield the estimated sugar outturn, the actual production will depend on whether all the beet is used for sugar as in 1971/72 or some for animal fodder as in other years.

At the beginning of November, the International Association for Sugar Statistics published their own estimates for member countries in Western Europe and these are tabulated below, together with the corresponding second estimates of F. O. Licht K.G. and the revised IASS figures for the 1971/72 crop.

	1972/73		1971/72
	IASS	*Licht*	*IASS*
	Thousands of metric tons, raw value		
Austria	367	367	278
Belgium	667	667	858
Denmark	344	345	332
Finland	88	87	66
France	2,978	2,945	3,273
Germany, West	2,264	2,250	2,395
Holland	764	764	857
Spain	798	780	1,046
Sweden	283	285	273
Switzerland	67	65	76
Turkey	844	845	930
UK	972	1,005	1,207
	10,436	10,405	11,591
Licht estimates for Non-IASS Members			
Greece	140	140	158
Ireland	190	190	192
Italy	1,222	1,222	1,274
Yugoslavia	390	390	389
	12,378	12,347	13,604
Licht estimates for East European countries			
Albania	19	19	18
Bulgaria	230	230	250
Czechoslovakia	750	750	730
Germany, East	600	600	542
Hungary	333	333	267
Poland	1,850	1,850	1,713
Rumania	610	610	510
USSR	9,200	9,200	8,400
	25,970	25,939	26,034

* * *

UK Sugar Board distribution payments

In view of recent changes in the level of the world price of raw sugar on the London Market orders were made by the UK Minister of Agriculture, Fisheries and Food varying the rate of distribution payments made by the Sugar Board. From the 13th October the payment of £28 per ton was reduced to £24 while a week later the rate of payment was restored to the earlier level. From the 3rd November, however, it was reduced again from £28 to £26 per ton.

* * *

US sugar quotas 1973

Following representations and arguments concerning the quota proposals made initially for 1973[2], the US Department of Agriculture has announced its determination of the initial figures for next year and these are tabulated below, with the corresponding quotas for 1972 at the present level of 11,800,000. Embodied in the 1972 figures are the slight changes which resulted from the declaration of a shortfall of 478 tons by Haiti; the Philippines could not take up her entitlement to one-third of this and it was allocated among Western Hemisphere suppliers.

	1973 *quotas*	1972 *quotas*
	—short tons, raw value—	
Domestic Beet	3,500,000	3,400,000
Mainland Cane	1,645,667	1,643,000
Hawaii	1,110,000	1,218,238
Puerto Rico	205,000	175,000
Philippines	1,376,753	1,401,761
Argentina	81,970	85,703
Australia	212,620	210,798
Bahamas	0	61
Bolivia	6,966	54
Brazil	591,480	618,401
British Honduras	36,433	38,091
Colombia	72,863	76,180
Costa Rica	73,935	99,213
Dominican Republic	685,773	716,985
Ecuador	87,328	91,303
Fiji	46,591	46,190
Guatemala	63,220	84,138
Haiti	33,216	22,522
Honduras	12,858	17,495
India	85,133	84,403
Ireland	5,351	5,351
Malagasy Republic	12,707	12,597
Malawi	15,670	0
Mauritius	31,343	31,074
Mexico	606,479	634,084
Nicaragua	69,113	72,358
Panama	69,113	43,500
Paraguay	6,966	7,281
Peru	423,250	442,513
Salvador	46,075	48,239
South Africa	60,144	59,628
Swaziland	31,343	31,074
Taiwan	88,521	87,763
Thailand	19,370	19,316
Venezuela	65,899	68,898
West Indies	220,732	206,788
	11,700,000	11,800,000

Irrigation in Mauritius[3].—The feasibility study of the Northern plain irrigation scheme is nearing completion. According to reports, the estimated cost is in the region of 50 million rupees for the 16,650 arpents of land involved. As a result of the irrigation scheme, it is estimated that an increase of some 60% will be seen in sugar cane production (about 223,000 tons of cane).

[1] *International Sugar Rpt.*, 1972, **104**, (29), 1–3.
[2] *I.S.J.*, 1972, **74**, 322.
[3] *Barclays International Review*, August 1972, 14.

The diffusion of cane sugar colorant in decolorization resins

By D. F. BAGSTER and K. B. KHOO

(Department of Chemical Engineering, University of Sydney, Sydney, N.S.W., 2006 Australia)

Introduction

THE purpose of the present study was to gain further information on the penetration of sugar colorant into ion exchange resin. Previous work[1,2] indicates that a core of uncoloured resin is sometimes left in the resin bead after decolorization has ceased.

It has been reasoned[2] that the shrinking core model[3] cannot strictly apply to this particular situation, for the coloured layers of resin do not appear to have a constant saturation concentration.

Another conceivable model of penetration behaviour is the application of Fick's law[4] to the transport of colorant into the resin bead in analogy to the heating of a sphere in a calorimeter. This problem has been treated by PATERSON[5]. The very presence of the uncoloured core is evidence that this type of diffusion mechanism cannot apply exactly, for otherwise the colorant concentration would be uniform after long periods, but it has been pointed out previously that the uncoloured core may not necessarily represent a large proportion of the resin bead volume. Further it would be useful to see how closely the diffusion model applies to the uptake of natural colorants by resin.

To enable comparison to be made of the effect of other variables a single sample of cane sugar raw liquor was used while a range of concentrations of two different resin types was selected.

Experimental

The two resins chosen, both supplied by Rohm and Haas Co., were IRA 401, a gel type anion exchanger, and IRA 900, a macroreticular anion exchange product. A reasonably narrow size range was achieved by sieving a fraction between 20 and 30 B.S. mesh, producing surface average diameters of 0·52 mm and 0·53 mm for IRA 401 and IRA 900 respectively. The resins were given a preliminary contact with 10% NaCl solution and then thoroughly washed with distilled water.

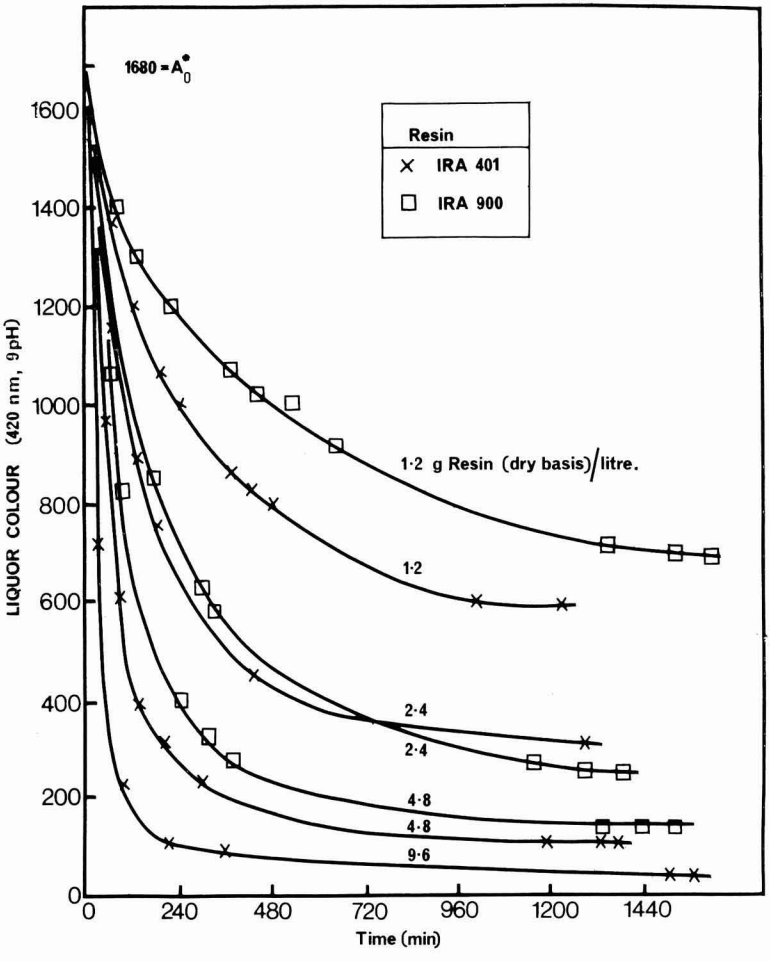


Fig. 1. Decolorization curves

[1] SCHNEIDER *et al.*: *I.S.J.*, 1968, **70**, 67.
[2] BAGSTER: *ibid.*, 1970, **72**, 200.
[3] LEVENSPIEL: "Chemical Reactions Engineering" (Wiley, New York), 1962, p. 338.
[4] BIRD *et al.*: "Transport Phenomena" (Wiley, New York) 1960, p. 503.
[5] *Proc. Phys. Soc.*, 1947, **59**, 50.

Experimental conditions were very similar to those used in the previous work. Known quantities of resin were added to a litre of 64°Bx liquor at 68°C and stirred with a laboratory stirrer at 540 r.p.m., a speed sufficient to prevent variation of liquor side resistance with the degree of agitation in the vessel.

Resin concentrations of 1·2, 2·4, 4·8 and 9·6 g (dry basis) per litre of liquor were used. Samples of liquor were removed at suitable time intervals in the manner previously outlined[2]. The measure of colorant concentration was again taken as the attenuation index

$$A^* = 1000\,\frac{(-\log T)}{bc}$$

where T = transmittance of the liquor (with resin filtered out of course), having dissolved solids concentration c g/cm³, in a cell of length b cm. A wave length of 420 nm was used and the pH of the liquor adjusted to 9.

The decolorization curves which were obtained are presented in Fig. 1.

The Model

The partial differential equation in spherical polar coordinates for a diffusion may be written

$$\frac{\partial \overline{A^*_s}}{\partial t} = D_p\left\{\frac{\partial^2 A^*_s}{\partial r^2} + \frac{2}{r}\frac{\partial A^*_s}{\partial r}\right\}$$

where D_p is an empirical diffusion coefficient within the particle, assumed constant with time and position within the sphere.

The colour concentration at the same radius r within the bead is A^*_s while the average colour concentration in the bead is

$$\overline{A^*_s} = \frac{3}{a^3}\int_0^a r^2 A^*_s\, dr$$

where a = particle radius.

The initial and boundary conditions are:

$\overline{A^*_s} = 0$ for $r \leqslant a$ at $t \leqslant 0$, and

$\overline{A^*_s} = KA^*$ at $r = a$ for all cases where $t > 0$

where K represents the relation between the liquor colour A^* and the average colour concentration in the resin, given by the appropriate isotherm.

K is not, in this particular case of sugar colorant uptake, an equilibrium constant since such uptake is not reversible[2]. Here K is simply a convenient representation of the isotherm and, as mentioned below, is in fact taken as a constant.

Helfferich[6] provides numerical values of the fraction of material transferred $U(w, \tau)$ as a function of dimensionless time

$$\tau = \frac{D_p t}{a^2}$$

and a capacity parameter

$$w = \frac{V_R K}{V}$$

where K is the slope of the linear isotherm and V_R and V are the volumes and resin and liquor respectively.

Fig. 2 is a plot of the residual liquor colour as a function of resin concentration, and this relation may be converted into a conventional isotherm plot, Fig. 3. Here the ordinate is the volume concentration of colour units in the resin, while the abscissa shows the colour concentration remaining in the liquor, i.e. simply the attenuation index A^* of the liquor.

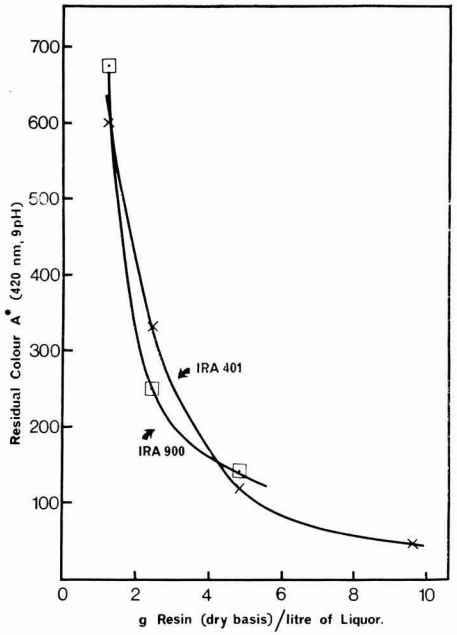


Fig. 2. Residual liquor colour as function of resin concentration

In addition to the two resins mentioned, Fig. 3 also shows the isotherm for Permutit FFIP, a resin roughly similar to IRA 401, the result of the previous work[2] and therefore with a different natural cane liquor.

The isotherms were assumed to be roughly linear, i.e. a constant value of K was assumed, for application to the present model, in the manner shown by Coulson and Richardson[7]. The value of D_p resulting from a particular value of K (and hence w) is not very sensitive to changes in the value of K.

For a particular capacity parameter w calculated from the resin concentration V_R/V and the values of

[6] "Ion Exchange" (McGraw-Hill, Toronto) 1962, p. 585.
[7] "Chemical Engineering" Vol. 3 (Pergamon, Oxford) 1971, p. 551.

K for the particular resin, a theoretical curve may be drawn of U against $D_p t/a^2$. Experimental values of U are available and corresponding values of $D_p t/a^2$ are found by assuming a value of D_p. The applicable value of Dp is the one giving the best fit to the theoretical line.

An excellent fit between experimental points and the theoretical line can be achieved for the early part of the decolorization and generally up to a value of 0·2 of the dimensionless group $D_p t/a^2$ (Fig. 4). Thereafter, owing to the very small departures from the final colour and the errors in colour measurement, the experimental line could not be expected to correspond to the theoretical line. Further, the final liquor colours were determined at finite times (corresponding

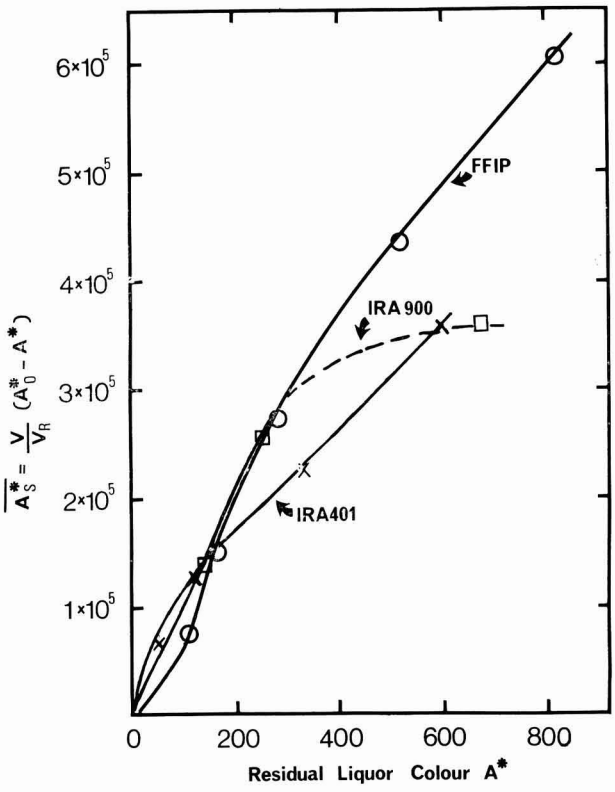


Fig. 3. Colour concentrations for liquor and resin in extended contact

to $D_p t/a^2$ of about 0·6) at which decolorization had ceased. The diffusion theory predicts a small but finite departure from completion at such a finite value of $D_p t/a^2$.

The values of the empirical diffusion coefficient found in this way are given in the accompanying table.

Table I. Experimental diffusion coefficients

Resin concentration g (dry)/litre	$w = \frac{V_K}{V_R}$	Dp *cm² sec⁻¹*
IRA 401		
1·2	0·051	16×10^{-9}
2·4	0·104	7×10^{-9}
4·8	0·208	2×10^{-9}
9·6	0·416	$0{\cdot}6 \times 10^{-9}$
IRA 900		
1·2	0·097	4×10^{-9}
2·4	0·194	$1{\cdot}3 \times 10^{-9}$
4·8	0·388	$0{\cdot}4 \times 10^{-9}$

Results

Despite the more open pore structure of the macroreticular resin the diffusion coefficient at a given value of w or of g/litre is lower than for the gel type. These values of D_p depend on the application of the model of course and on the assumption of linearity of the isotherms and hence may be regarded with caution. However a glance at Fig. 1 shows that the gel type IRA 401 *does* actually decolorize more rapidly. Lagos and Kitchener[8] concluded that the influence of cross-linkage on diffusion is largely through its control of the water content of the resin. It is not inconceivable that it is the water content also which reduces the importance of resin structure, for the two resins (after the pretreatment) had very similar water contents, viz. 60% and 63% for IRA 401 and IRA 900 respectively.

Further, whereas Schneider *et al.*[1] observed a much greater penetration of colorant into their S type (macroreticular resin) than for the gel type, this does not necessarily reflect the greater rate of mass transfer, possibly the contrary.

The order of magnitude of the diffusivities in the table of 10^{-9} cm² sec⁻¹ appears reasonable. Boyd and Soldano[9] found for simple ions at 25°C in anion exchange resin of roughly the same chemical type diffusivities one or two orders of magnitude greater. Considering the size and complexity of the natural colorant molecules[10] it is not surprising that the elevated temperature used in the present study does not counter the effect of such size.

The more disturbing feature of the results in the table is the fact that D_p is not constant for a given resin, but has a uniform trend downwards with in-

[8] *Trans. Faraday Soc.*, 1960, **56**, 1245.
[9] *J. Amer. Chem. Soc.*, 1954, **75**, 6099.
[10] Farber *et al.*: *Proc. Tech. Session Cane Sugar Refining Research*, 1969, 85.

creasing w (Fig. 5). The constancy of the D_p resulting from the theory is a necessary condition for confidence in the diffusion model.

A clue to this may be provided by the fact that the decolorization ceases with a concentration gradient still within the resin bead, as evidenced by the uncoloured core in some cases. There is thus likely to be a type of threshold concentration gradient which has to be overcome to transfer mass further into the bead. Thus if resin with an uncoloured core is contacted with another batch of liquor darker than the residual colour of the first liquor, the coloration penetrates further in.

At lower values of w (or lower resin dosages) more colorant is taken up per unit mass of resin and it is not unreasonable to assume that concentration gradients will be locally greater for at least some of the time, perhaps exceeding the threshold gradients more than in cases of higher w. The overall effect would then be a greater D_p measured in the manner expounded above.

It will be noticed from Fig. 5 that the D_p/w graph tends to level out. Experimental extension of these curves to values of greater w is needed but it is possible that they level out to a constant D_p. At large w, much more surface area is available and concentration gradients would be less steep. The effect of the threshold concentration gradient would then be more dominant and could lead to an apparently more constant behaviour.

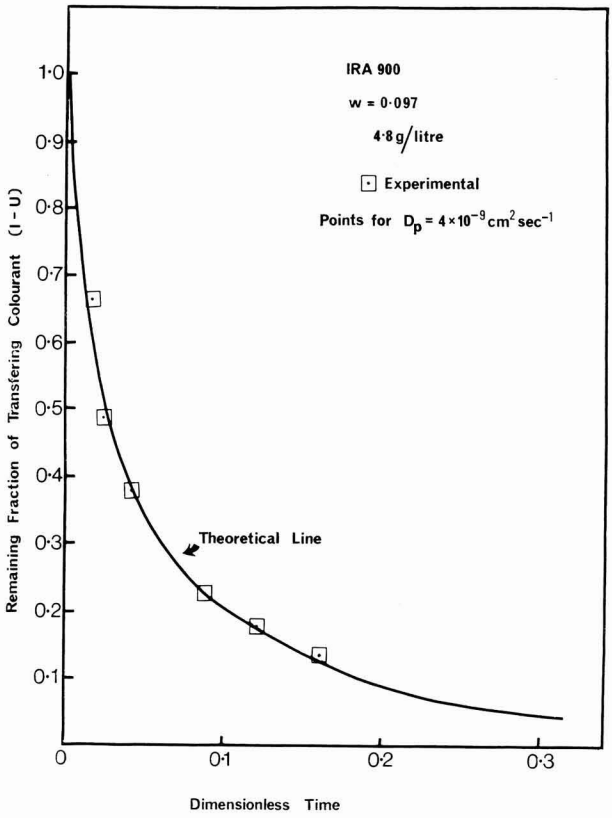


Fig. 4. Comparison of diffusion model with experiment

Another viewpoint is that the diffusivities of colorant molecules in resin are concentration dependent[11,12].

It is worth noting that the application of the simple diffusion model assumes that the only resistance to mass transfer is the necessity for colorant molecules to diffuse through the resin material. As such it is "empirical" diffusion coefficients which result from the calculations, and the possibility of any ion exchange occurring and being rate controlling has been ignored, while the possible existence of a rate-controlling counter-diffusion of molecules or exchanged ions has also been neglected.

Conclusions

(1) Measurements of the diffusion of natural cane sugar colorants into anion exchange resin have revealed that the gel type tested is superior to the

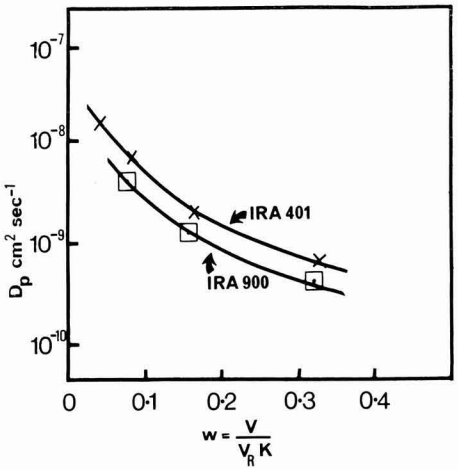


Fig. 5. Diffusivity as function of capacity parameter

[11] GLASSTONE *et al.*: "The Theory of Rate Processes" (McGraw-Hill, Toronto) 1941, p. 530.

[12] REID and SHERWOOD: "The Properties of Gases and Liquids" (McGraw-Hill, Toronto) 1966, p. 546.

macroreticular type, although the ultimate capacities of the two resins are very similar (Figs. 2, 3).

The application of this knowledge to plant decolorization in columns must be considered in relation to

(*a*) whether the liquor side mass transfer rate is controlling,

(*b*) the relative regenerability and service life of the resins, and

(*c*) overall economics.

(2) Fick's law may be applied to the transport of colorant within the resin material but there must be accepted a concentration dependence of diffusivity.

(3) Values of diffusion coefficient of the order of 10^{-9} cm^2 sec^{-1} have been found for both the gel and macroreticular resin types.

ACKNOWLEDGEMENT

The authors are extremely grateful to the Colonial Sugar Refining Co. Ltd., Australia, for carrying out the colour determinations, and for the liquor sample.

The DDS Cane Diffuser at T.P.C.

A review of 10 years' experience

By G. VAN DER WOLF

(Factory Manager, Tanganyika Planting Company Ltd., Arusha Chini Estate, Moshi, Tanzania)

WITH the completion of the 1971/72 milling season, a DDS cane diffuser will have been operational for 10 seasons at the Tanganyika Planting Company Ltd., Moshi, Tanzania. When the DDS diffuser was installed in 1962, the two main objectives were to improve mill extraction and to increase throughput. In 1957 a 5th mill had been added to the then installed 12-roller 28 in × 48 in mill train, but this plant was thought to have reached its maximum capacity in the early sixties.

The hourly crushing rate (excluding stops) was at that time 55 tons of cane, which was slightly more than its rated capacity (50 tons/hr) while the mill extraction averaged 93·5% over the previous 5 years.

In consultation with DDS it was then decided to replace the 3rd mill by a cane diffuser, which at that time was a novelty in the processing of sugar cane. This was to raise the daily capacity from approx. 1250 tons to 1500 tons, at the same time largely improving extraction.

Effects on Process and Performance

After installation of the diffuser in 1962, the factory staff started the year 1963 in a rather uncertain state of mind. As the influences of the diffusion process were largely unknown at that time, both Engineering and Chemical Departments had their doubts about things to come.

Engineers were worried about dewatering the very wet diffuser bagasse, increased slip, lower calorific value of bagasse and steam production, while the chemists felt rather uncertain about clarification of the poorer juices expected, inversion losses in the diffuser, increased draft and scaling-up of evaporators, the effect on molasses exhaustibility and, most of all, whether the increased extraction would show up as "sugar in the bag"!

It would be incorrect to state that all worries were unfounded. During the first year diffuser operators had to be trained how to run the unit efficiently, while dewatering also caused some problems in the beginning. But by improving the drainage of the rollers by way of larger grooving, more chevrons and Messchaert grooves and knives, these problems were solved at a rather early stage.

Boiler performance did not appear to be affected as moisture content in final bagasse remained at the same level as before the installation of the diffuser.

Inversion losses, a subject of exhaustive investigations by the Company's own staff[1] and visitors from abroad[2], proved to be at a minimum. Clarification problems did not occur. Tests were made with application of lime in the diffuser, thus raising the pH of the diffuser juice, but apart from giving a rather slippery bagasse, sucrose losses were found to increase as well as the extraction of unwanted gums and pectins[1,3,4].

The expected increase in purity drop between first and last expressed juice did not occur, as may be seen from the following table, indicating that the extraction of impurities did not follow the extraction of sucrose, as it would normally do with increased extraction in conventional milling.

Several performance figures of milling plant etc. before and after installation of the diffuser are given below for comparison.

Production figures as tabulated are, of course, not only dependent on the performance of the extraction plant. With increasing throughput, additions and modifications were made to the sugar end, while changes were made in processing. In 1965, the clarification system was changed from limed juice sulphitation to simple defecation, which meant a considerable

[1] Unpublished work from T.P.C. files.
[2] DE OLIVEIRA and MELLO: *Brasil Acuc.*, 1966, **67**, 264–277.
[3] BRÜNICHE-OLSEN: *Sugar y Azúcar*, 1966, **61**, (8), 27–29.
[4] BJERAGER and BRÜNICHE-OLSEN: *Proc. 13th Congr. I.S.S.C.T.*, 1968, 151–164.

saving in clarifier and evaporator capacity and less scaling. In 1966, a refinery was added to produce white sugar by the melt sulphitation process, while in December 1967 a pre-evaporator was added to the existing set. More low-grade crystallizers were added in 1967 and 1969 to improve low-grade work, several pans were added, and in general the chemical control was tightened up.

Further, there are always the fluctuating seasonal influences which will have their effects on factory performance. But it may be seen from the tabulated figures that there has been a steady progress in throughput, while mill extraction remained on a steady high level.

Although in general the actual extraction figures are higher than the yearly averages, disturbances due to chokes, technical difficulties, lack of cane, etc. which may occur several times a day will bring the overall extraction figures down. Different cane varieties will influence results, owing to changing fibre content and hardness, while young and stale cane will all cause variations in much the same way as experienced in straight-forward milling.

From Table I it may be seen that, apart from season 1970/71 when the cane was very difficult to handle owing to scaling disease, there has been a constant increase in throughput. As the design capacity of the diffuser was 1500 tons/24 hr certain alterations had to be made to bring the capacity up to its present 2000 tons/24hr. These alterations were mainly concentrated on increasing the capacity of the discharge and of dewatering. A larger discharge was installed in 1967/68 which at the time reduced the moisture content in exhausted bagasse, as the position of the scrolls causes a squeezing action on the transported bagasse, the water being returned through the perforated scroll housing. Once the capacity reached a maximum of approx. 1850 tons, it became clear that further improvement was necessary as the sheer volume of the bagasse caused chokes and flooding of the 1st dewatering mill.

DDS solved this problem by installing a specially designed dewatering unit in the chute for exhausted bagasse. This brought down the moisture content from 84% to approx. 73–75% and increased the maximum throughput to approx. 2100 tons. This dewatering unit consists of a standard mill roller on top (2-inch grooving and chevrons) while the bottom roller is built-up from stainless steel triangle bars, matching the ridges on the top roller, with perforated screen welded between the bars. The bottom roller is self-cleaning and press water runs directly back into the top end of the diffuser.

Economic aspects

Although further modification may still increase throughput slightly, it is generally felt that maximum capacity on mills and diffuser has been reached, and that further increases would be at the cost of extraction. It therefore seems the correct time to assess the overall gains obtained from the decision to install the diffuser in 1962.

Three points appear to be of interest here:

(*a*) loss of milling time as compared with milling with 5 mills,

(*b*) maintenance costs as compared with one mill removed before diffuser installation, and

(*c*) gain in sugar produced as compared with orthodox milling with 5 mills.

(*a*) *Loss of milling time* (Total net time lost = 100%)

Taking the average of % net time lost on mills and engines, 22·3% is lost for 4 mills, or 5·6% per mill. The average for the diffuser amounts to 3·5% or 62·5% of the downtime per mill. When related to

Table I

Milling	58/59	59/60	60/61	61/62	62/63	63/64	64/65	65/66	66/67	67/68	68/69	69/70	70/71	71/72
Tons mixed juice % cane ..	98	95	97	91	92	94	94	95	96	94	99	100	98	99
Mill extraction	93·1	93·5	93·7	93·4	93·7	95·4	95·4	95·4	95·6	95·6	95·6	96·1	95·8	96·0
Imbibition % cane	27	27	27	19	20	28	25	29	30	24	31	32	30	28
Tons cane/hr crushed	58·3	58·7	53·1	55·2	55·6	58·0	61·8	61·5	62·4	65·6	74·4	78·7	74·8	82·4
Purity of 1st expressed juice..	85·1	85·1	84·8	84·2	84·5	83·7	83·9	83·2	83·7	83·5	83·9	83·2	80·9	84·1
Purity of mixed juice.....	82·1	82·1	82·7	82·5	82·8	81·9	80·9	80·8	81·7	80·8	81·7	80·9	78·4	81·6
Purity of last expressed juice	76·9	76·2	75·9	76·8	78·4	74·3	72·7	74·5	75·1	74·1	73·8	72·2	71·7	76·9
Cane														
% Pol	12·07	11·99	13·62	12·18	12·79	12·45	12·61	12·13	12·76	12·39	12·63	12·18	11·13	12·69
% Fibre	14·81	15·54	14·74	14·49	13·70	13·68	14·06	14·90	14·71	14·53	14·63	14·56	13·92	14·12
Final bagasse														
% Moisture	47·4	47·7	47·0	46·5	47·2	46·8	46·9	47·2	46·7	46·3	49·2	48·7	49·7	47·9
% Pol	3·4	3·4	3·1	3·4	3·9	2·1	2·5	1·8	1·9	1·9	1·8	1·6	1·6	1·8
% Fibre	48·2	47·9	48·9	50·4	49·2	50·4	49·7	50·4	50·8	51·2	49·2	49·1	48·0	48·9
Production														
Yearly production (thousand metric tons)	22·3	24·1	25·4	25·6	27·7	31·2	33·3	34·3	35·7	36·9	38·9	40·7	40·3	47·5 (Est.)
Tons sugar/hr crushing time	5·1	5·5	5·2	4·9	4·8	5·0	5·8	5·7	6·1	6·2	7·3	7·4	6·3	8·4

NOTE

(*a*) During season 62/63 diffuser installed, operational half season
(*b*) During season 1970/71 cane quality suffered heavily from scaling disease in cane
(*c*) For season 1971/72: To date this season—estimated production

a mill train with 5 mills, the down time would have been 28·0% against 25·8% with the diffuser installed. This reduction of 8% in downtime on the extraction plant is an additional gain.

Table II

	64/65	65/66	66/67	67/68	68/69	69/70	70/71
% net time lost: Mills and engines	19·4	18·4	19·5	10·0	26·6	23·4	38·7
% net time lost: Diffuser	9·1	4·3	4·4	0·1	4·0	1·8	1·1

Theoretically, there is no need to lose milling time when the diffuser is stopped. The conveyor arrangement taking the 2nd mill bagasse to the diffuser is such that it can be by-passed without stopping the mills. As such by-passing will greatly increase bagasse losses, it is done rather seldom.

The main reason for a mill stop is generally overfilling of the diffuser after which the operating level in the diffuser has to be brought back to normal. The dewatering mills continue running, while the feeding mills are stopped. Although such a stop is entered against the diffuser, basically it is not a diffuser failure, but an operational fault.

Time losses as described, as well as those caused by pumps, conveyors and electrical equipment, are entered in the daily log to give a weekly figure for diffuser running efficiency, which is the percentage of actual running time against running time available.

Yearly averages since introduction of this figure have been 68/69 = 96·02%, 69/70 = 97·90% and 70/71 = 97·85%.

(*b*) *Maintenance costs as compared with one mill*

It will be realised that in order to obtain an hourly throughput of 80 tons on mills of a rated capacity of 50 tons, maintenance has to be of a very high standard, and it may be said that at TPC more attention is being paid to this than is probably the case at the average mill.

The average costs for the four mills over the past 7 years have been 403,000 Shillings, or Shs 100,000 per mill per year, while the average yearly maintenance costs for the diffuser were Shs 74,800. The average costs per ton of sugar were Shs 10·74 on four mills, or Shs 2·68 per mill.

Maintenance costs per ton of sugar for the diffuser were Shs 2·03.

As these figures indicate the maintenance costs of the diffuser are approx. 25% lower than those of a mill. The costs of additions to the original plant have not been included in the average for diffuser maintenance costs.

(*c*) *Overall gain in sugar produced as compared with orthodox milling*

As Table I indicates, production of sugar has increased from 27,700 tons in 1963 to an expected 47,500 tons in 1972. This is an impressive increase when one remembers that the same mills are being used. But it would not be correct to attribute this gain only to the installation of the diffuser. As mentioned before, overall efficiency has improved, and the milling season has been extended. It can be assumed that this would also have been the case if milling with 5 mills had been continued. Thus, rather than yearly production figures, a proper yardstick of gains appears to be a comparison of years without and with diffuser using the appropriate throughput and extraction figures.

These figures indicate that the diffuser, by the increased extraction and throughput, will be instrumental in obtaining an increase of 15,800 tons above the production which could have been expected from crushing with 5 mills during season 71/72. From similar calculations for all years the diffuser has been operational, a total of 74,000 tons increase is obtained.

Without going into details, it will be clear that the original investment has paid off handsomely, while the diffuser itself is still in excellent shape and is expected to operate at the present throughput for years to come.

To the Tanganyika Planting Company it has been very satisfying indeed to have seen confirmed its confidence in the DDS diffuser, and to have realised in a most economical way its original objectives: increased extraction at a higher throughput.

Table III

(Figures from Season 1971/72)

	Hours actual milling	*Tons cane/hr*	*% Pol in cane*	*Extraction*	*Tons Pol in mixed juice*	*Boiling house recovery*	*Tons sugar produced*
Orthodox milling with 5 mills..	5860	55·0	12·69	93·5	38,241	83·5	31,931
Operating diffuser	5860	80·1	12·69	96·0	57,183	83·5	47,747

Cane mechanization in Spain

THE only sugar cane plantations in Europe are found along the valleys on the Mediterranean coast of Spain between Málaga and Motril. Of the total cane area of 4000 hectares, the Motril district accounts for half. Overall, the area's production of cane totals about 300,000 tons with a sucrose content of 10–12%.

Sugar cane farming in the area can be traced back to the time of the Moors. Methods have changed little; land preparation, planting, irrigation, harvesting and transport have been carried out in much the same way as they have through the centuries. Even so, the crop has always been productive and provided worthwhile returns to the farm owners.

But emigration and the labour requirements of Spain's ever-growing tourist industry have deprived the area of its once abundant manpower, and the steadily rising wages of those that remain are threatening the sound economic base enjoyed for so long in the crop's production.

Studies carried out from time to time on the possibility of introducing harvesting machines and other mechanized equipment exposed the major difficulties faced by the industry in modernizing its production methods. The ownership of the land was scattered and divided, access routes and estate roads were poor or non-existent, irrigation ditches were poorly sited for mechanized operations, and in some places, the fields were crossed by low-level electricity lines. All this, coupled with a conservative approach to change on the part of the cane producers, hampered any real progress.

Two years ago, however, against the background of advances made by the cane equipment industry in designing field machinery, a new mechanization study of the Motril district was carried out by the San Francisco de Salobreña sugar factory and submitted to Motor Iberica S.A., the Spanish associate company of Massey-Ferguson, the world's biggest cane harvester manufacturer which pioneered the chopped cane concept of harvesting.

Fig. 1. The scene at harvest time as it has been for hundreds of years in Europe's only sugar cane plantations in Spain

Fig. 2. The MF 201 "Cane Commander" in action in Spain, cutting, topping, chopping and loading cane in one continuous operation

Subsequently, in conjunction with MF's Mechanziation Advisory Service, a plan was prepared with the sugar factory for installing one of the Australian-made MF 201 "Cane Commander" chopper-harvesters to operate on cane fields belonging to associates of the factory.

The management and technical direction of the mechanization programme was handed over to Mr. GASTON DE FAUCAL, who was invited to do the job by the management of the sugar company because of his experience in introducing the MF harvester in Madagascar with impressive success in reducing harvesting costs at the island's Nossi-Bé estate.

Consequently, the first mechanical harvesting in Spain was carried out last year when the MF chopper worked for the last eight weeks of the harvest, cutting

more than 4000 tons of cane from fields selected because of their accessibility to the main roads.

At the same time, work was also started on preparing new fields with rows planted at 1·4 metres spacing to suit the harvester. This will greatly increase the harvester's output, and the first benefits of its were seen this year when nearly 12,000 tons of cane were harvested and loaded by the MF machine.

Since mechanical planting is virtually an essential part of the process for creating the best conditions for efficient mechanical harvesting, the new planting is being carried out with an MF 20 cane planter. The initial results provided a cogent reminder of the wisdom of undertaking a pilot project whenever an estate introduces mechanized practices for the first time.

The MF planter operates by opening a furrow, cutting the cane into setts, dipping them in a mercurial fungicide, placing them in a furrow and covering with firmed soil. It was found, however, the whole cane planted by hand at the same time, without any preparation, produced a better growth. Investigations showed that this was due to a hard pan 8–10 cm below the ploughed surface, as a result of years of ploughing at the same depth. There had been a build-up of potassium and phosphate fertilizers, which interacted with the fungicide and killed many shoots.

The planter is now being operated with the cutter and fungicide tank removed. This is now producing satisfactory results and, with the non-availability of labour, its use will be essential in promoting the mechanization programme.

Even at this early stage, the project is already showing the small but compact Spanish cane industry the way to the cost savings which are needed to maintain its viability.

The cost of manually cutting and loading the cane, plus transport, is generally about 350 pesetas per ton. The cane harvested by the MF machine this year showed a considerable reduction and, as field conditions for the harvester are improved, the costs of harvesting will be reduced even more—perhaps by as much as one half of the manual cutting costs. There is now more confidence that this unique corner of the world cane industry can solve its problems.

Disease-resistant sugar cane clones

By P. B. HUTCHINSON
(Colonial Sugar Refining Co. Ltd., Roseville, N.S.W., Australia)

Paper presented to the 14th Congress, I.S.S.C.T., 1971

Introduction

MANY of the classical disease-control measures are not practicable for use with sugar cane. The major diseases do not respond to chemotherapeutic measures, and, even if they did, the expense of employing them to protect this high-bulk, low-value crop could not be justified. It is almost impossible to move within the closed-in crop to protect it by spraying or roguing, and it is difficult to penetrate it from the air. By its very nature the crop surrounds the mill as an intense monoculture, continuous in space and time, and the escape techniques of isolation and seasonal avoidance are not available. It is a grass crop and thus alternative hosts for disease and vectors abound in headlands and wild pastures. Often the crop is grown by a host of small, independent farmers and programmes of concerted disease control are impracticable.

For these reasons, the industry is highly dependent on disease-resistant varieties. The sugar cane pathologist is weaned on this dogma and experience convinces him of its truth. He leans heavily on the cane breeder. On the other hand the breeder is frustrated by finding high-yielding selections decimated by disease. He is dependent on the pathologist for the development of screening techniques to ensure that the varieties he releases are viable. The task of providing and testing the disease resistance of new varieties has no end. Even in the 3 years since the 13th Congress there are records of well known diseases becoming established in new countries. There is evidence of new strains of sugar cane mosaic, yellow spot, gumming disease and leaf scald. However, even in the face of new or mutating pathogens, the industry continues to grow cane and to increase its yield. The fact that this is possible is a tribute to the cooperation between pathologists and breeders.

The science of breeding disease-resistant sugar cane is less than 100 years old. Beginning about 1880, sereh disease prompted Dutch plant breeders in Java to search for and attempt to breed resistant clones. This led to the production of the early POJ canes, some of them resistant to sereh, leaf-scald, gumming disease and mosaic. The Dutch work not only showed the way to disease-resistant canes but also resulted in the discovery that hybrid sugar canes far outyielded the existing *Saccharum officinarum* clones and thus provided the basis for present sugar cane breeding practices. However, it took many years to combine in one variety the disease resistance of the wild canes and the high sugar content and desirable agronomic characteristics of the noble canes. The climax of this work in Java was the production of POJ 2878, which has been grown successfully throughout the world. This clone and its progeny, incorporating *S. spontaneum* chromosomes, virtually eliminated gumming disease, a major problem of the 1920's. The high-yielding attributes of this and later hybrids make it impossible to revert to the pure *S. officinarum* clones.

The development of interspecific hybrids, however, has not proved to be a general panacea for disease problems. In fact, the very clones of *S. spontaneum* which are most commonly used in hybridization programmes often introduce susceptibility to mosaic, downy mildew and yellow spot. Even when a hybrid line is generally resistant, the heterozygous nature of sugar cane continually produces a proportion of susceptible segregants which must be recognised and eliminated.

Disease resistance is of course only one of the many goals in cane breeding. However, owing to serious endemic diseases, often this goal cannot be subordinated to the others, and we must be content to tolerate varieties which are less than perfect provided that they resist serious diseases. As with other goals of the cane breeder, success in producing resistant varieties is dependent on choosing suitable parents and on adequate screening of the progeny. This paper, an introduction to the breeder-pathologist symposium, itemizes some of the sugar cane pathologist's stock-in-trade which can aid the breeder in selecting parental clones and in testing the progeny of the resulting crosses.

The conservation of disease resistance genes in basic genetic stocks

An inevitable prerequisite of enlightened cane breeding is the characterization of basic genetic stocks. Too often, disease resistance trials are aimed solely at screening possible commercial clones; the important task of recognising and conserving disease resistance genes in basic breeding stocks is neglected. Resources for holding large stocks are limited, but basic material should not be eliminated solely on the criterion of general agronomic characteristics. It would be more rational to discard clones only after appraisal for both agronomic and disease-resistance characteristics. DUNCKELMAN and BREAUX[1] have shown that there is a wide variation in resistance of *S. spontaneum* clones to mosaic disease, and this knowledge will be used to retain valuable germ-plasm.

The inheritance of disease resistance

It is true to say that sources of resistance to most sugar cane diseases are available. For the major diseases, many generalizations are well-known. For example, some *S. spontaneum* clones transfer resistance to mosaic, Fiji disease and to gumming disease, some *S. officinarum* clones donate resistance to yellow spot and downy mildew. General studies will divulge whether or not it is possible to breed for resistance to a particular disease. Progeny testing will isolate resistance donors and permit the re-structuring of crossing programmes in order to arrive at populations with a high order of resistance. Where a major disease problem exists, there is no satisfactory alternative to resistance inheritance studies, and it is necessary to assign these some measure of priority within the total available screening effort.

In order to study the inheritance of Fiji disease resistance in New South Wales, we have set up a comprehensive series of reciprocal crosses involving susceptible, intermediate and resistant clones. The resulting progeny will be tested for resistance. Analysis of variance together with regression analysis of the results should give some indication of quantitative aspects of the inheritance of resistance to this disease.

Assembling information on disease-resistant clones

Owing to the dictates of his own environment a particular cane breeder will often have to choose from his own portfolio the specific clones to be used as resistant parents. These will include basic stocks, selections from his own commercial breeding programme and commercial introductions from overseas. However, an adequately documented catalogue of world genetic stocks would give him wider and easier access to known sources of resistance. It would enable him to intensify his efforts towards breeding clones with resistance to local diseases and would provide him with a knowledge of available stocks to help cope with the introduction of new diseases. There are several prequisites before data on disease resistance from worldwide sources can be correlated.

The first is an adequate means of communication. The "*ISSCT Sugarcane Pathologists Newsletter*" (*SPN*), which originated as an off-shoot from the "*ISSCT Sugarcane Breeders Newsletter*," is serving this purpose. It functions as a central filing-place for all the results of disease resistance trials which pathologists care to submit.

The second requirement is a flexible information retrieval system which can recover references to all published disease resistance data. Such a system has recently become available with the initiation of INCANDEX (International cane disease index), a computerized information retrieval project which runs parallel with *SPN*. It is possible to retrieve all indexed references which include information on varietal resistance to any particular sugar cane disease. This facility can be used for accumulating itemized disease resistance data for the ISSCT project on "Description of Sugar Cane Clones"[2] and is being used by breeding stations for assembling information on varietal resistance to diseases with which they are concerned.

A third prerequisite for the useful exchange of information is the adoption of standardized methods for testing for resistance, or at least the use of testing methods which have been published and are generally available. SPN continues to publish a series of articles on methods of testing for resistance, each written by a pathologist who is a specialist in a particular disease. INCANDEX can help here too, since it is possible to retrieve references to varietal screening methods for specific diseases. Of importance also is

[1] *Sugar y Azúcar*, 1969, **64**, (10), 16–18.
[2] HUTCHINSON and DANIELS: *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971; *I.S.J.*, 1972, **74**, 303.

uniformity in the method of assessing the trials once they have been completed and the desirability of using a uniform series of standard clones.

A fourth requirement for the correlation of international records is the adoption of a uniform rating system so that the results of overseas trials can be scanned without necessity for the conversion of symbols and systems. At this Congress, the ISSCT Standing Committee on Sugar Cane Diseases will recommend the adoption of a defined, uniform rating scale[3,4].

The importance of using standard clones in resistance trials

A particular disease resistance trial if properly conducted will give results which enable the clones being tested to be classified in the order of their resistance. Ideally, if the same clones were included in a later trial, the order of resistance would be found to be the same. While the order may be the same it is unlikely, because of differences in environment, that the absolute level of infection on which resistance ratings are based would be identical. However, the inclusion in each trial of a number of standard clones with established resistance ratings can overcome differences in environment from trial to trial. The infection levels of the clones under test can be referred to the level of infection in the standards in each particular trial. It is thus possible to assign resistance ratings with confidence and to compare the results of one trial with another.

The choice of standard clones is of importance. Ideally, they should cover the maximum range of resistance. Initially it is usually possible to select standards on the basis of known field performance and to refine the rating of each as results from successive trials become available. It is also possible to use statistical regression methods in order to minimize the effect of possible atypical behaviour of particular standards in a given trial[5]. The behaviour of each standard used in a long series of trials can be examined and those which lack stability in their resistance patterns can be discarded. Lack of stability is indicated by deviation from regression and this is not necessarily due to experimental error. It can be due to instability at the genetic level. For example, in 5 successive downy mildew trials conducted during 1970, the ratings of variety LF 63-863 varied from 1 to 6, while the other 9 standards each maintained a constant rating throughout the same series of trials.

The need for early screening

DANIELS and STEVENSON[6] have discussed the necessity for decreasing the intergeneration interval in sugar cane. If clones with adequate agronomic characteristics and disease resistance can be isolated in a shorter time and then returned to the breeding programme, there will be greater opportunity for concentrating genes for disease resistance. This approach has also been discussed recently by SIMMONDS[7].

In many situations, resistance to a particular disease is of paramount importance for a commercial variety. No matter how good it is in other respects, a clone which is susceptible to Fiji disease cannot be a commercial success in Fiji. The same situation applies to many other diseases in most other countries. And yet we have traditionally conducted resistance trials only on final selections at a near-commercial stage. This means that clones which ultimately fail to pass the disease resistance screen (and this may be a large proportion) have been tested for other characteristics for many years in vain. The reason for this of course has been the unavailability of methods for testing the very large numbers of candidate clones in the early selection stages. However, the expense involved in carrying susceptible varieties through several years of trials demands a careful look at the economics of bringing forward disease resistance testing to an early stage in selection programmes.

Early screening of large numbers of clones for disease resistance also has the inherent advantage that it gives a better statistical chance of recovering varieties of a high order of resistance, even immunity. Such varieties could be used for breeding if not for commercial exploitation.

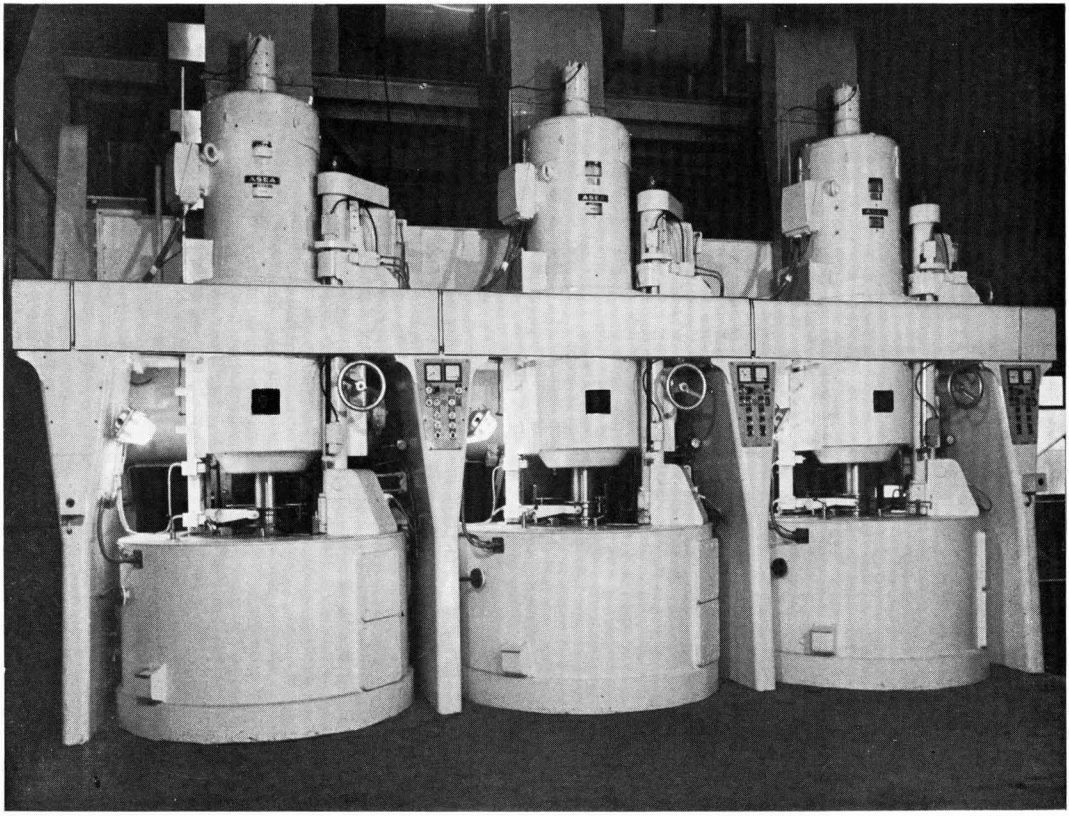
In Fiji and New South Wales our screening for resistance to Fiji disease previously took the form of field trials. These were limited in the number of varieties which could be accommodated each year, and at least 2 years were needed to obtain results. Over several years we have developed a greenhouse method[8] which delivers reliable results within 1 or 2 months. Within the last year, we have been able to test several hundred clones in each trial and to conduct 5 separate trials. This increased efficiency will make possible the screening of new varieties at an early stage of selection, with the result that in the future all varieties carried forward to later stages will be known to be resistant.

The other disease of prime importance in Fiji is downy mildew. We have made only limited progress towards accommodating more clones in these trials[9]. Currently we have projects aimed at developing a greenhouse method of screening so that larger numbers of seedling clones may be tested. Other possibilities are the inoculation of leaf pieces in dishes in the laboratory[10], a method of correlating biochemical leaf analyses with resistance to the disease, or observations of varietal reactions to fungal extracts containing possible toxins.

Correlation between disease resistance and undesirable characteristics

Early screening can also be conducted on a population basis rather than determining the resistance of individual clones. In this type of testing, large numbers of seedlings are inoculated and those which are susceptible are discarded, leaving a population

[3] EGAN: *Sugarcane Pathologists Newsletter*, 1970, (5), 42.
[4] HUTCHINSON: *Proc. 13th Congr. I.S.S.C.T.*, 1968, 1087–1089.
[5] HUTCHINSON *et al.: Sugarcane Pathologists Newsletter*, 1971, (6), 19.
[6] *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971; *I.S.J.*, 1972, **74**, 304.
[7] *Sugarcane Breeders Newsletter*, 1970, (26), 4–6.
[8] DANIELS *et al.: Proc. 13th Congr. I.S.S.C.T.*, 1968, 1100–1106.
[9] REDDI and GALUINADI: *Sugarcane Pathologists Newsletter*, 1970, (5), 38–39.
[10] LEU and TAN: *ibid.*, 16–21.



ASEA-WEIBULL

Fully automatic centrifugals with thyristor controlled DC motor drives fulfil the following requirements:

- **High capacity**
- **Flexibility**
- **Reliability**
- **Low operating costs**
- **Low maintenance costs**

Available in two sizes, 48″×42″and 48″×30″ for any centrifuging speed between 1000 and 1700 rpm.

If you want to know more – Ask us!

Chemical Industry Department, ASEA
S-721 83 VÄSTERÅS, Sweden

ASEA

Represented in more than 70 countries

with enhanced resistance. This technique has been applied successfully in screening for mosaic resistance in Louisiana[11].

For some diseases, it is possible to apply very heavy selection pressure in order to eliminate susceptible progeny. Because of this, it must be ensured that there are no strong genetic correlations between disease resistance and unfavourable agronomic and biochemical characteristics. BREAUX and FANGUY[11] have demonstrated for mosaic disease resistance that no such correlations exist and that it should be safe to apply heavy selection pressure. This precaution is of course not necessary in late-stage screening when clones have already been shown to have desirable agronomic characteristics, but it is mentioned because experience with late-stage screening could lead breeders to overlook the importance of possible genetic correlations if they should change their methods to include large populations and massive selection pressures.

Breeding and screening for resistance to foreign diseases

Just how far pathologists can push cane breeders is an interesting point. Breeding towards resistance for endemic cane diseases already adds an immense load to a breeder's programme. It may seem to be asking too much to add the goal of resistance to diseases which do not even occur in his country. Whether or not this is necessary depends of course, on local and regional circumstances. It is very obvious why Mauritius must aim for resistance to Fiji disease, which does not occur there but is present in Madagascar. The Hawaiian Sugar Planters' Association is also concerned that Fiji disease could reach Hawaii, where the vector insect is already well established. For many years Hawaii has tested its clones in Fiji with the object of including resistance to the disease in commercial clones. Taiwan clones will be tested for Fiji disease resistance in Australia. In reciprocal programmes, Taiwan tests clones from Hawaii, Fiji and Australia for resistance to smut, leaf scorch and white leaf disease, none of which currently occurs in the latter countries[12]. [*Note added in proof: Smut disease has recently been found in Hawaii (*I.S.J.*, 1972, **74**, 192).—P.B.H.]

Even if the data accumulated from these projects are not used in current breeding programmes, they give the breeder knowledge of the resistance of his breeding and commercial canes. This could prove invaluable should the diseases be inadvertently introduced to his country.

Mutagenic methods

Many otherwise acceptable clones are discarded because of susceptibility to disease. Mutagenic agents offer the opportunity to correct this defect. Gamma irradiation from a cobalt-60 source has proved successful in inducing red rot resistance in sub-clones of Co 449[13] and Co 997[14] in India. In Fiji, the clone Waya is a desirable commercial type but cannot be used in certain areas because of its susceptibility to downy mildew disease. Among the plants grown from some 2000 setts exposed to gamma irradiation we have currently isolated 6 sub-clones which show promise of resistance to downy mildew.

Chemical mutagens have also been shown to be effective in altering sugar cane traits[15], and it is not impossible that they could be used for inducing disease resistance.

Future prospects

In the immediate future we will certainly see faster, automated screening programmes for the major diseases, and these will supply data which will lead to the isolation of superior sources of disease resistance, perhaps from wild genera. The first halting karyotypes of sugar cane clones have been made, and before the next congress computerized analyses of karyograms will have given us a better knowledge of chromosomal transfer between species and genera. Perhaps there will be some correlations between individual chromosomes or groups of chromosomes and disease resistance which will give the breeder a clear signpost to parents whose progeny will be resistant. This work will be augmented by isoenzyme studies. We will have an enhanced ability to utilize parents with asynchronous flowering, perhaps through the use of floral culture techniques. Culture techniques will also allow selection and stabilization of sub-clonal material with aberrant chromosomes which could perhaps be conducive to disease resistance. Irradiation facilities will become more generally available and this could lead to the elimination of disease susceptibility in otherwise superior clones. Indications already exist that there will be some control over the spectrum of changes which can be induced by mutagenic agents.

We already have a nucleus of projects which allows the filing and retrieval of international data on sources of disease resistance. The development and wider use of these systems will certainly make the cane breeder's task easier and faster.

This is doubtless a very optimistic look into the near future of the fields where sugar cane breeders and pathologists co-operate. And why not? They have never looked brighter.

Summary

Sugar cane breeders and pathologists co-operate in selecting parental clones and in screening the progeny. Aspects of both these phases of producing disease-resistant clones are discussed. These include: the conservation of disease resistance genes in basic genetic stocks; the inheritance of disease resistance; assembling information on disease-resistant clones; uniform methods of screening for resistance; the importance of using standard clones in resistance trials; the need for early screening; correlation between disease resistance and undesirable characteristics; breeding and screening for resistance to foreign diseases; mutagenic methods; and future prospects.

[11] BREAUX and FANGUY: *Proc. 12th Congr. I.S.S.C.T.*, 1965, 773–779.
[12] LEU *et al.*: *Sugarcane Pathologists Newsletter*, 1970, (4), 36–37.
[13] RAO *et al.*: *Proc. Indian Acad. Sci.*, 1966, **64**, (B), 224–230.
[14] SINGH: *Sugarcane Pathologists Newsletter*, 1970, (5), 24.
[15] HRISHI and MARIMUTHAMMAL: *Proc. Indian Acad. Sci.*, 1968, **68**, (B), 181–189.

Sugar cane agriculture

Economic aspects of the analysis of sugar cane experiments. A. MARTÍNEZ G. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 3 pp.—In agricultural experiments the ability to discriminate economically among treatments has rarely been considered. For sugar cane it is thought there is only the work of ROJAS[1]. In this paper an interpretation in economic terms of sugar cane variety trials is introduced. A profit index is defined and used to discriminate among varieties. An experiment on Mexican varieties is used to illustrate the methodology.

* * *

The orthogonalized San Cristóbal design. B. A. ROJAS. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 9 pp.—The San Cristóbal design for fertilizer trials was introduced by the author to provide a compact design for a small number of treatments which is capable of furnishing the information needed by experimenters. Such a design of reduced size is especially important when a series of similar trials is established in an agricultural area with the objective of determining general fertilizer recommendations and/or obtaining correlation with soil or foliar analysis. This paper presents a family of designs suitable for any number of factors, each tested at several levels, and with proper considerations to allow for the estimation and significance of a quadratic response in a simple manner. For 3 factors, such as nitrogen, phosphate and potash, a common factorial design would require 3 levels of each to estimate a complete quadratic response, i.e. the design would need $3 \times 3 \times 3 = 27$ treatments to be tested.

* * *

An auger harvesting system for recumbent sugar cane. J. E. CLAYTON. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 6 pp.—Lodged cane is difficult to harvest with machines. The heavy growth and the inability to top the cane cause chokes and high power consumption. An experimental harvesting system has been designed which eliminates gathering chains and provides slowly revolving components for handling the cane. The cane is chopped into short lengths immediately as it is cut, to permit proper conveying. Two 20-inch diameter augers with 12-inch core and 12-inch flight pitch are mounted on the side of a tractor. A conventional 36-inch diameter rotating disc with segments cuts the cane at ground level. Other details are given, with diagrams or drawings. These auger harvesting devices demonstrate that recumbent sugar cane can be harvested with slowly revolving components. Little trash wrappage occurs with the large diameter augers. Pick-up efficiency is good on flat cultivation, but additional pick-up assistance would be needed for ridges or furrows.

* * *

Systems for cleaning immature tops and other trash from sugar cane. J. E. CLAYTON and H. D. WHITTEMORE. *Paper presented to the* 14*th Congr. I.S.S.C.T.* 1971, 6 pp.—Sugar cane in Florida contains large amounts of immature tops and leaves owing to the rank growth characteristics. At certain times suckers may add a large trash content to the cane. Fortunately Florida does not encounter the problem of harvesting rocks as occurs in some countries. The several systems of cane cleaning that have been or are being tried are described.

* * *

A mechanical equipment management system. J. F. CYKLER. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 10 pp.—Machinery management techniques offer an added area of scientific endeavour for the cane producer. A comprehensive system of machinery management has been developed, tested and implemented on seven of C. Brewer & Co. Ltd. plantations and several of its subsidiary activities. The system was basically designed to increase the level of equipment maintenance and repair programme, and to develop cost standards of operations on an exception and on a call-reporting basis. The system of management control reports provides management with tools to determine variances in the current activity and pinpoints problem areas.

* * *

Two-row sugar cane harvesting combine. R. FANJUL. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 7 pp.—Difficulties over imported labour for cane cutting led to the harvesting programme here described. In 1968 and 1969 Osceola Farms Company, Canal Point, Florida, purchased three S-6 cane harvesters built by J & L Engineering Company, Jeanerette, Louisiana. These machines cut two rows of cane, regardless of the state of recumbency, and then chop and load it into carts in one continuous operation. Harvesting cost at this rate was $1·65/ton compared with approximately $2·45/ton for cane which is hand cut and loaded with continuous loaders. Trash content of the harvested cane was not a problem owing to the early freezes and ability of the machines to top cane that is standing upright. Generally speaking the trash content of the machine-

[1] *Proc. 11th Congr. I.S.S.C.T*, 1962, 197–203

cut cane has been in the range of 8–12%. There have been other apparent losses associated with mechanical harvesting, such as sucrose losses and cane losses. This has not been accurately determined as yet and further tests will be needed.

* * *

The power budget of sugar cane production. R. O. PETERSEN. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 5 pp.—Sugar cane is one of the last major crops which is not yet fully mechanized. This study presents econometric models for tractors and cane harvesting equipment, attempting to correlate crop values to cost of operating tractors and mechanical cane harvesters. The possibility of data processing is indicated. Fuel consumption of both tractors and harvesters is found to be a useful indicator. A table shows the costing of a chopper-loader harvester in the US during its service life.

* * *

Field mechanization in the Puerto Rican sugar industry. R. T. SYMES. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 4 pp.—The great problem that faced the Puerto Rican sugar industry was the rapid decrease in the availability of hand labour for the cutting of cane. Practically every type of mechanical harvester has been tried in Puerto Rico, including the famous back pack powered cane knife, but the writer limits his discussion to those which reached some acceptance as production harvesters. As the position up to the year 1965 has been described in an earlier paper the writer has restricted himself to developments since 1965, and accelerated mechanization developments in harvesting, loading and transport are described.

* * *

Use of water by sugar cane in Hawaii measured by hydraulic lysimeters. P. C. EKERN. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 8 pp.—Consumption of water by sprinkler and drip irrigated sugar cane was measured in Hawaii by hydraulic load cell lysimeters. One-eye cane transplants of variety H 50-7209 were set in a 5 × 5-ft grid under flat bed culture in Molokai latosol. Water use by full canopy approximated that from a conventional Class A pan. The patterns of water use closely reflected this seasonal change in net radiation.

* * *

Land grading for surface irrigation of sugar cane. T. CHINLOY and J. A. KELLY. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 8 pp.—An experiment in Jamaica lasting 28½ months is described. It was to evaluate the merits of precision land forming for irrigation under the conditions of 2 slopes, 3 furrow stream sizes and 3 furrow lengths. The experiment was carried out on 33 acres of a poorly drained, structureless, heavy clay soil. Measurements were made of the water entering the experimental area, the rainfall and evaporation from a U.S. Class A pan, and irrigation applied when 75% of the water available in the top 2 feet of soil had been used. There was no difference between using 70, 120 and 170 US gal/min, and it is likely that a furrow stream size of less than 70 US gal/min would produce as good results as the faster flows used. Based on the concept that one acre-inch of irrigation and/or useful rainfall should produce a ton of cane, high irrigation efficiencies of between 70 and 80% were obtained. It appeared that precision land grading was the most important single contributory factor, as all combinations of slope, furrow length and furrow stream size tested gave relatively high irrigation efficiencies.

* * *

Methods of surface irrigation in sugar cane. J. M GOSNELL and T. L. PEARSE. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 11 pp.—In Rhodesia border and basin irrigation are used only to a limited degree in sugar cane, nearly all surface irrigation being applied by furrow. The advantages and disadvantages of the two principal methods of furrow irrigation, in-row and inter-row, are discussed. The former results in much greater applications of water owing to crop resistance. The design of furrow irrigation systems both on uniform flat grades and on steeper undulating topography is discussed and a number of examples are given, including the level furrow, level ditch, border bed-furrow, continuous long line, herringbone, fixed grade and variable grade systems. Techniques for improving irrigation efficiency using the above design systems include the use of cut-back irrigation, corrugation furrows and check dams. Field methods of evaluating uniformity are briefly described.

* * *

Irrigation of sugar cane on an estate and its integration with other operations. J. N. S. HILL. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 10 pp.—During a world study tour the writer found that the approach by estate or farm management to irrigation control was remarkably similar in various countries. Detailed procedures involved in the irrigation of sugar cane at Tongaat (S. Africa) are given, as well as the grouping of all operations that must be integrated with irrigation. The relative merits of decentralized or centralized irrigation control on a large sugar cane estate are discussed. Some results obtained at Tongaat in recent years are presented in terms of quantities of water applied, the effects of rainfall and water shortage on irrigation efficiencies, and the effect of irrigation on sucrose % cane. In Natal rainfall is regarded as inadequate and poorly distributed for a crop such as sugar cane.

* * *

Irrigation practices in the Queensland sugar industry. K. C. LEVERINGTON. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 7 pp.—The nature of the quota system in Queensland and its bearing on the cane grower and the management of his farm are discussed. The systems of irrigation used in the Queensland sugar industry are outlined, and current research programmes are mentioned. It is pointed out that stability of production in areas of variable rainfall is a major factor contributing to the expansion

of irrigation in Queensland. Water usage has frequently been wasteful in the past but, owing to diminishing reserves of surface and underground water, farmers are becoming more aware of the necessity for increasing irrigation efficiency.

* * *

The sugar cane plant in the soil-plant-atmosphere continuum. J. C. MONGELARD and L. G. NICKELL. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 14 pp.—Contradictory conclusions concerning the effect of water shortage have been reached by different workers on experiments that were conducted apparently under similar conditions. The purpose of this paper is to analyse some of the contributions made to the understanding of the sugar cane plant as it reacts, on the one hand, to the evaporative demand of the atmosphere, and, on the other hand, to its water supply in the soil, during the inevitable upward movement of water initiated by radiation energy. In high rainfall areas uneven distribution during the year may result in periodic moderate drought and reduced growth, while in arid zones water supply can be the limiting factor in conditions of high radiation intensity and temperature which would otherwise give excellent growth. In areas where water supply to compensate for low rainfall is difficult, greatest yields are obtained from drought-resistant varieties. More biochemical knowledge is needed of the plant's physiology at tissue and cellular levels to improve understanding of its reactions to soil and climatic factors.

* * *

A plantation method of determination of the value of water. P. SCOTT. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 6 pp.—It is popularly assumed that it takes one ton of water to produce one pound of sugar, and in many of the sugar cane areas of Hawaii irrigation is practised when rainfall is less than about 70 inches per annum. There is a need for a sugar plantation to develop a dollar value for its irrigation waters. Economic evaluations of expenditure concerning irrigation water can be determined only if the value of water is known. A practical water value for plantation usage may take liberties in its development that would not be allowed in a strictly scientific approach. The accuracy of the developed value need be no better than the plantation's ability to measure both yield and water application. Experimental data on evapotranspiration and yield: water relationships are cited. A method of determining the value of water is presented.

* * *

Soil moisture regimes and levels of nitrogen: effects on the yield and quality of sugar cane. P. P. SINGH and G. SINGH. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 6 pp.—The yield and quality of sugar cane are closely related to the amount of N applied and the availability of soil moisture in the root zone. Hence it is necessary to work out the optimum level of N and suitable moisture level. Field experiments are described which were conducted to study the effects of soil moisture and N levels on the yield and quality of sugar cane at the U.P. Agricultural University, Pantnagar (Nainital) during 1968–69. Irrigations were applied when 25, 50, 75 and 100% available soil moisture had been depleted during the pre-monsoon period. The treatments of 50, 75 and 100% depletion and no irrigation were superimposed over these treatments during the post-monsoon period. The levels of N were 75, 150, 225 and 300 kg/ha. The variety selected for the study was Co 1158. The study revealed that soil moisture regimes and N applications significantly influenced the cane yield and available sugar/ha.

* * *

Estimating water use by sugar cane from meteorological and crop parameters. G. D. THOMPSON and J. P. BOYCE. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 14 pp.—Evapotranspiration from sugar cane crops was measured weekly at Chaka's Kraal by means of hydraulic lysimeters and daily at Pongola by means of weighing lysimeters. The meteorological parameters necessary for the estimation of evapotranspiration by four methods were measured daily at both these South African sites. In the light of the increasing complexity of models of general applicability for predicting evapotranspiration it is suggested that the requirements of practising agriculturalists may be met more conveniently by using reliable empirical relationships, such as that between evapotranspiration and evaporation from a Class A pan. However the surface resistance parameter may still be used to advantage in exploring soil-plant-atmosphere relationships.

* * *

Soil water infiltration and redistribution under furrow and sprinkler irrigation. G. UEHARA, T. C. JUANG and M. ISOBE. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 5 pp.—Furrow or flood irrigation on a strongly aggregated oxisol in Hawaii was simulated by maintaining a 1 cm head of water over the soil surface during infiltration through a laboratory soil column. Sprinkler irrigation was simulated by spraying water on the soil surface at a constant rate. At cessation of infiltration the wetting front under the flooded surface was shallower than the wetting front in the column receiving water as a spray. During redistribution, the wetting front under the flooded surface overtook the one under simulated sprinkler irrigation. The unusual characteristic of water movement in aggregated oxisols was attributed to the dependence of their water content-tension relation on water application rates.

* * *

Water, a key to sugar production. R. P. HUMBERT. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 6 pp.—Water is an all-important factor in the growth and development of the sugar cane plant. Water deficiency, or excess, limits cane and sugar yields in many areas. The water deficiencies of Central Aguirre (Puerto Rico) and Tamazula (Mexico) are discussed. At Tamazula, where 41 wells have been dug and distri-

bution canals have been enlarged, each additional acre-inch of water produces 1·3 tons of cane/acre. Costs of water development have been written off in 7 years. Water holds the key to cane maturity and the conversion of reducing sugars to recoverable sucrose. Excess soil moisture with unused nitrogen creates many problems of immaturity as evidenced by recent production records in Puerto Rico.

* * *

Influence of water deficiency and excess on growth and leaf nutrient element content of sugar cane. G. SAMUELS. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 4 pp.—Farmers are often faced with two moisture conditions in the growing of their crops; deficiency (drought) and excess (flooding or poor drainage). In many parts of the tropics the two extremes of water status can occur within the growth of a single sugar cane crop. Excess or deficiency of moisture not only influences growth but availability and distribution of nutritive elements in the plant. Sugar cane was studied under conditions of flooding in the field and both water excess and deficiency in the greenhouse. Excess water in the field caused reduction of growth, sheath moisture, and leaf N, P and K. The greenhouse experiment revealed that both water deficiency and excess greatly reduced plant growth, deficiency more so than excess.

* * *

Effects of flooding on sugar cane growth. I. Stage of growth and duration of flooding. P. W. D. WEBSTER and B. W. EAVIS. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 7 pp.—Flooding the soil can have both harmful and beneficial effects on sugar cane growth. The results presented in this paper illustrate effects of duration of flooding at different stages of growth on tiller production, tiller elongation rate, leaf area, transpiration and yield of shoots and roots. Lysimeters with growing B 49119 sugar cane were flooded for 1, 4, 14 or 30 days at one month and three months of age, and again after harvesting the cane. The newly harvested ratooning plants were killed when flooded for 30 days. Flooding at any stage reduced the production of new tillers and tiller elongation rate of established tillers. Tiller elongation rate in the post-flooding period was greater than in the non-flooded controls, and cumulative elongation tended to equalize. There was no significant difference between shoot yields at 5 months of age.

* * *

Effects of flooding on sugar cane growth. II. Benefits during subsequent drought. B. W. EAVIS. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 7 pp. In Barbados the chief factor limiting sugar cane yield is drought in many areas. If rainfall is regularly distributed throughout the growing season, the ability of the soil to conserve water in rainy periods for subsequent use by the crop in a drought may have an important influence on yield. The water storage capacity of the soil is greatest when drainage is prevented and all the pore space is filled with water. Experiments reported here were carried out to determine whether the extra water stored as a result of waterlogging and drainage restriction could be used by the plants subsequently during a drought. Two varieties were grown in lysimeters. Waterlogging increased total shoot elongation during the drought by 200 and 50% in the kaolinitic and montmorillonitic soils respectively.

* * *

The effect of water table depth on the yield of sugar cane. R. PÉREZ E., W. F. ALLISON and J. JUÁREZ. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 5 pp.—The experiments reported were undertaken because of the paucity of information on the subject. The effect of water table depth on the yields of cane and sugar was studied with three varieties under lysimeter tank conditions. One of the three varieties, PR 980, was also studied under actual field conditions. Results showed that varieties differed in their reaction to water table conditions. PR 980 yielded more cane and available sugar as the water table was lowered. Sucrose content was not affected by the different treatments. Under field conditions, using plastic drains, PR 980 gave significantly higher sugar yields than the undrained plots. The results obtained in the lysimeter tanks are in accord with those obtained under commercial conditions.

* * *

Light and nitrogen-sensitive ATP-ases in sugar cane leaves. A. G. ALEXANDER, R. MONTALVO-ZAPATA and A. KUMAR. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 6 pp.—Evidence of light-dependent and dark ATP-ases was found in cell-free preparations of sugar cane subjected to variable illumination and variable N supply. The light-requiring enzyme represents about half of total ATP-ase activity. Extreme diurnal fluctuations suggest a close relationship with photosynthesis. The dark enzyme accounts for 40–50% of total activity and is not suppressed by 96 hours of continuous darkness. Inhibition with a bipyridylium free radical ("Paraquat") was largely confined to the light enzyme. Dark ATP-ase is thus synonymous with a low N regime (restricted growth, sugar accumulation). It is suggested that light ATP-ase is linked with photosynthetic phosphorylation steps incident to rapid growth processes, while the dark ATP-ase is related to active sucrose transport and storage, possibly via mitochondrial phosphorylative reactions.

* * *

Effect of burning and chopping on sugar cane deterioration in the UAR. M. H. AMIN, A. A. EL-BADAWI, G. E. K. SAYED and A. T. HABIB. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 8 pp.—In the United Arab Republic both whole-stick and chopper harvesters are being used. The present investigation was carried out to study the effect of burning and chopping on the rate of deterioration of two commercially important varieties, N:Co 310 and Co 413. Burning of N:Co 310 or Co 413 followed by immediate harvesting reduced the sucrose inversion to a minimum, although it resulted in a loss of weight amount-

ing to about 8–10% after 96 hours' storage under open field conditions. Chopping of burnt or unburnt cane had no effect on the rate of deterioration except that moisture loss was enhanced by chopping. Delaying the harvesting of burnt standing cane for more than 24 hours resulted in a marked loss in the sugar yield. In the case of accidental burning it is best to harvest the cane immediately after burning and later transport it to the mill, instead of leaving it standing in the field, in order to minimize the loss of sugar yield.

* * *

The crop logging system for sugar cane production: 1971 edition. H. F. CLEMENTS. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 16 pp.—Yield potentials in the various parts of Hawaii vary enormously and successive yields in the same field can differ greatly. The achievement of maximum production requires the fitting of the crop control methods to each set of circumstances; what may be too much of one thing one year can be too little in another. If attention is paid to certain indices, reflecting the well-being of the crop, improved yields will result. Just as obtaining maximum yields requires taking full advantage of all the positive elements of the environment—sunlight, temperature, water and mineral nutrients—it also requires the complete absence of the negative factors, whether they be biotic, chemical or meteorological. Measuring them is the first step towards their elimination.

* * *

Sweet sorghum as a potential sugar crop in South Texas. W. R. COWLEY and B. A. SMITH. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 6 pp. Trials with the crop in south Texas have shown promise. Maturing takes place in 100–120 days, to afford a possible harvest period from July until December. Yields are strongly influenced by day length and solar radiation. Yield performance follows the pattern of longer days and maximum radiation to afford sugar/acre yields in the range of 2000–4000 lb. High plant populations are required for maximum yields. Plant spacings of 3 inches in drills 38 in apart were found to be the optimum. Sucrose and purity value were not found to be significantly correlated with spacing or yield. Moderate levels of nitrogen were required for maximum yields. No correlation was found between nitrogen levels and juice qualities.

* * *

Relationship between fertilizer and leaf blade P and S and sugar cane yield in Louisiana. L. E. GOLDEN. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 7 pp.—In recent years Louisiana sugar cane growers have increased the use of fertilizer P in both liquid and solid forms which contain no S or only small amounts of S. The purpose of this study was to determine the effect of P and S in fertilizers applied to sugar cane on yield and on P and S contents of leaf blades, and to ascertain whether experiments should be conducted on a wide range of soil types with fertilizer P and S as independent variables. Sulphur deficiency in sugar cane has been reported from many cane growing countries, notably Australia, India, Puerto Rico and Rhodesia, often as a result of changes in fertilizer use.

* * *

Effect of time of sampling in sugar cane on foliar analysis in Venezuela. F. GOMEZ-ALVAREZ. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 6 pp. In order to find out how the time of sampling would influence sugar cane leaf composition, trials were carried out in a commercial field of PR 980. The field was sampled on two dates, one month apart, and at every hour from 6 a.m. to 2 p.m. The results showed that sugar cane leaf composition was influenced by age of crop, time of day and weather variations, especially cloudiness, and that the best time to sample was early in the morning between 6 and 8 a.m.

* * *

Appraisal of soil salinity for land reclamation in lower Iraq. D. P. GOWING and N. ROZEFF. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 4 pp. The most important problem in establishing an agricultural project or in maintaining continuous cultivation of crops in southern Iraq is soil salinity. Soil samples from areas of low and high salt content were compared. The conductivities of the 1·1 soil:water extracts were determined, using about 144 sampling sites per square km. Frequency distributions from both series were not normally distributed, in the statistical sense, and differed from each other. Transformation of the data to logarithms strikingly reduced the coefficient of variation of the determination, and very greatly reduced the number of samples required for salinity appraisal of the areas to the required degree of productivity. The investigation reported was undertaken at the Amarah Cane Sugar Project, which is located near the marshes on about 12,000 ha bordering the Tigris River, 30 km south of Amarah.

* * *

Cultural methods for sugar cane production in the sub-tropics. R. R. PANJE. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 7 pp.—The fundamental problem of sugar cane culture in the sub-tropics is the wide amplitude of the energy regime. Growth stagnates in winter and the newly planted crop is ill-equipped to utilize the rapidly increasing solar radiation in spring. The solution of the problem therefore is to build up the crop canopy rapidly. This is more quickly achieved by a relatively small population of large primary shoots than by numerous small tillers. Breaking the plough-pan by deep trenches and planting long setts vertically helps to extend the root system extensively in the subsoil, but this increases yield only if the subsoil is fertilized. The combination of these cultural modifications constitutes a new planting system, which has been designated 86206. In 12-month crops it gave 25–40 metric tons more cane/ha than flat planting. It makes applications of nitrogen over 40% more efficient. The

crop takes in 20% more water at each irrigation and apparently uses it effectively, and juice quality is improved.

* * *

Long term effects of manuring, cropping and cultivation practices on cane yield and soil properties. P. M. JOSHI and G. K. ZENDE. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 9 pp.—A long term experiment in India is reported on the effect of organic and inorganic manure, used both singly and in 3 combinations, on the growth and yield of sugar cane. The addition of mineral equivalents of compost was found to be effective in maintaining yields at optimum level. However, compost gave a slight increase even in the presence of the mineral nutrients. Soil studies indicated a superiority of and necessity for the application of compost as a basal manure for maintaining soil fertility at an optimum level. Studies of soil changes caused by irrigating and manuring a medium black soil confirmed the beneficial effects of organic manure on aggregation, reduction of the water dispersion coefficient and increase of chemical fertility.

* * *

Effects of ground water table and soil compaction on nutrient element uptake and growth of sugar cane. T. C. JUANG and G. UEHARA. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 9 pp.—An experiment in Taiwan is reported in which water table depths were maintained at 80, 50 and 30 cm in ceramic pots filled with a sandy loam or clay loam soil. Sugar cane performed the best in the treatment with the water table held 80 cm below the surface. A sharp reduction in nutrient uptake was noted between bulk density of 1·4 and 1·6 g/cm^3. Sugar cane grown in pots containing soil compacted to bulk densities of 1·2, 1·4, 1·6 and 1·8 g/cm^3 performed best in the 1·6 bulk density treatment. For comparable bulk densities, sugar cane performed at the higher fertilizer level.

* * *

Crop logging as a means of controlling sugar cane fertilization in small holdings. M. LAKSHMIKANTHAM, G. N. RAO, P. H. RAO, P. V. R. RAO and M. R. RAO. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 7 pp.—The results of logging sugar cane crops in small holdings distributed over 6 factory zones in Andhra Pradesh (India) have been presented in order to indicate the relationship between nutrient indices of crops given different levels of N and cane yield. The findings indicated that 3–6 leaf sheath moisture in the first 4 months and at harvest may be taken as a relable guide for prediction of cane yields and quality of the crop respectively. Completion of N fertilization within 4 months and provision of adequate irrigation, especially, in this period were noted to result in maintenance of optimum sheath moisture values at appropriate times, leading to good cane yields of satisfactory quality.

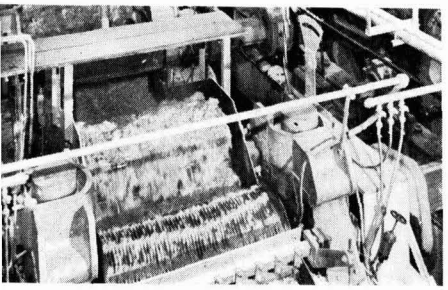
Anatomy of the branch roots of sugar cane. B. B. EXNER. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 7 pp.—What little has been recorded on the anatomy of the branch roots of sugar cane is discussed. This paper concerns a detailed investigation of the comparative anatomy of primary and branch roots and was carried out on 4 varieties. Studies were confined to sett roots and superficial roots of shoots. The most intensive branching in both shoot and sett roots is usually found in roots of the greatest diameter, which normally arise first and from primordia of the lowest ring within the root band. One factor which seemed to contribute to variability in size of branch roots of the same order was injury to the apex of the root from which they arose. The paper is illustrated with photomicrographs.

* * *

Factors affecting the sprouting and growth of sett roots in sugar cane. R. R. PANJE, P. S. MATHUR and M. P. MOTIWALE. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 8 pp.—Although the germination of sugar cane has been studied extensively, the investigations seem to have centred largely on the emergence of buds. Very little information is available on the factors affecting the activation of root primodia, even though this phenomenon is closely associated with the sprouting of buds and is obviously essential for their continued growth. Results of 9 experiments concluded at Lucknow, India, are presented. Light, under the normal day-night sequence, has an overall inhibitor effect on the activity of nodal root primordia. In sustained darkness and under high humidity, rooting is induced in cane stalks and cuttings. The water content of cane also affects rooting. Rooting propensity differs with variety and presumably with age, environmental and cultural conditions. Nodal rooting in sugar cane is a sensitive reaction and shows response to many factors. Observations suggest pattern of control by an auxin-inhibitor mechanism.

* * *

Effectiveness of nitrification inhibitors formulated with anhydrous ammonia when applied to sugar cane in Louisiana. J. F. PARR, B. R. CARROLL and S. SMITH. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 8 pp.—Losses of fertilizer nitrogen up to 50% occur through leaching, run-off, biological denitrification and volatilization through improper application of aqua ammonia or urea. A study of the relative effectiveness of "N-Serve" [2-chloro-6-(trichloromethyl) pyridine] and potassium azide (KN_3) as nitrification inhibitors is reported. Increased cane yields of 5–6 tons/acre from 100 lb of N indicated a marked increase in fertilizer efficiency due to "N-Serve". Yields obtained with 100 lb of N applied as NH_3 + "N-Serve" (3% and 6%) were equal to that from 150 lb of NH_3 nitrogen alone. The high inhibitor level (6%) was related to slightly lower values for sucrose and sugar/ton of cane, which in most cases were offset by increased cane yields with little or no difference in tons of sugar/acre.



Cane sugar manufacture

A method of operating filter presses for peak capacity utilization. K. K. SHARMA and S. C. JOHRI. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 107–117. Optimum filter press utilization has been worked out for a given hourly throughput of cane and the associated filtration area requirements.

* * *

A case study on cane juice clarification. D. L. N. RAO, A. SIDDIQUI and B. S. SRINIVAS. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 119–122.—The performance of the Oliver filter station at Nizam Sugar Factory Ltd. is reported. Because of unsatisfactory results, with recirculation of insoluble matter, certain modifications to the system are recommended in order to raise filter cake mud retention, particularly through an increase in bagacillo usage.

* * *

A study on the demineralization of sugar cane juice at Khandsari Prayogsala, National Sugar Institute, Kanpur. S. MUKHERJEE and M. U. OVAISI. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 135–139. Khandsari juice clarified by cold liming and sulphitation was subjected to mixed bed ion exchange demineralization, which gave a purity rise of 9–10 units, 90% ash removal and 91% decolorization, i.e. comparable to results obtained with conventional carbonatation or sulphitation juice.

* * *

A new continuous juice liming and sulphitation unit. J. P. MUKHERJI, A. C. CHATTERJEE and S. S. GANGAVATI. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 153–159.—Details are given of a continuous juice liming and sulphitation unit which in a modified form during 15 days' trial gave satisfactory results, with clarity and settling rates sometimes better than with the batch system used at the same factory.

* * *

Studies on the effect of deaeration of treated cane juice before the same is boiled and settled in the sulphitation process. II. T. P. SAKSENA, K. K. GUPTA, J. P. GUPTA and R. K. DIXIT. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1960, 161–175.—Factory experiments confirmed earlier laboratory results[1] by indicating a slight rise in juice purity and settling rate, and a reduction in CaO content, colour and mud volume after deaeration of sulphitation juice for 15 min at a vacuum of 22–23 in Hg. Both khandsari and conventional factory juices were tested.

Some observations on mechanical cleaning of evaporators without soda boiling. K. P. MITTAL and A. PRAKASH. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 177–181.—After draining the evaporator bodies at the authors' sugar factory the scale is cracked by applying cold water and is then removed by cutters driven from a 3-hp motor with a speed of 2900 rpm. The tubes are then polished by brushing. Comparison of syrup Brix obtained in the evaporators with results achieved in evaporators boiled out with soda shows a general rise, while other advantages are also claimed.

* * *

Press cake and its removal in carbonatation sugar factories. V. M. BHALWAR. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 183–186.—Details are given of a suggested modification to the design of chutes used to feed filter press cake to trollies which is aimed at reducing trolly loading time and labour requirements.

* * *

Application of hydrocyclones in the sugar industry for removal of suspended solid from mixed juice. S. C. GUPTA, T. P. SAKSENA, K. K. GUPTA and K. G. B. DOSS. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 189–197.—The performance of a Bauer "Centricleaner" is reported[2].

* * *

Decalcification of clarified juices by diammonium phosphate in sugar factories. S. C. GUPTA, N. A. RAMAIAH, R. C. GUPTA and K. U. CHETAL. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 199–205. Addition of 0·2–0·25% ammonium diphosphate (on cane) to clarified juice reduced the CaO content from 700 to 70 mg per litre and the ash content from 0·48 to 0·25%, while a purity rise of 1·2–1·5 units was obtained, compared with conventional carbonatation.

* * *

A study of the technical and economic feasibility of spray drying of deionized cane juice. R. B. NIGAM and A. C. RAHA. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 209–215.—Technical factors and costs are calculated for a spray drying process in which deionized juice containing 94% sucrose would be concentrated to 60°Bx in an evaporator and spray dried to yield a sugar of use in confectionery and beverage production, etc. Advantages of the process and its

[1] *I.S.J.*, 1970, **72**, 145.
[2] *ibid.*, 1971, **73**, 310.

product are described. The final molasses from deionized juice crystallization takes the form of an edible syrup containing 31·8% sucrose.

* * *

On the rise in purity in clarification processes. S. C. GUPTA and N. A. RAMAIAH. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 217–222.—Of the components of possible significance for juice purity rise in clarification, potassium is regarded as the most important; its elimination is mainly responsible for the 4 unit purity rise obtained in certain clarification processes such as that described by SAHA *et al.*[1] which is based on sulphitation at high pH.

* * *

Automation—its application in the Indian sugar industry. R. C. SHARMA. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 225–227.—The advantages of automatic control are discussed with particular emphasis on the obstacles in the Indian sugar industry. Attention is focused on cane unloading, cane testing with a view to payment on quality basis as well as weight, weighing, boiler feed water temperature control and sugar detection, automatic boiler combustion control, pH control in carbonatation and sulphitation, and evaporator control.

* * *

Effect of cane knives reversal. H. N. GUPTA, P. N. R. RAO and S. C. VERMA. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 231–243.—Tests with the experimental milling unit at the National Sugar Institute indicated that cane knife reversal gave finer preparation, resulting in a decrease in 1st mill power consumption but an increase in the energy consumption of the carrier motor. Top roller lift at the 1st mill was appreciably reduced, probably owing to better packing of the cane in the grooves. At 13·5% fibre in cane and with 12·5 mm pitch mill roller grooves there was no appreciable change in primary extraction, whereas there was a noticeable increase at 20% fibre content with 25·0 mm pitch.

* * *

Study of heat transfer rate in evaporators. I. A. C. RAHA. *Proc. 27th Conv. Sugar Tech. Assoc. India*, 1970, 245–251.—Laboratory evaporation experiments with water and molasses solutions showed that (i) the overall heat transfer coefficient in a calandria where steam distribution is irregular can be lower than in a single tube, (ii) heat flow (heat transfer rate/heating surface area) increases with increase in the height of the liquid level in the tube up to a maximum of one-third of the overall height and then falls, (iii) the steam film heat transfer coefficient h_1 decreases with increased concentration at the same heat flow, the value of which is unaffected by the steam side temperature but is dependent on the physical properties of the liquid, and (iv) heat flow and h_1 increase with rise in liquid temperature at entry, so that juice preheating before evaporation is important.

Remote control of sugar mill operations. I. Cane feeding. II. Lubrication of mill engines. M. SINGH and M. N. DEVA. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 253–257, 259–261.—(I) A simple device is described which indicates, by means of light signals, the level of cane on the main carrier. (II) A cane mill engine lubricant level indicator which uses light signals is described.

* * *

Optimization of the number of evaporator effects with respect to capacity and steam economy in the sugar industry. B. B. PAUL and J. J. BHAGAT. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 285–298A.—See *I.S.J.*, 1971, **73**, 149.

* * *

A new concept in designing the multiple-effect evaporator set in a sugar factory. B. L. MITTAL. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 309–311. Calculated data are presented showing that arrangement of the effects so that the 1st and 2nd bodies each have 22·5%, the 3rd body 25% and the 4th body 30% of the total heating surface will give 20% more evaporation capacity (lb/hr) than an evaporator of the same total heating surface but with the effects of identical heating surface. The greater size of the last two effects will considerably reduce entrainment risks, while shocks caused by irregularity in rate of steam feed are better absorbed and the juice level is easier to maintain in all effects.

* * *

Corrosion inhibitor in the use of mechanical cleaning of evaporators. S. C. SHARMA and N. C. DUTT. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 323–331. Laboratory tests with "Rodine 213" corrosion inhibitor are reported in which sections of evaporator tubing were treated with 2·5% HCl in the presence of 0·2% inhibitor at room temperature for 2, 4 and 6 hours. Although corrosion prevention was satisfactory in the case of copper, brass and mild steel plate, results with cast iron were unsatisfactory.

* * *

Cane sugar factory maintenance. S. SRINIVASAN. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 361–368.—Preventive maintenance of cane sugar factory plant is discussed and the use of lubricants and protective paints examined with recommendations on types and colours.

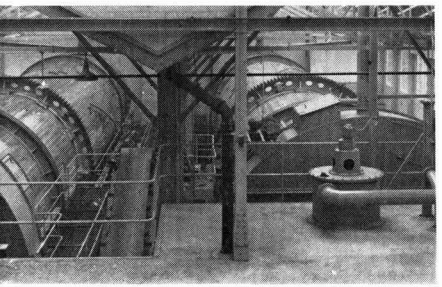
* * *

Automation—its repercussions on employment in the Indian sugar industry. R. C. SHARMA. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 401–402.—In considering the possible effect of automatic control in Indian sugar factories on labour requirements, the author expresses the view that there need be no unemployment since automatic control devices merely supplement human agencies, not replace them.

* * *

Self-synchronizing motors for automatic controllers. R. C. SHARMA. *Proc. 37th Conv. Sugar Tech. Assoc. India*, 1970, 403–407.—Types of self-synchronizing motors are described with the aid of some circuit diagrams for the torque and resolver types.

[1] *I.S.J.*, 1951, **53**, 102–194, 196.



Beet sugar manufacture

The influence of milk-of-lime sugar content on beet juice purification. J. VAŠÁTKO and A. DANDÁR. *Sucr. Belge*, 1971, **90**, 485–489.—See *I.S.J.*, 1972, **74**, 117.

* * *

Sugar juice purification by ion exclusion with macroreticular resins. K. ČÍŽ. *Ind. Alim. Agric.*, 1971, **88**, 965–969.—See *I.S.J.*, 1971, **73**, 154.

* * *

Decolorization of sugar juices by means of calcium hypochlorite. J. BUREŠ, M. FRIML and B. TICHÁ. *Ind. Alim. Agric.*, 1971, **88**, 971–973.—Laboratory tests on decolorization of solutions containing caramels by oxidizing agents showed that while potassium iodate, periodate and bromide and hydrogen peroxide had practically no effect, calcium and sodium hypochlorites had a marked effect up to complete decolorization of a solution of 0·05 absorbancy using 0·03% hypochlorite. Chloramine was slightly less effective than hypochlorite, the effect of which fell with increase in Brix. In the case of nitrogenous colorants, hypochlorite had little effect and ten times as much was needed to obtain the same degree of decolorization as for caramels, while complete colour removal was impossible. Sucrose loss through acid formation under the action of hypochlorite was negligible and was even smaller in the presence of non-sugars than in pure solution. A linear relationship was established between decolorizing efficiency and the quantity of hypochlorite up to 0·1% solids concentration at temperatures in the range 20–90°C. Prolonged heating at 90°C gave rise to a slight recoloration, caused by unreacted hypochlorite and colorant oxidation products. For best results it is recommended to add the hypochlorite with milk-of-lime in conventional liming, followed by simultaneous liming and carbonatation at pH 8·5. Pilot- and factory-scale tests with remelt carbonatation after hypochlorite addition have given 45% and 50% decolorization efficiencies at initial absorbancies of 0·252 and 0·320, respectively. Subsequent treatment with active carbon or bone char also gives good results, but treatment with ion exchange after hypochlorite addition and carbonatation is not as effective.

* * *

Filtration in the sugar industry yesterday, today and tomorrow. L. FLEMINGER and H. FORTH. *Ind. Alim. Agric.*, 1971, **88**, 975–978.—Brief reference is made to filtration and filter development in the sugar industry, and particular attention is focused on the use of filter-thickeners and pressure filters for carbonatation juice and mud treatment. Details are given of pressure filters manufactured by H. Putsch & Comp., of West Germany.

* * *

Development of the sugar centrifugal. W. BRINER. *Ind. Alim. Agric.*, 1971, **88**, 1003–1008.—After a survey of centrifugal development in the sugar industry, details are given of the batch machines designed and manufactured by BMA. Full details are then given of the BMA "Variant" fully-automatic centrifugal[1] which has an hourly capacity of 17·5 tons of sugar, i.e. five times that of the first BMA fully-automatic machine.

* * *

Bulk storage of sugar. M. CHAVANNE, –. RISBEZ and –. SAGUEZ. *Ind. Alim. Agric.*, 1971, **88**, 1011–1028. Problems connected with bulk storage of white sugar are considered, and the procedure followed in planning the siting, layout and construction of silos is described in detail with the aid of photographs and diagrams of various types of vertical, horizontal and compartmented silos. Details are given of a scheme for blowing air through the mass of stored sugar and factors to be considered in planning such a scheme. Equipment for charging and reclaiming, etc. and measuring and control devices are also described.

* * *

Purification by rapid oxygenation in a fermenter: application to sugar factory waste waters. B. REVUZ. *Ind. Alim. Agric.*, 1971, **88**, 1031–1037.—Pilot-plant tests are reported in which beet wash and flume water was subjected to biodegradation in a fermentation vat for 4 hours (followed by 2 hours in a settling tank) while air was injected from a blower. Solids content was reduced from 6–9 to 2–4 g/litre, the COD from 3500–6000 to 250–500 mg/litre, and the BOD_5 from 3200–4600 to 180–300 mg/litre. An essential requirement of the process is adjustment of the nitrogen and phosphorus contents as a proportion of the initial BOD_5. After settling, the muds are recycled to the fermenter, thereby gradually building-up the microorganisms. The pH rose to no more than 7·5–8 in the fermenter, while most of the tests were conducted at 20°C.

* * *

Natural gas in the sugar industry. M. GILLIO. *Ind. Alim. Agric.*, 1971, **88**, 1071–1074.—The use of natural gas for lime kilns, steam generation and pulp drying in a beet sugar factory is discussed and the

[1] *I.S.J.*, 1972, **74**, 125.

heat requirements for each of these purposes calculated (as well as those for lucerne drying). The costs are worked out for French conditions.

* * *

Supply, handling and washing (of beet) in the sugar industry. M. ROCHE. *Ind. Alim. Agric.*, 1971, **88,** 1083–1085.—Beet transport, reception, piling and treatment between the pile and washer are described with reference to the methods and equipment adopted by French sugar factories.

* * *

Offenau—a new factory replaces three old factories. ANON. *Zeitsch. Zuckerind.*, 1971, **96,** 503–508. Details are given of processes and equipment at this new West German white sugar factory which started operations in September 1971. At a daily slicing capacity of 6000 tons of beet, the factory replaces the three factories in the group (Süddeutsche Zucker-AG) at Stuttgart, Heilbronn and Züttlingen.

* * *

Adjustment to DDS mechanical diffusion. E. MÜLLER. *Listy Cukr.*, 1971, **87,** 203–204.—Adding press-water to a DDS continuous diffuser at a point nearer the juice end than at the same place as the fresh water will help extraction since over the last 1·6 m of a 22·4 m trough, corresponding to 6 min duration, the cossette sugar falls from only 0·7% to 0·3% (exhaustion), whereas over the previous 4·1 m, of 16 min duration, the extraction is much greater. Elimination of the last 1·6 m of the diffuser length will not reduce the pulp losses by a great deal compared with the proportion of the diffuser length curtailment.

* * *

Graphical statistical methods in sugar manufacture. V. ULRICH, M. MAROUNEK and J. HEJTMÁNKOVÁ. *Listy Cukr.*, 1971, **87,** 204–212.—Statistical methods for use in sugar manufacture are surveyed and application explained by examples covering crystal granulometry, weight of packeted sugar, moisture of sugar carried in trucks, and temperature of sugar entering a fluidized bed dryer.

* * *

Critique of methods and conclusions of research on sugar beet protection with (forced) ventilation on a factory scale during 1964/1968. Z. SOMORA. *Listy Cukr.*, 1971, **87,** 213–216.—The essential requirements for successful beet storage tests using forced ventilation are explained in the light of experimental work conducted in Czechoslovakia during 1964–68.

* * *

A commercially tested process for continuous crystallization of sugar. G. WINDAL. *Sugar J.*, 1971, **34,** (4), (4), 15–19.—Details are given of the Fives Lille-Cail continuous vacuum pan and results obtained at Nassandres, Marle and Ochsenfurt discussed. Design of a 4-compartment pan for cane sugar manufacture, where magma from low-purity sugar is used as footing for higher purity boiling, is reported and the major advantages of the pan listed.

* * *

The carbonate process developed at Enns sugar factory for non-sugars separation. J. ELMER, H. HITZEL and E. MOEBES. *Zucker*, 1971, **24,** 657–662.—See *I.S.J.*, 1972, **74,** 116.

* * *

Experiences with Braunschweig juice purification. G. SCHÄFFER. *Zucker*, 1971, **24,** 663–667.—Details are given of the carbonatation process and results obtained at Tulln sugar factory (Austria) where the 1957 variant of the BMA process has been replaced by the 1965 modification, in which juice is subjected to pre-carbonatation with simultaneous liming and CO_2 gassing to pH 8·8–9·0. Intermediate liming to pH 11 follows, 600–1000% of the juice then being recycled to pre-carbonatation. The next stage involves liming to pH 12, followed by 1st carbonatation, settling, filtration and 2nd carbonatation. The essential difference between the 1965 and 1957 variants lies in replacement of 2-stage pre-carbonatation in the earlier version with 1-stage treatment in the later. Advantages of the system are discussed, and details are given of the application of the 1965 variant at Valdivia beet sugar factory in Chile.

* * *

Molasses desugaring. V. SÁZAVSKÝ. *Listy Cukr.*, 1971, **87,** 235.—Use of the Steffen molasses desugaring process is briefly discussed with reference to practices in the USA and other countries.

* * *

Experience in operation of Novokuban' sugar factory with flat cossettes. A. F. BEREZOVSKII *et al. Sakhar. Prom.*, 1971, **45,** (10), 11–13.—Tests indicate the advantages of flat cossettes over grooved cossettes in terms of reduced sugar losses in diffusion and better juice circulation and draft. Details are given of the knife frame design used in the slicers at Novokuban'. Cossette thickness varies from 1·5 to 2 mm. Monetary savings involved are mentioned.

* * *

Test on a universal scheme for diffusion juice purification at Shamraevskii sugar factory. A. K. KARTASHOV *et al. Sakhar. Prom.*, 1971, **45,** (10), 14–18.—Tests are reported in which three 1st carbonatation schemes were tried with almost the same equipment layout, the aim being to have a universal layout with the possibility of varying the carbonatation process according to beet quality. Full details are given of the tests, which involved standard carbonatation, standard carbonatation after hot pre-carbonatation with simultaneous liming and gassing, and a scheme in which cold, simultaneous precarbonatation was followed by cold then hot liming and standard 1st carbonatation. Results are tabulated and some recommendations given on suitable schemes for given types of diffuser.

reader inquiry service

If you wish to receive further information on the products and services mentioned in the advertisements please fill in the inquiry section of this card and post it to us.

reader inquiry service

Please arrange for me to receive without obligation further details of the products referred to below which are advertised in your ..... 19..... issue.

Advertiser	Product	Page

Signature.....

Block Letters

NAME ..... Date.....

Position.....

Firm.....

Address .....

photocopy service

We are able to supply one photocopy, for research or private study purposes, of most of the original papers abstrated in this journal. It should be noted that these are not translations but are in the original language of publication, which may not be English. Please ask us to quote you the cost of your requirements, indicating whether surface or air mail delivery is to be provided.

photocopy service

Please submit your pro-forma invoice for the supply of one photocopy of each of the following original papers, abstracts of which appeared in your.....19..... issue.

Page	Author(s)	Title

Air Mail/Sea Mail

Signature.....

Block Letters

NAME ..... Date.....

Position.....

Firm.....

Address .....

additional subscriptions

To receive additional copies of *The International Sugar Journal* all you need do is to complete the card with details of the subscription required, and return it with your remittance of £3.00 or U.S. $10.00 for supply by surface mail.

additional subscription order

Please send a further copy of your journal each month to the address below, starting with the issue

.....19.....

Block Letters

.....

.....

.....

.....

.....

Signature.....

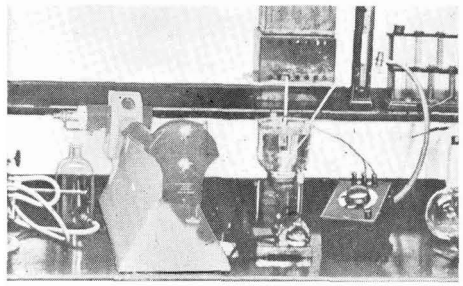
Date.....

I enclose cheque/draft/M.O./P.O. for £3.00/$10.00.

Reader Inquiry Service,
The International Sugar Journal Ltd.,
23a Easton Street,
High Wycombe, Bucks.
England.

Photocopies Dept.,
The International Sugar Journal Ltd.,
23a Easton Street,
High Wycombe, Bucks,
England.

Subscriptions Dept.,
The International Sugar Journal Ltd.,
23a Easton Street,
High Wycombe, Bucks.,
England.



Laboratory methods & Chemical reports

Quality of Indian raw sugar in the last decade of production. S. C. GUPTA and A. P. GUPTA. *Indian Sugar*, 1971, **21**, 169–175.—Average raw sugar analyses are given for the cane seasons from 1962/63 to 1969/70 in India, demonstrating the gradual improvement in quality to meet the requirements of buyers outside India. The average 98·7 pol sugar produced in the 19 factories of Maharashtra (assigned the task of high-pol sugar production) in 1969/70 had a moisture content of 0·248%, a safety factor of 0·190, sulphate ash of 0·365%, colour of 0·12 ICUMSA units and a grain size of 20 mesh for 59% of the crystals.

* * *

Reduced boiling house recovery formula (Gundu Rao): a review. A. C. CHATTERJEE. *Indian Sugar*, 1971, **21**, 177–181.—The views of OOMMEN & GURUMURTHY[1,2] that the GUNDU RAO formula for reduced boiling house recovery[3] is based on misunderstanding of the concepts of virtual purity and purity loss is criticized and the formula shown to be an improvement on the formula of NOËL DEERR.

* * *

Reducing sugar destruction in alkaline medium. M. ROCHE. *Ind. Alim. Agric.*, 1971, **88**, 981–983.—Hexose decomposition in alkaline medium takes the form of two types of reaction: degradation proper and glucose-fructose-mannose interconversion (Lobry de Bruyn reaction). While MOTTARD found considerably reduced mannose formation in his experiments[4], there was marked glucose-fructose interconversion. This inter-conversion is explained and the effects of hexose degradation described in terms of disappearance of reducing power, reduction of pH, formation of colouring matter and change in optical rotation. Basic lead subacetate has been found to cause the same type of reaction as alkaline or alkaline earth bases, so that measurement of the polarization of a sugar solution will be affected. Why heating to 90–95°C for 45 min in the presence of lead subacetate will lead to a pol reading which is closer to the true value than will cold digestion is explained.

* * *

Theoretical aspects of crystallization in the sugar industry. F. HEITZ. *Ind. Alim. Agric.*, 1971, **88**, 991–1002.—After recalling the various physical chemistry laws pertaining to the sucrose molecule and its behaviour in solution and defining certain aspects concerning supersaturated solutions, the author describes the occurrence of lacunae and dislocations in the sucrose crystal and the effect of specific heat and molecular vibrations. The factors involved in crystal formation and affecting crystallization velocity are then explained with the aid of photomicrographs. It is shown how the use of a simple molecular model will permit solution and crystal properties to be found quantitatively.

* * *

Determination of the sugar content in cane. M. DEMAUX. *Ind. Alim. Agric.*, 1971, **88**, 1049–1060. Methods, equipment and formulae applied to direct analysis of cane in Réunion, Guadeloupe, Martinique, Hawaii, Puerto Rico and South Africa are described in detail.

* * *

Relation between viscosity and nucleation of sucrose solutions. G. PIDOUX. *Sucr. Franç.*, 1971, **112**, 431–433.—Known facts about the viscosity and its changes in sucrose solutions are re-stated and the structure of a solution described in terms of clusters of crystals floating in a medium composed of molecules or groups of small molecules (embryos). Under saturation or sub-saturation conditions the clusters are in equilibrium with the medium, but when the solution is concentrated by evaporation the quantity of solvent falls and viscosity increases much more rapidly than the concentration. This non-linearity in relationship between viscosity and concentration has been found to increase with concentration. The disparity is a result of the formation of new or larger clusters, so that at the same quantity of sucrose molecules the apparent molecular volume is greater. (The process is described mathematically starting with a modification of Einstein's formula.) The greater the initial viscosity, the greater will be the change in volume as a result of the increase in size and volume of the clusters. Hence, with increase in supersaturation there are more nuclei and therefore more crystals. However, viscosity also increases with time without any other change in the solution parameters. This is attributed to the formation of new clusters in juxtaposition with embryos or the spread of already large clusters to include molecules or embryos and known as protonuclei. When viscosity reaches constancy, the clusters have attained a critical size after which increase becomes irreversible and nucleation takes place. Acceleration of nucleation and increase in the number of crystals at a given supersaturation when the solution is agitated have been ascribed to a decrease in the relaxation period

[1] *I.S.J.*, 1970, **72**, 243.
[2] *ibid.*, 1971, **73**, 92.
[3] *Proc. 7th Congr. I.S.S.C.T.*, 1950, 665–683.
[4] *I.S.J.*, 1960, **62**, 326.

with probable increase in entropy; rapid crystallization in a highly supersaturated solution subjected to "shock" can also be explained by cluster capture. The subjection of a slightly supersaturated solution to extreme acceleration has caused the formation of crystals relatively quickly at the bottom of a tube indicating the possibility of overcoming the inhibiting effect of viscosity on cluster sedimentation. (See also *I.S.J.*, 1971, **73**, 25.)

* * *

Determination of water in molasses by the Karl Fischer method. B. KVIESITIS. *J.A.O.A.C.*, 1971, **54**, 1231–1235.—Using the Karl Kischer titration method to determine the moisture content of cane molasses gave more accurate results when larger samples (0·37–0·57 g) were used than when smaller samples (0·20–0·27 g) were used. In addition, use of a surfactant to increase molasses solubility in the methanolic reagent improved accuracy. The values given by the method were more accurate than results of vacuum oven drying when the larger samples were used, although a number of factors governing the accuracy of the proposed method require consideration and further study is recommended.

* * *

Methods for determination of "Phenmedipham" residues in plant material. K. KOSSMANN. *Weed Res.*, 1970, **10**, 340–348; through *Anal. Abs.*, 1971, **21**, 2997. Photometric and GLC methods are described for determining residues of "Phenmedipham" (I) in various crops, including sugar beet, and in sugar. Samples are subjected to a distillation-extraction procedure[1] in which I is hydrolysed by NaOH to *m*-toluidine (II), which is collected in 2,2,4-trimethylpentane and re-extracted into N HCl for determination. The photometric method involves the diazotization of II; the resulting diazo-compound is coupled with N-(1-naphthyl)-ethylenediammonium dichloride and the extinction measured at 555 nm. For GLC, the II is brominated and the resulting 2,4,6-tribromo-*m*-toluidine extracted with toluene and determined on a column packed with 1% SE-30 polyester (NPGA terminated) on "Chromosorb G" (80 to 100 mesh) and operated at 180°C, with electron-capture detection and Ar-methane (19:1) as carrier gas (120 ml per min). Detection limits are 0·05 ppm of I by the photometric method and 0·02 ppm by GLC.

* * *

Core sampling and direct analysis of cane deliveries. F. ROBICHON. *Proc.* 1969 *Meeting W.I. Sugar Tech.*, 119–125.—Studies are reported on core sampling of cane while in trucks and of subsequent direct analysis. The investigations have been carried out in Guadeloupe in an attempt to eliminate problems involved in analysis of crusher juice or juice from the 1st two rollers of the 1st mill in a tandem, which is the procedure used to assess cane quality for payment. The core sampler used in the tests was a French-built FAPMO borer with a 207-mm diameter core drill which penetrates 1 m into the cane load, all movements being hydraulically controlled. The sampler is installed in line with the weighbridge and can move alongside the truck on a rail. The 5-10 kg samples are shredded by a "Jeffco" cutter-grinder and 500 g samples subjected to a pressure of 3500 psi for 2 min, after which the refractometric Brix and pol of the expressed juice are determined. The cake of pressed cane is dried and the fibre content according to TANIMOTO[2] calculated from the dry weight, assuming the residual juice to have the same dissolved solids content as the expressed juice. The HUGOT formula (juice extractable sugar = pol — 0·3 Brix) is applied to the juice analysis and fibre content for recoverable sugar content (RC). From the average RC for the complete crop is deducted

$$\text{Re}=\left(\frac{\text{weight of 97°S sugar manufactured} \times 100}{\text{weight of cane ground}}\right),$$

the difference being termed the manufacturing divergence, which is calculated for the whole country, deducted from RC and payment made on the adjusted recoverable sugar content % cane. The 3-year experiments showed that the procedure is straightforward and gives a reliable assessment, so that the system was recommended for adoption as from 1970.

* * *

Quantities in sugar technological calculations. H. J. DELAVIER. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 10 pp.—Because of differences between designations and nomenclature used for physical quantities in calculations of balances in the sugar industry as found in the literature, the author proposes a simplified, standardized system based on one developed by HAUCKE[3] for use in beet sugar technology calculations at the Institut für Zuckerindustrie in Berlin. The symbols and notations are given and explanations given where necessary.

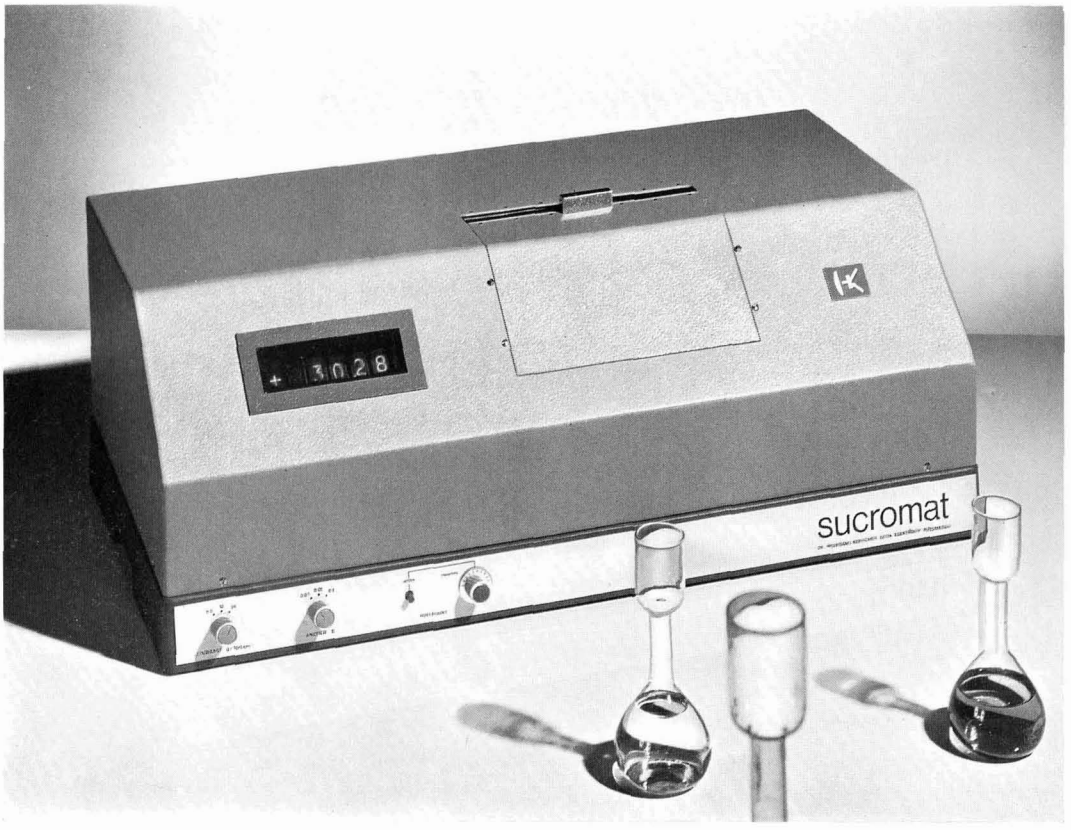
* * *

Cane sampling by coring, hydraulic press and automatic saccharimetry. Y. LEMAIRE. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 11 pp.—Details are given of the method used for cane sampling and evaluation for cane payment in Guadeloupe[4].

* * *

Rheological properties of carbonatation cane juice. A. C. RAHA. *Paper presented to the* 14*th Congr. I.S.S.C.T.*, 1971, 7 pp.—Experimental studies on the rheology of carbonatation cane juice involving the use of a rotary viscometer are reported. The viscosity increased with increase in the volume fraction of solids and tended to decrease with reduction in particle size at the same volume fraction. Although normally viscosity would increase with particle size reduction because of increase in shape irregularity, it would decrease where surface properties and the non-free flowing nature of the solids predominated. No attempt was made to establish a relationship between the viscosity of a pure sugar solution and that of cane juice.

[1] BLEIDNER *et al.*: *Anal. Abs.*, 1954, **1**, 2562.
[2] *Hawaiian Planters Record*, 1967, **47**, (2), 133.
[3] *Zeitsch. Zuckerind.*, 1960, **85**, 74–81, 117–123, 184–192.
[4] *I.S.J.*, 1972, **74**, 151 ; ROBICHON : *this page*.



The automatic sugar polarimeter **sucromat** *has built-in reliability*

When we developed the **sucromat** some years ago, we had the choice of three different optical systems to realize automatic balance:

1. Servo-rotated analyser.
2. Servo-driven quartz wedge compensator.
3. Feedback controlled Faraday compensator.

Our experience led us to system number one which combines accuracy with reliability.

The servo-rotated analyser principle has the advantage of a scale which is nearly independent of temperature. As power consumption of the **sucromat** is only 72 watts due to its modern electronics containing extensively reliable integrated circuits, there is no need for ventilators and air filters which cause maintenance problems. Equipped with a dust- and splash-proof case, the compactly designed **sucromat** withstands all climates and tough ambient conditions.

The optical system chosen for the **sucromat** offers a wide measuring range of ± 120° S for versatility of applications in the beet and cane sugar industries. Sample tubes of reasonable length (200 mm) are used to produce an optical signal which is sufficiently large to resolve 0.01° S without noise and zero point drift problems. In addition, the **sucromat** can easily be checked with quartz control plates of certified accuracy.

Digitizing of rotated analyser position is performed by a shaft encoder. Results are continuously displayed by an electronic up-and-down counter which is completely free of the zero point drift and calibration errors common to digital voltmeters.

Both the opto-mechanical and the electronic systems of the **sucromat** are manufactured by us. This guarantees unlimited availability of competent service.

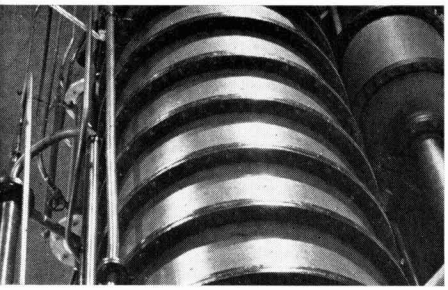
International success of the **sucromat** proves that our conception is right.

For more information and references write to:

DR. WOLFGANG KERNCHEN
OPTIK-ELEKTRONIK-AUTOMATION
D-3011 LETTER-HANNOVER
WEST-GERMANY

Stord Bartz Industri a·s

C. Sundtsgt. 29 Bergen, Norway



By-products

Dried carbonatation mud as feed supplement. J. MÁRKUS. *Cukoripar*, 1971, **24**, 110–113.—Replacement of feed lime in pig and broiler chicken rations with dried carbonatation mud (6% of the total feed) led to greater weight gains, while more and somewhat heavier eggs were laid by the hens.

* * *

Elephant grass and rice straw as forage sources for cattle fattened on molasses-based diets. II. Rumen protozoal population. L. SIMÓN, J. L. VEITÍA and C. ESQUIVEL. *Rev. Cubana Cienc. Agríc.*, 1971, **5**, 175–177.—The effects of the two forage sources mentioned in the title on the rumen protozoal populations of bulls fed on a diet containing molasses and urea were determined and the findings discussed in terms of earlier results obtained by other authors.

* * *

Milk production of Holstein × Brahman cows given free access to elephant grass forage and either a high protein concentrate, molasses or molasses/urea. J. VEITÍA. *Rev. Cubana Cienc. Agríc.*, 1971, **5**, 179–183. Comparison between milk yields of cows fed on rations containing (i) 23% protein concentrate, (ii) final molasses, or (iii) final molasses and urea, all in addition to elephant grass forage fed *ad libitum*, showed that the control diet (i) gave highest yield, followed by (ii). No differences were found in milk composition. Cows fed on (i) consumed much less of their ME in the form of forage and received significantly more nitrogen daily.

* * *

Effect of urea concentration in molasses on feed intake and N metabolism in cattle fed on grain or forage-based diets. A. RAMÍREZ and T. M. SUTHERLAND. *Rev. Cubana Cienc. Agríc.*, 1971, **5**, 185–193.—The effect of urea (up to 20% of molasses mixture) in rations containing molasses and either fresh forage or a cereal grain-bagasse pith mixture was studied with steers. Although increasing the urea level beyond 2% with forage and 4% with grain reduced molasses intake, the blood ammonia and rumen pH and ammonia levels never reached toxic levels, so that cattle can apparently tolerate high levels of urea without risk of toxicity, provided the increase is made gradually.

* * *

The effect of molasses-based diets on rumen development of dairy calves. N. PERÓN. *Rev. Cubana Cienc. Agríc.*, 1971, **5**, 195–204.—In the tests reported, calves fed for up to 8 weeks on rations containing ground maize, soybean meal and final molasses, plus a mineral and vitamin supplement, obtained more advantage with regard to rumen development than did calves fed on rations containing high-test molasses with or without urea.

* * *

Cerebro-cortical necrosis (molasses toxicity) in beef cattle: some preliminary biochemical parameters. C. M. GEERKEN and V. FIGUEROA. *Rev. Cubana Cienc. Agríc.*, 1971, **5**, 205–209.—Investigations on the incidence of molasses "drunkenness" amongst bulls showed marked differences in the pH and quantities of substances in the rumen liquor and a significant increase in blood glucose and pyruvic acid contents compared with healthy animals. Although no specific diet component is regarded as the source of the problem, the disorder is associated with high levels of molasses, particularly when forage is absent.

* * *

High-test and final molasses for fattening ducks. R. PÉREZ and B. DEL CRISTO. *Rev. Cubana Cienc. Agríc.*, 1971, **5**, 211–214.—Results are given of tests in which ducklings were fattened on a diet containing high-test molasses or raw sugar plus final molasses. Over 42 days, live weight gain was 20% greater when high-test molasses was used, although there were no significant differences in feed conversion between the two energy diets. High mortality was attributed to a sticky diet and the use of battery cages.

* * *

Rice milling by-product and niacin in sugar-based diets for broilers. C. T. GONZÁLEZ, A. J. FERNÁNDEZ, R. RODRÍGUEZ and E. I. SALCEDO. *Rev. Cubana Cienc. Agríc.*, 1971, **5**, 215–220.—Tests are reported in which a rice milling by-product rich in B vitamins and synthetic niacin were incorporated in rations containing raw sugar in order to improve feed efficiency which has been found to be significantly reduced when sugar replaces cereals in broiler diets. The rice milling by-product reduced feed conversion which, on the other hand, increased linearly with the level of niacin.

* * *

Review of bagasse depithing. J. E. ATCHISON. *Paper presented to the 14th Congr. I.S.S.C.T.*, 1971, 16 pp. A survey is presented of work on wet bagasse depithing and methods devised, and descriptions are given of a number of depithers. The capacities and efficiencies of these, used in the wet process, are compared, and factors for consideration in selecting an appropriate depither or depithing system are discussed.

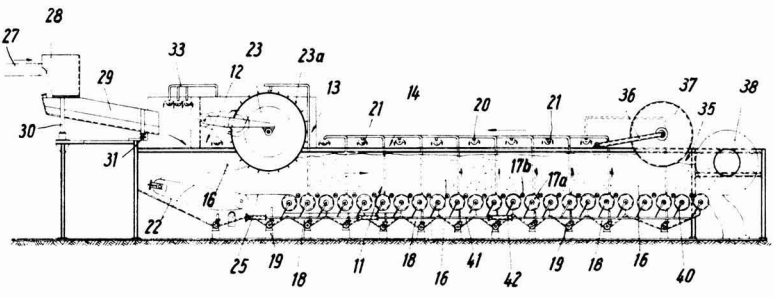
Patents

UNITED KINGDOM

Cane diffusion. BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT, of Braunschweig, Germany. **1,252,749.** 12th December 1968; 10th November 1971.

Prepared cane enters the intake zone 12 of the diffuser from conveyor 27 which feeds a hopper 28 delivering to a swivelling spout 29 which pivots about axis 30 and spreads the cane across the width of the diffuser. Hot juice is sprayed through pipes 33 onto the falling curtain of cane, so giving intimate mixing and effectively raising the temperature of the bed which collects on the inclined conveyor belt 22. The conveyor takes the cane into the transition zone 13 under the slower-moving conveyor roller 23 which is provided with radial webs 23a and which compresses the cane against a slide plate 25 (or an endless plate conveyor). The juice content is expressed and collects in the chamber below from which it is removed, part heated and sent to pipes 33 and the remainder sent to process.

The lower bagasse surface is given a consistency which permits it to be carried over the conveyor



surface at the bottom of the diffuser without breaking up; this conveyor surface is made up of driven rollers 17a separated by small idler rollers 17b. Water is sprayed onto the bagasse bed near the discharge end and percolates through, draining between the rollers 17a, 17b into chambers 18 from which it is sent by pumps 19 to distribution channels above the bed but nearer the cane feed end. The liquid thus becomes progressively richer in sugar while the bagasse becomes more and more exhausted during its passage along the diffusion zone 14 of the trough. It passes under the brake roller 37 which compresses it, expressing the water content, before it is guided by the paddles of wheel 38 and sent for further treatment.

Weed control in sugar cane. CIBA-Geigy A.G., of Basle, Switzerland. **1,253,143.** 13th February 1969; 10th November 1971.—Weeds are controlled by application to the crop area of a compound N-methyl, N-*R*,N′-(3-*A*, 4-*B*-phenyl) urea, where *R* is a H atom or OCH_3 or a C_1–C_4 alkyl group. When *B* is I, *A* is F or Br; when *B* is Br, *A* is H, CH_3, CF_3 or OCH_3; when *B* is F, *A* is F, Br, CH_3, CF_3 or OCH_3.

* * *

Weed control in sugar cane. CIBA-GEIGY A.G., of Basle, Switzerland. **1,255,258.** 13th February 1969; 1st December 1971.—Weeds are selectively controlled in cane using N-*R*, N-methyl-N′-(4-*X*, 3-*Y*-phenyl) urea, where *X* is F or a C_1–C_4 alkyl group, *Y* is H, F, Cl, Br, I, a C_1–C_4 alkyl group, a C_1–C_4 alkoxy or alkylthio group, a C_1–C_4 alkyl sulphinyl or sulphonyl group, a nitro group, or a halogeno-(C_1–C_4)-alkyl group, and *R* is H, a C_1–C_4 alkyl which is unsubstituted or substituted by two C_1–C_4 alkoxy groups, a C_1–C_4 alkoxy group, allyl, or butenyl, with the proviso that when *X* is CH_3 and *Y* is H, Cl, Br or CH_3, *R* is not OCH_3.

* * *

Citric acid production. TAKEDA YAKUHIN KOGYO K.K., of Osaka, Japan. **1,257,900.** 13th July 1970; 22nd December 1971.— (+)*Iso*-citric acid (100 parts) is contacted (at 25–45°C) with a fermentation broth (which has been incubated at pH 3–7 and 25–35°C) based on e.g. cane molasses, of a yeast (10–100 parts on a dry basis) capable of accumulating (+)*iso*-citric acid and belonging to the genus *Candida*, *Brettanomyces*, *Debaryomyces*, *Hansenula*, *Kloeckera*, *Trichosporon*, *Torulopsis* or *Pichia*, or a processed matter derived from the broth or yeast cells (10–100 parts on a dry basis of yeast or derived matter), in an aqueous medium at pH 7·0–9·5, thereby converting the (+)*iso*-citric acid to citric acid, which is recovered.

* * *

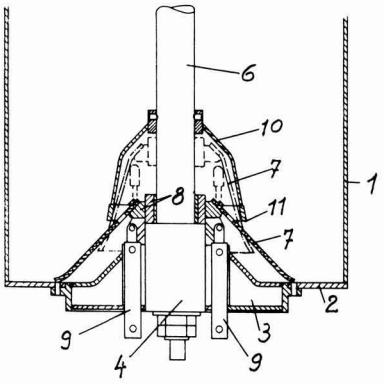
(Bagasse) Particle board or fibreboard manufacture by incorporation of a binder in gaseous form. J. P. VERBESTEL, of Kortrijk, Belgium. **1,262,313.** 6th March 1969; 2nd February 1972.—Particles or fibres of lignocellulosic material, e.g. bagasse, are impreg-

nated (while in suspension in a fluidized bed) with one or more gaseous materials (phenol, formaldehyde and ammonia; urea and formaldehyde) capable of reacting with a material (styrene, methyl styrene or vinyl toluene) (previously or subsequently impregnated or) already present in the particles (or impregnated with two reactants and a catalyst able) to form a polymeric binder or monomeric components of a polymeric binder and subsequently hot-pressing the particles or fibres to effect reaction of the gaseous materials to form the polymeric binder and so bond the particles or fibres together. The gaseous materials may be introduced into the carrier gas stream by which the particles or fibres are fluidized.

* * *

Centrifugal discharge valve. SALZGITTER MASCHINEN A.G., of Salzgitter-Bad, Germany. **1,262,801.** 3rd February 1970; 9th February 1972.

The spindle 6 of centrifugal 1 is mounted in a boss 4 carried by the arms of a spider 3 located within the discharge aperture of the base 2. The spindle carries a bell-like rigid hood 10, adjustably located, and also a collar 8 which can slide up and down the spindle under the action of the pistons of pressure cylinders 9.

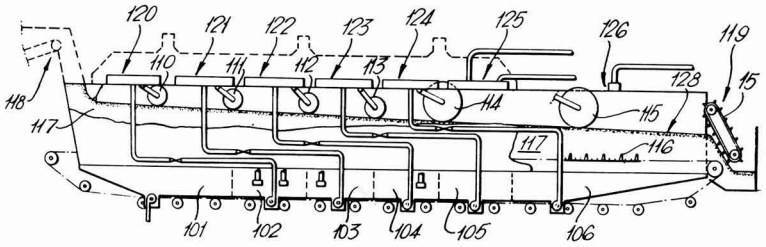


Attached to the collar 8 is a hood 7 made of flexible material, e.g. rubber, such that in the lower position of the collar the lower edge of hood 7 covers the discharge aperture completely while in the upper position of the collar the hood is withdrawn into the bell, the lower edge of which is undulating in order to receive the flexible hood. In this way the wide aperture can be covered completely by a hood which does not occupy a great amount of space when raised and so does not present difficulties in regard to the plough or washing devices within the centrifugal basket.

* * *

Cane diffusers. FAIRYMEAD SUGAR CO. LTD., of Fairymead, Queensland, Australia. **1,262,917.** 25th September 1969; 9th February 1972.

The diffuser is in the form of a trough in which a moving bed of bagasse travels on conveyor 116 from one end to the other while subjected to the percolating of an extraction liquid supplied as water



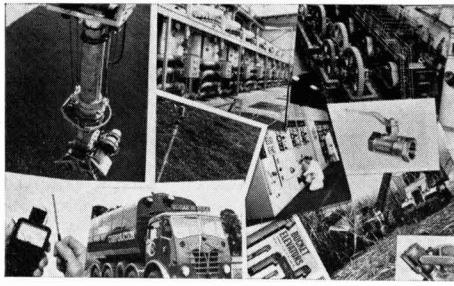
through distributor 126 at the discharge end and, by recirculation of the liquid draining into the collecting chambers 102, 103, 104, 105, 106, produces a liquid richer and richer in sucrose, the liquid draining into chamber 101 at the feed end of the diffuser being withdrawn as juice for processing.

The diffuser is separated into a number of diffusion zones corresponding to the chambers below the conveyor 116, and each zone is provided with a juice distributor 120, 121, 122, 123, 124, 125 and a drum 110, 111, 112, 113, 114, 115 pivoting about a horizontal transverse axis and rotating on top of the bagasse owing to friction. The weight of the drum causes a compression of the bagasse beneath which expresses the juice content into the chamber below and aids absorption of the subsequently applied liquid on re-expansion of the bagasse.

* * *

Laundering composition comprising a sucrose-based detergent. THE GILLETTE CO., of Boston, Mass., USA. **1,264,337.** 15th July 1969; 23rd February 1972.—The laundering composition comprises (i) a sucrose-based detergent consisting of one or more mono- or di-esters of sucrose with fatty acids of 12–18 C atoms, ethers of sucrose with alkylene oxides in which each alkylene group has 3–18 C atoms, ethers of sucrose of formula *R*-CH_2O-sucrose where *R* is alkyl, alkenyl (but not α-alkenyl) or alkoxy groups of 8–24 C atoms, an aralkyl group of 14–24 C atoms of which 8–18 C atoms are in the alkyl group attached to the aryl ring, or sucrose N-(C_{12}–C_{18}) alkyl urethanes, (ii) a cationic softening agent and (iii) a condensed phosphate builder, (i) and (ii) being in a proportion of 33:1–2:1.

Trade notices



Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.

Pumps for cane sugar factories. Deming Division, Crane Co., P.O. Box 450, Salem, Ohio, 44460 U.S.A.

The Deming Division of Crane Co., manufacturers of pumps and water systems for residential, agricultural, chemical and industrial use, have worked out specifications for pump applications in cane sugar factories. The result of a study of the methods used in a number of factories, with the assistance of sugar technologists, is a diagram of the layout of process plant from cane reception through to molasses and sugar discharge to road vehicles. Boiling schemes for raw and refined sugar production are also given. On the back of the diagram are given details of the various types of pumps for use at different stages in the processing. The data include pump description and type, special features, liquid properties, volume required, average working pressure, and special remarks.

* * *

Conveyor/elevator for granulated sugar. Canterbury Conveyors Ltd., Brett House, Wincheap, Canterbury, Kent, England.

Following successful applications in major food manufacturing plants where sugar is processed, Canterbury Conveyors Ltd. are now recommending their "Rigiflo" spiral screw conveyor/elevator for granulated sugar handling.

Five versions of the "Rigiflo" are available, with capacities ranging from 0·5 to 3·0 m^3/hr. The rotating steel screw which moves the sugar along the fixed steel tube is flexible and comprises a coreless spiral formed by an open-pitch spring, so that the crystals are not crushed or packed together to clog the tube. Moreover, the sugar is protected from dust and airborne contamination. The "Rigiflo" can be positioned at any angle up to 70° and will transfer sugar from silos and other bulk storage installations to points up to 9 m above the tube inlet. In one plant a "Rigiflo" unit at an angle of 40° carries up to 3 metric tons of sugar an hour to an automatic weigher located 5·5 m from a 20-ton silo.

Bag-type air filters. Microflow Ltd., Fleet Mill, Minley Rd., Fleet, Hants., England.

The Series "S" bag-type air filters announced by Microflow Ltd. have a wide application for use where higher-than-average air cleanliness is required. Each filter comprises four bags located on a galvanized steel holding frame so designed to allow any number of filters or "cells" to be bolted together. A bag can be changed by withdrawing it from the frame complete with its pre-formed cuff with virtually no contamination of ventilation ducts. Rated flow per cell is up to 4070 m^3/hr with a maximum dust load of 13,750 g at 95% efficiency (up to 99·5% efficiency is attainable at lower maximum dust loads and rated flows). Leaflet SfB(57)Xh UDC 697.94 gives details of the air filter.

* * *

PUBLICATIONS RECEIVED

CONDUCTIVITY INSTRUMENTS FOR PROCESS INDUSTRIES. Electronic Switchgear (London) Ltd., 58 Wilbury Way, Hitchin, Herts., England.

A new 4-page leaflet describes twenty electrolytic conductivity instruments produced by Electronic Switchgear (London) Ltd., a member of the George Kent Group, for a number of industrial applications, including boiler feed water treatment, liquid level control, water softening control and measurement of irrigation water salinity.

* * *

INDUSTRIAL CONTROLS. Actuated Controls Ltd., Vale Lane, Hartcliffe Way, Bristol, England.

A 6-page product summary has been produced by Actuated Controls Ltd., listing their range of industrial controls including pressure switches, vacuum switches, differential pressure switches, solenoid valves, pressure gauges, vacuum gauges and differential pressure gauges. The pressure range covered is full vacuum to 10,000 p.s.i.

* * *

Lime kiln order from Belgium.—Following the successful completion of a second beet campaign with the oil-fired lime kiln at Mosul, in Iraq[1], the suppliers, West's (Manchester) Ltd., of Albion Works, Miles Platting, Manchester M10 8AB, England, have received an order from Raffinerie Tirlemontoise S.A. for a similar oil-fired kiln to be installed at Brugelette factory for the 1973 campaign. The kiln will have a daily output of 115 metric tons of lime, maintaining the carbonatation gas CO_2 content at not less than 28%. Assistance in construction and erection of the kiln will come from the firm's West German licensees, Maschinenfabrik H. Eberhardt, of Wolfenbuettel.

[1] *I.S.J.*, 1972, **74**, 222.

Centenary of *La Sucrerie Belge*

THE first issue of the Belgian sugar journal "*La Sucrerie Belge*" was published on the 31st August 1872 on behalf of the Société Générale des Fabricants de Sucre de Belgique which had been founded on the 20th March of the same year. Since then "*La Sucrerie Belge*" has been published regularly as the organ of the Société Générale except in 1914–18 and 1940–45, during the two world wars.

Originally, much of its editorial content was devoted to political and financial problems peculiar to the Belgian sugar industry but sugar chemistry and technology were soon introduced and now constitute the main part of the journal.

In 1968 important changes were made in order to provide the journal's readers with a better information service. The size was increased to DIN A4 and the editorial content became classified under appropriate headings: articles, abstracts of papers, news from Belgium, news from the EEC and other countries, etc., while some articles were published in English instead of French which is used traditionally. In addition, each article is now accompanied by abstracts in English, French, Dutch and German.

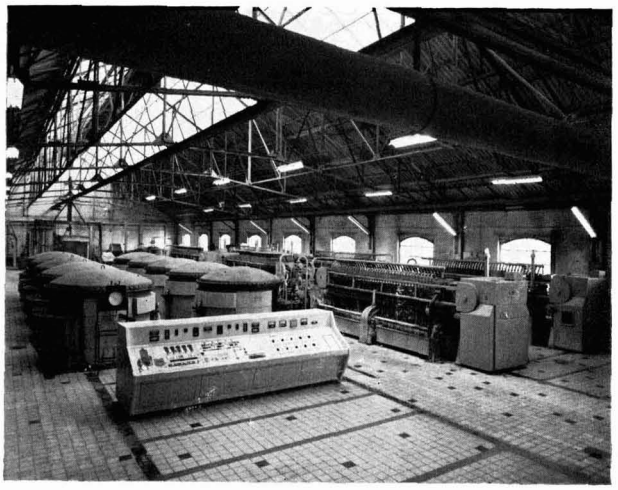


Fig. 1

Two years ago, joint publication started of "*La Sucrerie Belge*" and "*Sugar Industry Abstracts*"; the latter, prepared by Tate & Lyle Research Centre and the Information Department of Raffinerie Tirlemontoise S.A., provides a detailed survey of all papers, articles, patents, books, etc., dealing with the beet and cane sugar industry and with the uses of sugar and sugar industry by-products.

A special issue of the journal was published on the 15th September 1972 to mark the centenary; it contains an article describing the development of the Belgian sugar industry during the past hundred years and also includes a directory of the existing sugar factories, with information on their capacities, production figures, beet supplies, and the equipment and processes employed, so giving a complete picture of the Belgian sugar industry.

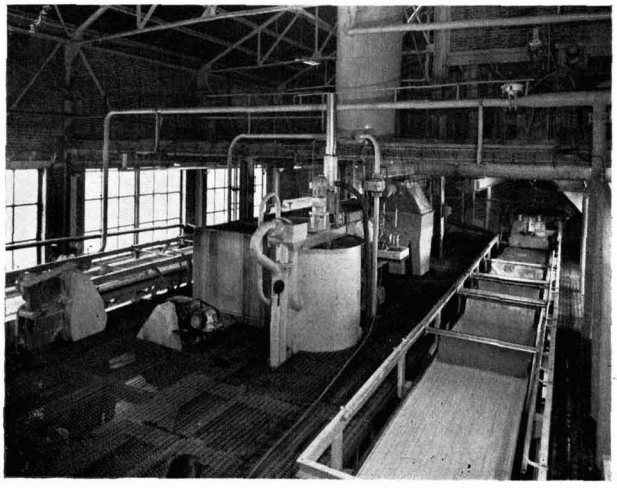


Fig. 2

In celebration of the occasion, a group of sugar industry journalists were invited to Belgium during the 8th–10th November. The group, representing publications from Cuba, France, Germany, Italy, Poland, the UK and USA, assembled in Brussels and were guests at a reception offered by the Société Générale des Fabricants de Sucre de Belgique. They were taken to see the Wanze sugar factory where they were able to inspect the huge new white sugar silo, conditioning plant, pans and automatic 1st carbonatation juice filtration equipment (Fig. 1). The decision to install the silo was taken in September 1971 and the plant was designed and built by August 1972, ready for the start of the current campaign.

Continuing to Tirlemont, the group visited the R.T. headquarters with its beet sugar factory and refinery, where they were able to view many of the unique features of the equipment, especially the new continuous Steffen plant (Fig. 2) where, with

only supervisory labour, molasses is treated with lime to give a continuous extraction of 85% of the sugar content as calcium saccharate cake which is then used for liming the raw juice; in this way sugar output of the factory is increased by 10% at very low cost.

At an excellent dinner given in the evening, the guests were able to meet members of the Société Générale and distinguished technologists of the Belgian sugar industry, while on the morning of the 10th they travelled to Moerbeke-Waas to visit the 103-year old sugar factory which was most impressive in its cleanliness and excellent condition. After lunch in the reception centre of the factory, the journalists returned to Brussels before departing homewards, grateful to their hosts and conscious of the good health of the Belgian sugar industry and its journal, clearly well-prepared for its second hundred years.

* * *

ICUMSA

16th Session 1974

Confirmation has been received from the Turkish National Committee of the International Commission for Uniform Methods of Sugar Analysis that the 16th Session of ICUMSA will be held in Ankara. Registration of delegates will take place in the afternoon of Sunday 2nd June 1974 and sessional meetings will be held throughout the period 3rd to 7th June. The Turkish National Committee has kindly offered to arrange visits to places of interest for both delegates and their ladies. Applications for hotel accommodation should be received by Mr. O. Bozok, Seker Enstitüsü, Etimesgut-Ankara, Turkey, *not later than* three months prior to the meeting.

Trinidad furfural plant[1].—The proposed furfural plant to be established somewhere in Central Trinidad by the Industrial Development Corporation was expected to get off the ground before the 16th June when it was hoped that a financial package would have been prepared by the Corporation and local investors invited to join in the venture. It is estimated that the setting up of such a plant would cost about $6 million. The plant will use bagasse as its intake and, according to the Chairman of the Industrial Development Corporation, it is envisaged that the company which will operate the plant will be able to dispose of about half the production locally and in the Caribbean while the rest will be for export.

* * *

US sugar refinery plans suspended[2].—Tasty Baking Co. of Philadelphia, Pa., announced on the 24th August that it is suspending its previously announced plans[3] to erect a $9,000,000 cane sugar refinery in Portsmouth, Va. The Company acquired the land in January 1972 but after studies which included engineering, feasibility and detailed investigations of sugar prices in the market the refinery was planned to service, it was concluded that the minimum reasonable return on the investment would not be realised as originally anticipated, and the plans have been suspended accordingly.

* * *

New sugar factory for Colombia[4].—A large sugar factory is to be established jointly by public and private interests, with an investment of 156 million pesos (£7,000,000), in the Department of Risaralda, in Colombia. It is to produce 79,000 tons of sugar annually.

Brevities

Guyana spring sugar crop[5].—The spring sugar crop in Guyana closed in May at 102,600 tons, 41,097 tons below the 1971 figure and 17,400 tons below the crop target of 120,000 tons. The Guyana Sugar Producers' Association reported that this greatly reduced figure resulted from extremely bad weather throughout the crop period.

* * *

Ivory Coast sugar imports[6].—Imports of sugar into the Ivory Coast in 1971 amounted to 53,690 metric tons.

* * *

Brazil bulk handling terminal[7].—The new bulk sugar terminal at Recife[8] has been opened. It can handle 1000 tons of sugar in bulk per hour and can receive or load a cargo of 10,000 tons within twelve hours. The storage capacity of the installation amounts to 200,000 tons of sugar and 10,000 tons of molasses.

* * *

Albania sugar production[9].—Sugar production in Albania was only 633 metric tons, white value, in 1950 but by 1960 had reached 14,453 tons, remaining roughly constant so that 1970 production was 16,708 tons.

* * *

EEC Commission investigation of sugar companies[10].—The European Commission is to follow up its earlier investigation of sugar companies to check if some of their other activities infringe the Community's free competition rules. The new investigations are centred exclusively on national sugar markets. The Commission suspects some firms in France, Germany and Holland of having agreements with their distributors to limit sales within these countries. Representatives of the 22 sugar companies named in July, when the Commission accused them of operating a market-sharing cartel throughout the EEC, were to meet in Brussels in October to discuss the allegations; most have already replied to the Commission's official letters of complaint.

* * *

Sudan sugar expansion[11].—The state-owned sugar company has decided to invite tenders for the construction of a third cane sugar factory. The new white sugar factory is to be built north-west of Sennar and process 5000 tons of cane per day, with the possibility of expansion fo 6500 t.c.d. Tenders must be submitted by 1st December and the awarding of contracts will take place on 1st April 1973. It is anticipated that the factory will start operations in September 1975 and begin to produce sugar in November 1975. An area of 200 feddans (84 hectares) has already been planted with sugar cane for seed production, and by August 1974 the cane area will be 8000 feddans (3360 ha). The Government of the Sheikdom of Kuwait is financially involved in the project.

* * *

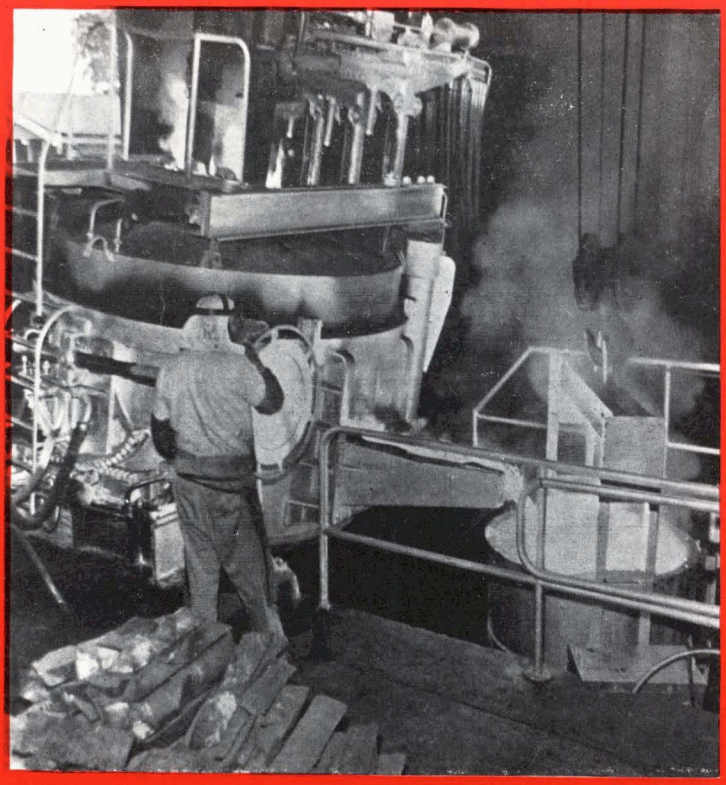
Chile sugar import requirement[12].—Chile is likely to require small quantities of imported sugar, of between 15,000 and 18,000 tons by the end of the year. Owing to increased demand, there may be a deficit in domestic production in 1973 but the size of the likely deficit is not clear. Beet sugar production in Chile dropped by 15·6% last year to 177,128 tons.

---

[1] *Evening News* (Trinidad), 17th May 1972; through *The Cane Farmer*, 1972, **13**, 194.
[2] *Willett & Gray*, 1972, **96**, 304.
[3] *I.S.J.*, 1972, **74**, 255.
[4] *Bolsa Review*, 1972, **6**, 518.
[5] *W. Indies Chron.*, 1972, **87**, 368.
[6] C. Czarnikow Ltd., *Sugar Review*, 1972, (1092), 161.
[7] F. O. Licht, *International Sugar Rpt.*, 1972, **104**, (25), 10.
[8] *I.S.J.*, 1971, **73**, 384.
[9] C. Czarnikow Ltd., *Sugar Review*, 1972, (1094), 172.
[10] *The Times*, 29th September 1972.
[11] *Zeitsch. Zuckerind.*, 1972, **97**, 535.
[12] *Public Ledger*, 30th September 1972.

WALKERS MAKE ALL THEIR OWN CASTINGS

OUR ELECTRIC ARC STEEL FURNACE IS SHOWN HERE IN ACTION

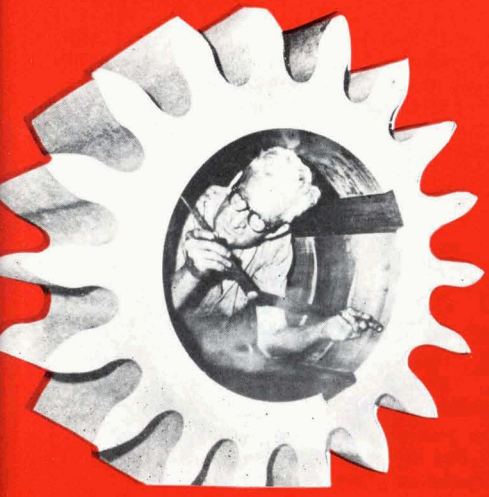


OUR RANGE OF CASTINGS INCLUDES:

1. STEEL AND ALL ITS ALLOYS TO 20 TONS WEIGHT.
2. CAST IRON TO 16/18 TONS.
3. ALL BRASSES AND BRONZES.
4. S.G. IRON OF ALL SECTIONS TO 12 IN. AND 16 TONS.
5. DI-RESIST, THE HEAT-RESISTANT HIGH-NICKEL IRON.
6. ALUMINIUM AND ALL ITS ALLOYS.
7. BABBITT METALS.

OR A 32 LB CAST STEEL SHREDDE HAMMER

CASTINGS, CASTINGS, **CASTINGS,** SUCH AS:
THIS CAST STEEL MILL PINION



OR THIS ROLLER SHELL OF SPECIAL C.I.

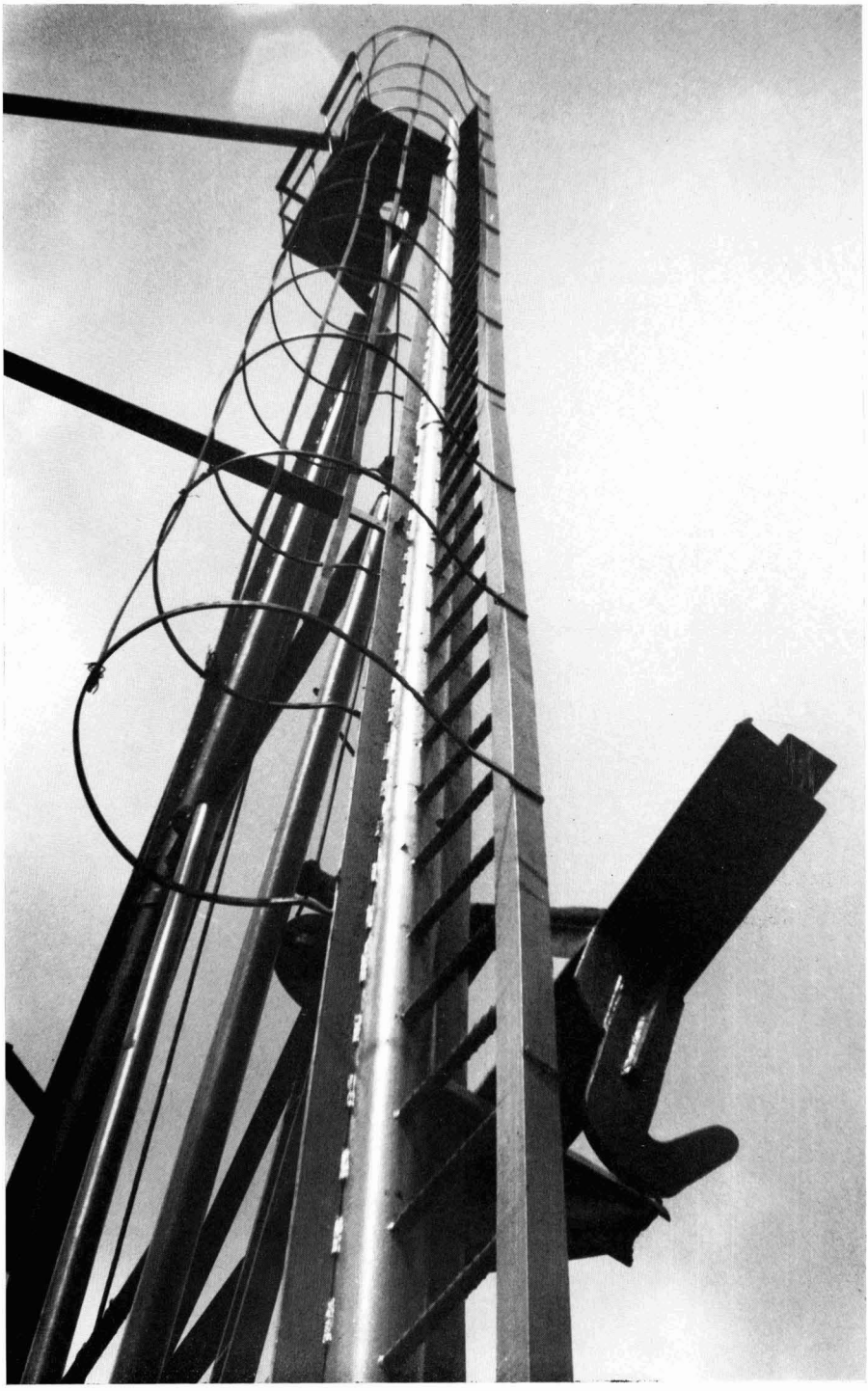
WALKERS LIMITED

CONSULTANTS
DESIGNERS
ENGINEERS

MARYBOROUGH QUEENSLAND AUSTRALIA

Index to Advertisers

FOR THE BUYERS' GUIDE SEE JULY ISSUE pp. xxvi-xlii



Cane cart unloading hoist

THE INTERNATIONAL SUGAR JOURNAL

A TECHNICAL AND COMMERCIAL PERIODICAL
DEVOTED ENTIRELY TO THE SUGAR INDUSTRY

EDITED BY:
D. LEIGHTON, B.Sc., F.R.I.C.
M. G. COPE, M.I.L.
F. N. HOWES, D.Sc., I.S.O.

JANUARY TO DECEMBER
1972

VOLUME LXXIV

PUBLISHED AT
23a EASTON STREET
HIGH WYCOMBE
BUCKS.
ENGLAND
1972

PANEL OF REFEREES

ERRATA AND CORRIGENDA

Page 19.	Line 35 of column 1.	Read "370–375, 400–404" for "370–374".
Page 53.	Line 3 of column 1.	Read "beet juice" for "beet".
Page 77.	Line 24 of column 2.	Read "froghopper" for "borer".
Page 81.	Line 25 of column 2.	Read "G. I." for "G. J."
Page 87.	Line 26 of column 1.	Read "ABRAM" for "ABRAMS".
Page 141.	Line 22 of column 2.	Read "S. SOLDEVILLA G." for "S. S. OLDEVILLA G."
Page 153.	Line 38 of column 2.	Read "185–191" for "175–191".
Page 155.	Line 50 of column 1.	Read "FARBWERK" for "FARNWERK".
Page 184.	Line 25 of column 1.	Read "S. Z." for "S. V."
Page 211.	Line 41 of column 1.	Read "J. C." for "L. C."
Page 240.	Line 20 of column 2.	Read "R. V." for "R. W.".
Page 241.	Line 25 of column 2.	Read "1971" for "1967".
Page 252.	Line 50 of column 1.	Read "on colour" for "of colour".
Page 279.	Line 13 of column 1.	Read "C. M. B." for "C. M. G.".
Page 323.	Figure 8.	Top left-hand corner of graph. Read "0, –0·0051, –0·0086, –0·0125" for "0, 0·0051, 0·0086, 0·0125".

MADE AND PRINTED IN ENGLAND
BY
JOHN ROBERTS & SONS
SALFORD
MANCHESTER

INDEX TO VOLUME LXXIV

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; Fertilizer; Irrigation; Mechanization; Pests; Soil; Transport; Varieties; Weeds, etc.); SUGAR PROCESSING (*see* Bagasse; Boilers; Boiling; Carbonatation; Centrifugals; Clarification; Crystallization: Diffusion; Evaporators; Filter; 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.

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

SUBJECT MATTER

INDEX

INDEX

▼

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

NAMES

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

Printed by JOHN ROBERTS & SONS, Salford, Manchester; and published by the Proprietors, THE INTERNATIONAL SUGAR JOURNAL LTD., at 23a Easton Street, High Wycombe, Bucks. Entered at the New York Post Office as Second-Class Matter.

PRINTED IN GREAT BRITAIN.