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, A.I.L.(*Rus.*)

JANUARY TO DECEMBER

1965

VOLUME LXVII

PUBLISHED AT
23a EASTON STREET
HIGH WYCOMBE
BUCKS.
ENGLAND
1965

PANEL OF REFEREES

ERRATA AND CORRIGENDA

Page 5.	Line 9 from bottom of column 2.	Read "herbicides" for "insecticides".
Page 7.	Line 27 of column 1.	Read "MILLHOLLON" for "MILLHOLLONY".
Page 58.	Line 2 of column 1.	Read "IMPROGO" for "IMPOROGO".
Page 117.	Line 17 of column 2.	Read "NEDUZHKO" for "NEDUZKHO".
Page 119.	Line 22 of column 2.	Read "micro-organisms" for "miro-organisms".
Page 170.	Last line of column 2.	Read 49·2 for 9·2 and 46·9 for 6·9.
Page 245.	Line 12 of column 1.	Read "H. J. SPOELSTRA" for "J. H. SPOELSTRA".
Page 249.	Line 18 of column 2.	Read "FAGIOLI" for "FAGLIOLI".
Page 250.	Line 1 of column 2.	Read "curve" for "surve".
Page 340.	Line 23 of column 1.	Read "thermal" for "hermal".
Page 346.	Line 12 of column 2.	Read 316 for 315.

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

International Sugar Journal

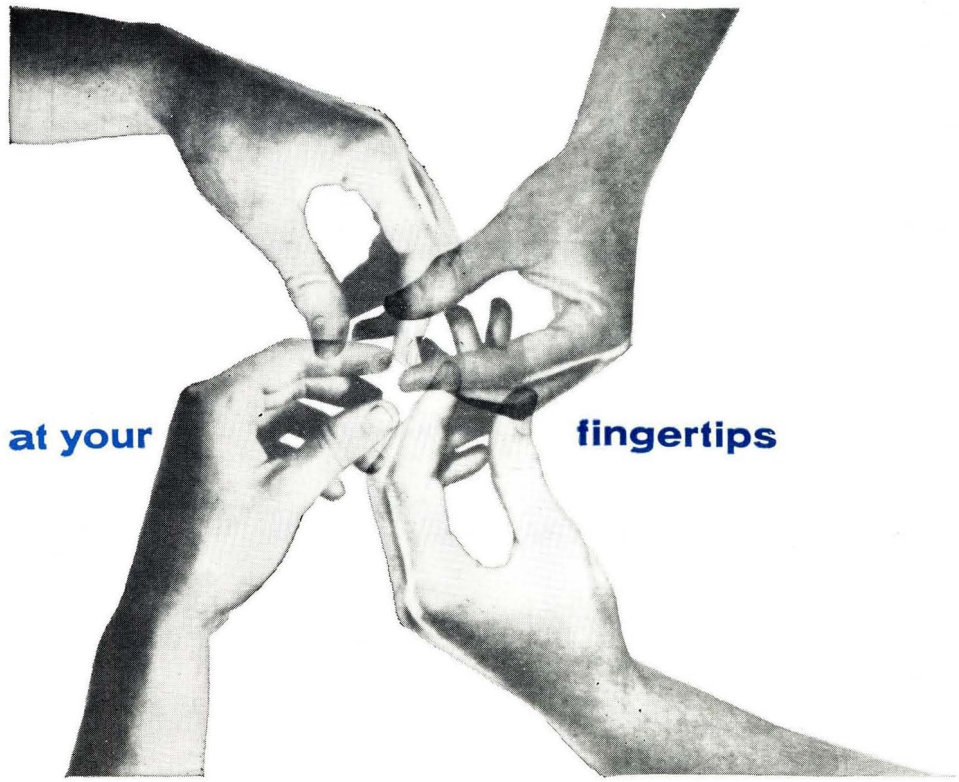
* * *

Published by
The International Sugar Journal Ltd.
Central Chambers, The Broadway,
London, W.5.
Telephone: EALing 1535
Cable: Sugaphilos, London, W.5.

* * *

Annual Subscription: 32s 0d or $5.00 post free
Single Copies: 2s 6d or 45 cents plus postage

VOL. 67 *January 1965* No. 793



If, anywhere in your plant, accurate control of shaft speed is important, then LDEP can be of service to you. LDEP have developed five main types of variable speed drive, available in powers from $\frac{1}{8}$ to 150 h.p., to meet any special set of circumstances. Many of their techniques are new, unmatched elsewhere for efficiency and reliability. Ask for details of LDEP drive control systems, and reprints of articles from technical journals.

LDEP DRIVES DIVISION

LANCASHIRE DYNAMO ELECTRONIC PRODUCTS LIMITED · RUGELEY · STAFFS · PHONE RUGELEY 371 · TELEX 36135

International Sugar Journal

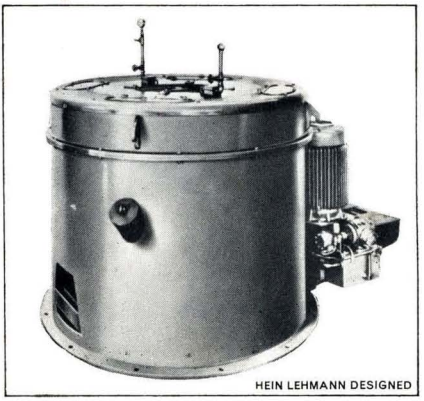
VOL. 67 *February 1965* No. 794

* * *

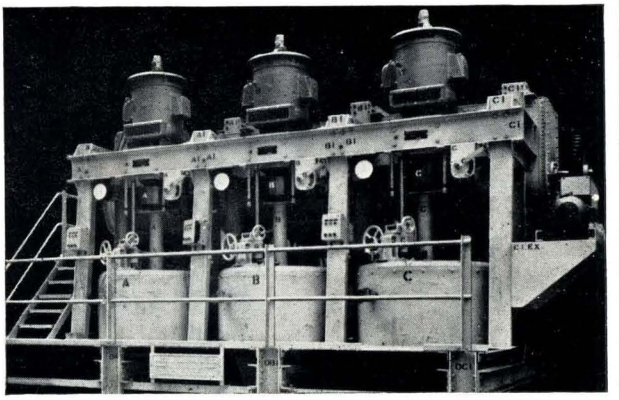
Published by
The International Sugar Journal Ltd.
Central Chambers, The Broadway,
London, W.5.
Telephone: EALing 1535
Cable: Sugaphilos, London, W.5.

* * *

Annual Subscription: 32s 0d or $5.00 post free
Single Copies: 2s 6d or 45 cents plus postage



HEIN LEHMANN DESIGNED



making the grade

. . . in the production of sugar,
Watson Laidlaw machinery has long since
"made the grade".
Watson Laidlaw Batch Type Centrifugals set the
standard in conventional machines of the
highest class, while for Low Grade massecuites, the
Watson Laidlaw built, Hein Lehmann designed
continuous centrifugal is unequalled
for efficiency, labour-saving and
economy in operation.

WATSON, LAIDLAW & CO. LTD., 98 LAIDLAW STREET, GLASGOW, C.5. TEL: SOUTH 2545. GRAMS: "FUGAL" GLASGOW.

International Sugar Journal

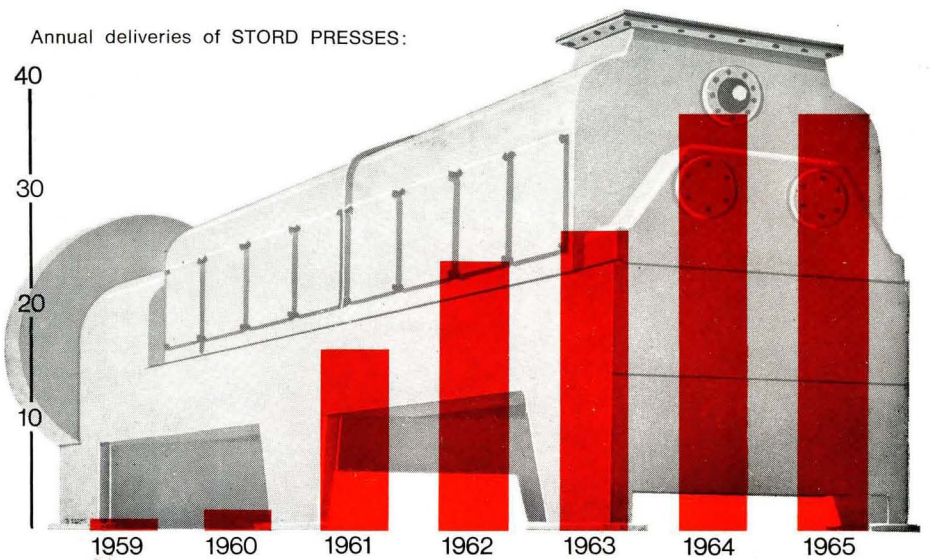
VOL. 67 *March 1965* No. 795

Published by
The International Sugar Journal Ltd.
Central Chambers, The Broadway,
London, W.5.
Telephone: EALing 1535
Cable: Sugaphilos, London, W.5.

Annual Subscription: 32s 0d or $5.00 post free
Single Copies: 2s 6d or 45 cents plus postage

Always in the lead . . .

The Stord press now also in corrosion resistant execution



A symbol of progress — a symbol of confidence

Superior economy and reliability.

Stord Bartz Industri a·s

3. Slottsgaten · Bergen · Norway

International Sugar Journal

* * *

Published by
The International Sugar Journal Ltd.
Central Chambers, The Broadway,
London, W.5.
Telephone: EALing 1535
Cable: Sugaphilos, London, W.5.

* * *

Annual Subscription: 32s 0d or $5.00 post free
Single Copies: 2s 6d or 45 cents plus postage

VOL. 67 *April 1965* No. 796

One Watson, Laidlaw Continuous Centrifugal to do the work of two Fully Automatic Batch Machines

1 = 2

HEIN LEHMANN DESIGNED

The substitution of one Watson Laidlaw continuous centrifugal for two of conventional design represents even more than a fifty per cent saving in capital outlay, installation and space overheads—operational and maintenance costs are still further reduced. And these valuable economies are effected without in any way impairing the machine's very high standard of efficient, uniform production.

WATSON, LAIDLAW & CO., LTD.

98 LAIDLAW STREET, GLASGOW, C.5.
Tel: SOUth 2545. Telegrams: 'FUGAL' Glasgow.

International Sugar Journal

•

Editor and Manager :
D. LEIGHTON, B.Sc., F.R.I.C.

Assistant Editor :
M. G. COPE, A.I.L.(*Rus.*)

•

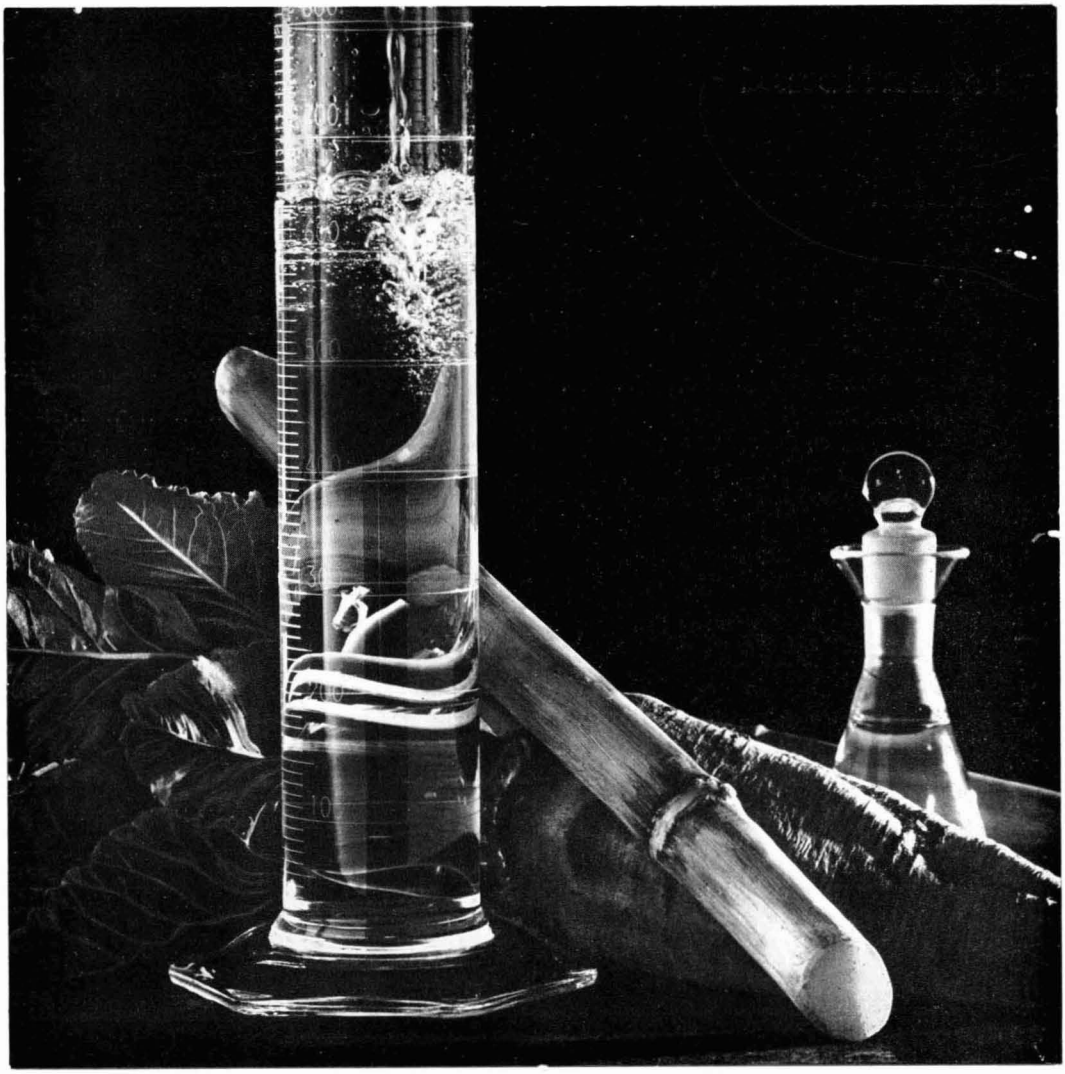
* * *

Published by
The International Sugar Journal Ltd.
Central Chambers, The Broadway,
London, W.5.
Telephone: EALing 1535
Cable: Sugaphilos, London, W.5.

* * *

Annual Subscription: 32s 0d or $5.00 post free
Single Copies: 2s 6d or 45 cents plus postage

VOL. 67 *May 1965* No. 797



Uniform clarity at the lowest cost with Celite Filtration

From month to month, carload to carload, year after year, Celite* diatomite filter aids give you high quality, uniform results. Because Celite is quarried from one pure deposit and processed in the world's largest diatomite plant, there can be no deviation in its performance. This one, closely controlled source assures a continuous supply of a complete line of standard and special grades.

Celite removes suspended colloids and thermophilic bacteria from cane and beet sugar at the fastest flow rates obtainable. As a result, costly fouling of char or activated carbon is greatly reduced. What's more, Celite diatomite's lower density provides greater surface coverage . . . six bags do the work of seven bags of other diatomites. Today, Celite grades include Celite perlite. See your J-M Filtration Engineer for full details or write Johns-Manville, Box 14, N.Y. 16, N.Y. In Canada: Port Credit, Ontario. In London: 20 Albert Embankment, S.E.1.

*Celite Division filter aids, when used as such, are not considered food additives as defined by F D & C Act Amended Section 201(s)

JOHNS-MANVILLE

JOHNS MANVILLE JM PRODUCTS

International Sugar Journal

VOL. 67 *June 1965* No. 798

Published by
The International Sugar Journal Ltd.
Central Chambers, The Broadway,
London, W.5.
Telephone: EALing 1535
Cable: Sugaphilos, London, W.5.

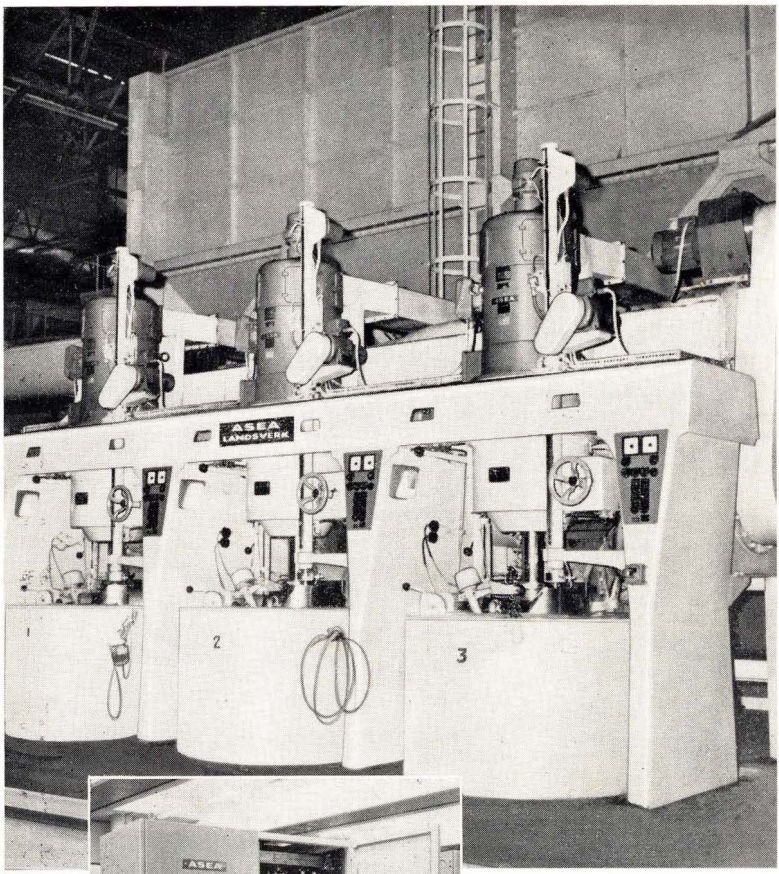
Annual Subscription: 32s 0d or $5.00 post free
Single Copies: 2s 6d or 45 cents plus postage

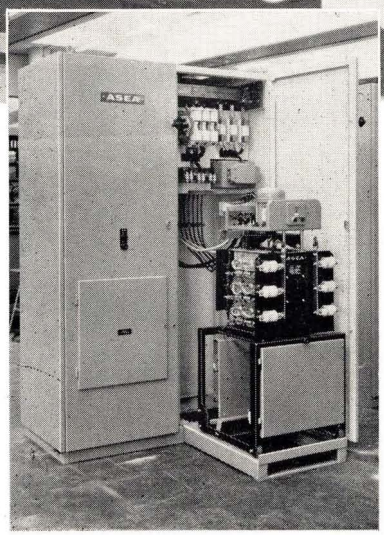
International Sugar Journal

VOL. 67 *July 1965* No. 799

Published by
The International Sugar Journal Ltd.
Central Chambers, The Broadway,
London, W.5.
Telephone: EALing 1535
Cable: Sugaphilos, London, W.5.

Annual Subscription: 32s 0d or $5.00 post free
Single Copies: 2s 6d or 45 cents plus postage





Cubicle with built-in static converter and control equipment.

ASEA-Landsverk centrifugals now supplied to

Argentine
Australia
Belgium
Denmark
Finland
France
Great Britain
Iran
Ireland
Italy
Mauritius
Mexico
Republic of the Congo
South Africa
Spain
Sweden

ASEA-Landsverk

fully-automatic centrifugals

D.C. motor drive with static controlled silicon rectifiers

ASEA

VÄSTERÅS SWEDEN

International Sugar Journal

•

Editor and Manager :
D. LEIGHTON, B.Sc., F.R.I.C.

Assistant Editor :
M. G. COPE, A.I.L.(*Rus.*)

•

* * *

Published by
The International Sugar Journal Ltd.
Central Chambers, The Broadway,
London, W.5.
Telephone: EALing 1535
Cable: Sugaphilos, London, W.5.

* * *

Annual Subscription: 32s 0d or $5.00 post free
Single Copies: 2s 6d or 45 cents plus postage

VOL. 67 *August 1965* No. 800

International Sugar Journal

Editor and Manager :
D. LEIGHTON, B.Sc., F.R.I.C.

Assistant Editor :
M. G. COPE, A.I.L.(*Rus.*)

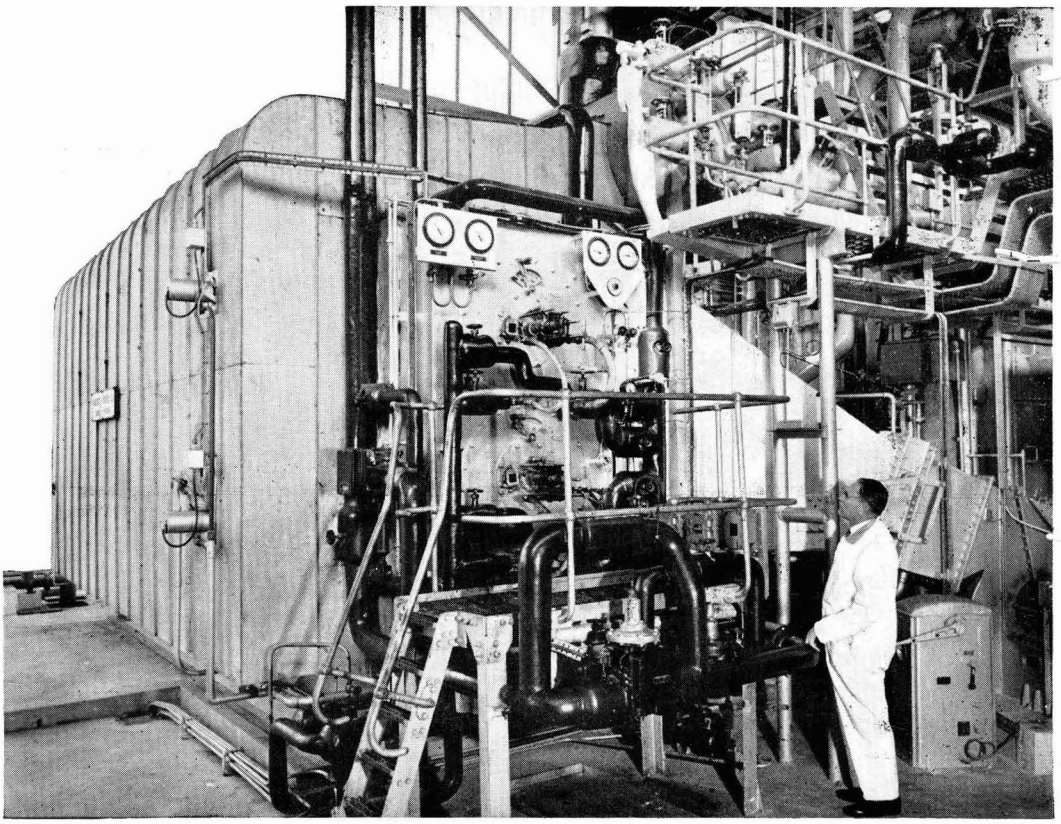
* * *

Published by
The International Sugar Journal Ltd.
23a Easton Street, High Wycombe,
Bucks.
Telephone: High Wycombe 2308
Cable: Sugaphilos, High Wycombe

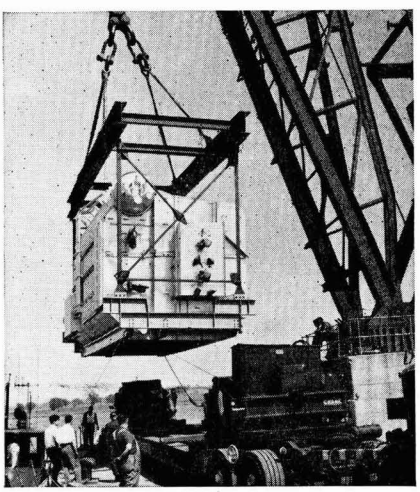
* * *

Annual Subscription: 32s 0d or $5.00 post free
Single Copies: 2s 6d or 45 cents plus postage

VOL. 67 *September 1965* No. 801



TYPE FM 'PACKAGED' WATER-TUBE BOILERS



— FOR POWER AND PROCESS

Many industries needing compact modern steam-raising plant have chosen BABCOCK Type FM oil-fired 'packaged' water-tube boilers. These boilers, with capacities up to some 75,000 lb. of steam/hr. can often be delivered to site as a complete factory-built unit — a feature of the Type FM 'packaged' boiler, which combines the economies of efficient and reliable performance with those of space-saving and speed of installation.

BABCOCK

BABCOCK & WILCOX [OPERATIONS] LIMITED
BABCOCK HOUSE, 209 EUSTON RD., LONDON N.W.1

International Sugar Journal

Editor and Manager :
D. LEIGHTON, B.Sc., F.R.I.C.

Assistant Editor :
M. G. COPE, A.I.L.(*Rus.*)

* * *

Published by
The International Sugar Journal Ltd.
23a Easton Street, High Wycombe,
Bucks.
Telephone: High Wycombe 2308
Cable: Sugaphilos, High Wycombe

* * *

Annual Subscription: 32s 0d or $5.00 post free
Single Copies: 2s 6d or 45 cents plus postage

VOL. 67 *October 1965* No. 802

International Sugar Journal

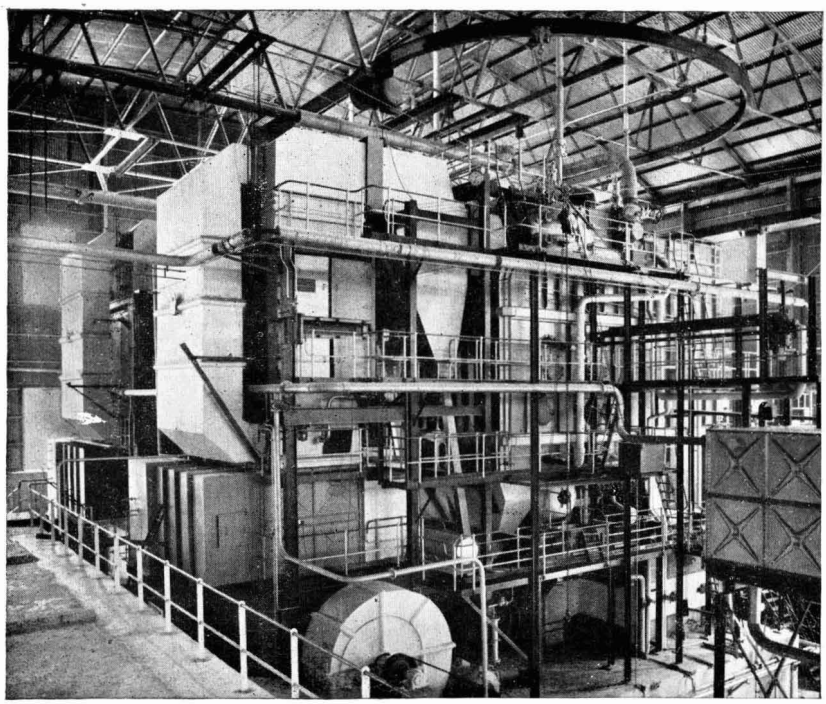
VOL. 67 — *November 1965* — No. 803

* * *

Published by
The International Sugar Journal Ltd.
23a Easton Street, High Wycombe,
Bucks.
Telephone: High Wycombe 2308
Cable: Sugaphilos, High Wycombe

* * *

Annual Subscription: 32s 0d or $5.00 post free
Single Copies: 2s 6d or 45 cents plus postage

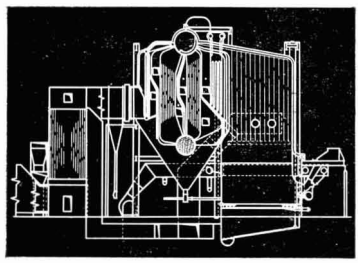


Two 77,000 lb./hr. bagasse-fired Bi-drum boilers serving Medine Sugar Estates, Mauritius. Features are the water-filled hoppers under the dumping grate, periodically flushed to remove ash; and automatic control to maintain steam pressure.

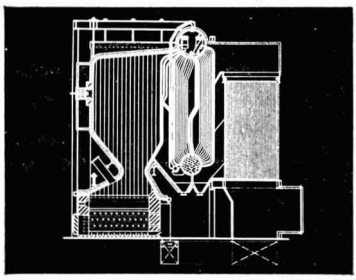
MODERN **BOILER PLANT** for the SUGAR INDUSTRY

For over half a century sugar mills and refineries throughout the world have chosen BABCOCK boilers, fired with conventional fuels such as oil, gas, coal and wood, or with bagasse and other vegetable-refuse fuels, to meet their steam-raising requirements with the utmost reliability, economy and ease of maintenance.

This long and specialised experience is combined with modern design and construction in various types of Babcock boiler plant, with a wide choice of firing equipment to meet local requirements — the versatile Babcock-Detroit spreader stoker, burning bagasse and a variety of other fuels; the widely-used Babcock-Ward bagasse-furnace for efficient combustion and low maintenance and the established Horseshoe and Step-grate furnaces — with auxiliary oil or gas firing, if required.



Bi-drum boiler for bagasse firing with Babcock-Detroit spreader stoker, and auxiliary oil-firing.



Bi-drum boiler for bagasse firing, with Ward furnace and auxiliary oil firing.

BABCOCK

A world-wide organisation

BABCOCK & WILCOX (Operations) LTD., BABCOCK HOUSE, 209 EUSTON ROAD, LONDON, N.W

International Sugar Journal

VOL. 67 *December 1965* No. 804

* * *

Published by
The International Sugar Journal Ltd.
23a Easton Street, High Wycombe,
Bucks.
Telephone: High Wycombe 2308
Cable: Sugaphilos, High Wycombe

* * *

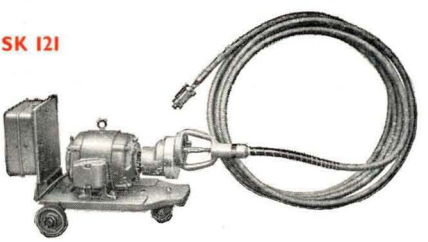
Annual Subscription: 32s 0d or $5.00 post free
Single Copies: 2s 6d or 45 cents plus postage

SCALE DOWN TUBE CLEANING PROBLEMS

How do you scale down a tube cleaning problem? Rapidly! By using "SKATOSKALO" flexible drive descaling equipment designed and manufactured by Gilmans of Warwick. Choose the power to suit your needs, electric, air or petrol engine, Gilmans "SKATOSKALO" can be driven by all three—and is—all over the world!

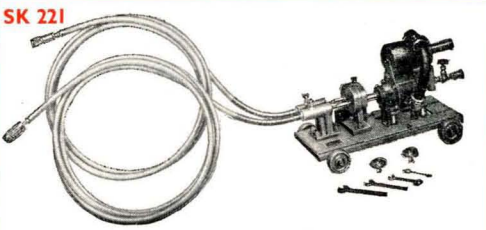
"SKATOSKALO" cleans most types of tubes including those in evaporators, juice heaters, vacuum pans and all types of water or smoke tubes. Gilmans manufacture "SKATOSKALO" machines from ½ to 5 h.p. to suit every requirement. Choose from a comprehensive range of machines (of which two are illustrated below) for descaling or brushing tubes from ½ in. i.d. up to 12 in. i.d.

SK 121



A single speed electric machine geared to give a speed of 4500 or 5000 r.p.m. Suitable for tubes up to 2 in. i.d. with shafts up to 32 feet in length.

SK 221



Twin drive air driven unit provides output speeds of 2800 × 2800 r.p.m. or 2800 × 4500 r.p.m. or 2800 × 1400 r.p.m. Suitable for tubes up to 4 in. i.d. with shafts up to 32 feet in length.

FLEXIBLE DRIVES···
GILMANS OF WARWICK LTD

manufacturers of

SKATOSKALO

Send for catalogue S.65/1

SKATOSKALO WORKS, Millers Road, Warwick.
Tel: 42693 *Grams:* SKatoskalo Warwick. *Telex:* 31451

THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXVII JANUARY 1965 No. 793

NOTES AND COMMENTS

Commonwealth Sugar Agreement arrangements for 1965.

The Ministry of Agriculture, Fisheries and Food, announced on 10th December 1964 that the series of meetings between the parties to the Commonwealth Sugar Agreement which began on 26th October 1964 had been concluded. Agreement was reached on the following matters:

Price for 1965

A thorough review was held of the method of fixing the Negotiated Price laid down in the Agreement. The British Government made proposals for changes in this method. It was decided that there would not be adequate time during the present talks for the full and detailed examination which these proposals required. It was therefore agreed that discussions about them and about any other proposals which may be put forward by the Exporters should continue early in 1965 with a view to reaching agreement on alternative methods, acceptable to both the British Government and the Exporters, of fixing the Negotiated Price which would be reasonably remunerative to efficient producers.

Without pre-judging the outcome of these discussions it has been agreed that the price to be paid for the sugar to be bought by the British Government shall be as follows:—

(i) A price of £42 a ton f.o.b. and stowed bulk for all territories.

(ii) A Special Payment of £3. 5. 0d f.o.b. and stowed bulk for sugar bought from the less developed countries which are members of the Agreement to which shall be added a further sum of £1. 6. 6d representing the benefits which accrued to Colonial Sugar Exporters by virtue of the operation of Colonial Certified Preference. The Special Payment of £3.5.0d is in recognition of the difficulties caused to these less developed countries by the seriously depressed prices of sugar, far below the costs of production of efficient producers, now ruling on world markets and likely to continue throughout 1965.

The Negotiated Price in 1964 was £46.0.10d a ton for bagged sugar c.i.f. (but including freight and insurance only at pre-war levels). The basis of the Negotiated Price has been changed to a price for sugar in bulk f.o.b. and stowed. This and other changes make direct comparisons with the 1964 price impossible. However the sum of the Basic Price and the Special Payment is broadly equivalent to the 1964 Price.

Negotiated Price Quotas

It has been agreed that the quantities of sugar to be bought in 1965 by the British Government shall be as follows:—

Australia	335,000	long tons
British Honduras	20,500	,, ,,
East Africa (Kenya, Uganda and Tanzania)	7,000	,, ,,
Fiji	140,000	,, ,,
Mauritius	380,000	,, ,,
Swaziland	85,000	,, ,,
West Indies and British Guiana	725,000	,, ,,

It has further been agreed that these figures shall be consolidated Negotiated Price Quotas which will be bought in future years and which will not be subject to any automatic increases or decreases arising from changes in British production or consumption of sugar. These figures represent an increase of 50,000 tons in quotas compared with 1964.

Admission of New Members

With the consent of all the existing members Swaziland has acceded to the Agreement in view of the termination on 31st December, 1964 of the British Bulk Purchase Contract with South Africa and the decision to introduce separate marketing arrangements for South African and Swaziland sugar.

All the existing members have also agreed to the adherence of India and Rhodesia to the Agreement with consolidated Negotiated Price Quotas of 25,000 tons each (representing the balance of the South African quota after allowing for the Swaziland quota and the recent increase in the British beet acreage for 1965). Discussions are proceeding with India and Rhodesia with a view to their accession as from January 1st, 1965.

Duration of the Agreement

The Agreement has been extended for a further year and will now run to the end of 1972.

International Sugar Agreement

The parties to the Agreement have re-affirmed their intention to work together for a realistic International Sugar Agreement and have thoroughly discussed together the basis on which they could make an effective contribution to the negotiation of such an Agreement and its subsequent operation.

* * *

Increase in sugar surcharge.

The Sugar Board surcharge of 3½d per lb (32s 8d per cwt) was increased to 4d per lb (37s 4d per cwt) from 11th December 1964. The Minister of Agriculture, Fisheries and Food, on the advice of the Sugar Board, made the necessary orders under the Sugar Act 1956. The change, which was made in order to bring the Sugar Board's trading position more into line with the current level of world prices, permitted an increase of about 4s 8d per cwt in the ex-refinery price of sugar.

* * *

World sugar production estimates, 1964/65.

Estimates of world production of beet and cane sugar in 1964/65 have been published by F. O. Licht K.G.[1] They embody the second estimate of European beet sugar production and are reprinted elsewhere in this issue.

Among the Western European countries slight increases are forecast on the figures of the 1st estimate[2], reflecting the good weather of the harvesting period, with the exception of West Germany and Italy where the estimates are unchanged. In Europe the only change forecast is in Czechoslovakia, where it is thought that the crop will now reach 975,000 tons. Total European beet sugar production is set at 23,810,300 metric tons, raw value, some 560,000 tons more than in the first estimate and 4,150,000 tons higher than the 1963/64 outturn.

Cane sugar production is expected to rise by about 2½ million tons, compared with the 1963/64 figure, although estimates are naturally rather hazardous since the crop has only just or has not yet started in many countries. Total cane sugar production is set at 33,865,100 metric tons and total beet sugar production at 27,982,400 tons, making a grand total of 61,847,500 tons. It is interesting to note that the U.S.D.A. issued its own estimate at the end of November, the figure converted to metric tons being: total cane 32,961,000, total beet 26,741,000, grand total 59,702,000. Whichever is the nearer, it is apparent that a combined crop of some 60,000,000 tons is in prospect, a very considerable jump from the level of the last few years.

* * *

World raw sugar price.

As reported in our issue of last month, the London Terminal Market price fell on the 11th November after a period of almost two months at the level of £32·50 per ton. It slowly declined and at the time of writing has been steady at £27·00 for some days. E. D. & F. Man, writing when the price was £29·50, have pointed out that: "Unless world demand surprisingly increases to a considerable extent, there is every reason to believe that the supply of sugar for the next 12 months is more than sufficient. What remains to be seen is who will need this surplus sugar. As prices fall so demand increases and this is becoming more apparent with each price reduction. If the price were to fall by £5 per ton, we would expect quite an amount of stock replacement and, therefore, the surplus would be moving into buyers' hands. However, as the price falls sellers become less inclined to sell their sugar, preferring to store it themselves in the hope of better levels. It should not be forgotten that the estimated surplus is hardly more than the normal stock that the International Sugar Council made exporting members carry when quotas were effective, and it need not be assumed that all these sellers will get rid of their sugar irrespective of price. Our belief, therefore, is that prices will probably fall a little more meanwhile, owing to the large amount of unsold Western Hemisphere cane raw sugar, but that we are not too far from the bottom."

* * *

Cuban sugar industry organization[3].

Early in July the Cuban Government formed a new Ministry of the Sugar Industry headed by the former vice-Minister of Industries, Lt. ORLANDO BORREGO DÍAZ. Its creation clears the way for the gradual integration of the agricultural and industrial sectors of the industry which, moreover, will not be subordinated to the Ministry of Industries but will raise its position in the administrative hierarchy appropriately to the economic importance of the sugar industry to Cuba.

Planting and cultivation of sugar cane will remain in the charge of the National Institute for Agrarian Reform (INRA) but the new Ministry is authorized to participate in the supervision of agricultural production of cane and control of its delivery to the factories. The new Minister stated his belief that a strong and autonomous agency at the head of the country's 152 mills was indispensable for fulfilment of the plans for increased production, which require more trained personnel, transport, etc., and profound changes as a result of mechanization of harvesting and increased bulk handling.

A new Division of Sugar Technological Advances in the Manufacture of Sugar is being organized and great efforts are to be made to raise the Cuban industry to world technological levels. Supply of materials and spare parts has been improved and courses have begun, for the second year, for training cane grab and harvester operators.

[1] *International Sugar Rpt.*, 1964, **96**, (33), 1–4.
[2] *I.S.J.*, 1964, **66**, 341, 371.
[3] G. BERNARDO: *Cuba Foreign Trade*, 1964, (2), 28–29.

SUGAR CANE AGRONOMY AND BOTANY IN HAWAII

Report of the 22nd Annual Conference, Hawaiian Sugar Technologists, 1964

Several papers concerned with the agronomy or the botany of sugar cane were given at this Congress.

Flowering

The flowering of sugar cane, so erratic in many countries, is always of importance to the cane breeder for he must have the sort of pollen he needs for the production of new and improved varieties. On the other hand very heavy flowering can be the cause of loss of sugar as far as the producer is concerned. The physiology of flowering is the subject of a short paper by R. E. COLEMAN. He points out that while we are still a long way from complete knowledge of the intricate processes involved in the change from a vegetative to a flowering plant, we now have an understanding of certain processes which have been useful in controlling flowering. The importance of photoperiod (length of day), night temperature, leaf and spindle trimming and of certain chemicals, such as maleic hydrazide, are discussed.

Translocation

The translocation of sugar in the plant is the subject of a paper by CONSTANCE E. HARTT (pp. 151–167). Attention is drawn to the value of radioactive carbon (^{14}C) in carrying out studies of this kind and of its advantages over conventional methods of analysis. The technique employed in carrying out this work with radioactive carbon is described. Interesting points emerge from this work. One is that translocation down the leaf-blade starts immediately after the sugar is formed, by no means waiting until night. The velocity of movement in the blade is surprisingly high, i.e. 2·5 cm or approximately 1 in per minute. The radioactive material follows the veins down the blade to the midrib and sheath, moving in the phloem. Leaves of different ages translocate at different velocities, the oldest being the slowest. Good cultural conditions are required for good translocation. Deficiencies in N, P or K interfere seriously with the translocation of sucrose from the blade to the stalk. Translocation takes place all day and all night. Sucrose is the principal, and probably the only, sugar transported.

Irrigation

An account of the overhead irrigation system evolved for 600 acres of former pineapple land put down to cane is given by J. A. RUSSELL. The land normally received only 15 inches of rain during 6 months of the year and supplemental irrigation was required to grow a crop of cane. As there was no surface water in that region wells were sunk. These could not supply enough water to support the area by surface irrigation, but by using overhead sprinklers it was possible to irrigate the entire area adequately.

The system involved the use of two trailer-mounted "Targetmaster" 1500-g.p.m. models, with the accompanying network of ditches, sumps and towpaths necessary for the conveyance of water and the sprinkler units. The two units were moved in leap-frog fashion by tractor along the supply ditch, with one sprinkler in operation while the other was being set up.

Soil Moisture

A paper by F. E. ROBINSON affords a good example of how modern scientific methods are likely to give assistance in estimating the irrigation needs of a cane crop. He describes the use of the neutron meter to establish soil moisture and soil moisture withdrawal by sugar cane roots. Basically the neutron probe consists of a radioactive neutron source, an electronic tube to detect reflected neutrons and a meter to indicate the number of neutrons which are reflected. The neutrons are shot out into the soil. They strike the hydrogen atoms in water and are counted as they rebound to the counting tube. The neutron probe is not recommended as a tool to control irrigation interval during the normal sequence of plantation irrigations. However, where changes in irrigation practices are contemplated, this sort of equipment could provide much needed information on soil moisture storage, effective rooting depth and lateral movement of water.

Weeds

An account of the special weed problems of the island of Hawaii is given by W. J. CRITTENDEN. On the plantations weed control generally begins with a pre-emergence application of either "Diuron" or "Atrazine" followed by a second application of either one or the other. Oil sprays may be interspersed at various times before, in between or after these applications depending upon the weed population and cultural operations. Sometimes 2,4-D is included with the oil spray or may be used separately. Combinations of TCA, "Dalapon", 2,4-D, "Diuron", "Atrazine", OSA and "Pentacide" are also used at various times, especially as spot sprays before the cane "closes in".

Special weed problems are usually those problems that develop in spite of the plantation's standard weed control practices. They are the "harder-to-kill" plants and quite often are not widespread throughout the island's plantations. Two outstanding exceptions to this observation are Crab grass and Wire grass. These grasses are generally found throughout all the plantations. "Diuron", "Dalapon" plus "Diuron", and "Ametryne" have been found to be specially effective on these species. The standard combinations used by the individual plantations are effective to some degree.

A table shows how individual plantations rated the different weeds according to their estimate of relative importance in their own area. Some 300 different weeds are listed, among them Napier (*Pennisetum purpureum*) and Kikuyu grasses (*Pennisetum*

clandestinum), useful grasses in some other countries. It is obvious there is much variation among growers in their estimates as to what constitutes the most serious weeds in their respective areas.

A second table presents a summary of the present plantation practices with weeds and experimental developments in 1963. It is of interest to observe that for grass control repeated applications of "Dalapon" applied by itself or in combination with "Diuron" appear most frequently and for broadleaf control repeated applications of 2,4-D or "Atrazine" and 2,4,5-T applied by themselves appear quite often as control measures.

A paper by T. R. SPARROW, Jr. discusses root characteristics and control of *Passiflora pulchella*, a troublesome cane field weed in some parts of Hawaii. A heavy infestation of the weed produced no less than 27-35 shoots per square foot of soil surface. Vertical roots were traced to depths beyond 5 feet. Five herbicides showed possible ability to control the weed. The best of these was "Torton". At 4 lb per acre it controlled both tap and lateral root-stock growth. Further tests are planned.

F.N.H.

Agricultural Abstracts

Weed control in sugar beets by combinations of thiocarbamate herbicides. E. F. SULLIVAN, R. L. ABRAMS and R. R. WOOD. *Weeds*, 1963, **11,** (4), 258–260; through *Weed Abstracts*, 1964, **13,** (3), 113.—Field observations suggest that the thiocarbamates give satisfactory weed control in sugar beet over a wide range of seasonal conditions, most weeds being affected. None of the the herbicides tested effectively controlled *Kochia scoparia*.

* * *

Brine: weedkiller and fertilizer in one. ANON. *Farmer and Stockbreeder*, 1964, **78,** (3874), 101.—The use of sodium chloride or common salt as a post-emergence weed killer with sugar beet is explained. The recommended application is 30–40 gal/acre saturated solution, or 1 cwt sodium chloride per acre, plus wetter. This is sprayed, as band treatment, over the rows when the sugar beet seedlings are in the 2-leaf stage.

* * *

Weedkillers in sugar beet—the results of the 1963 trials. L. DETROUX and M. MARTENS. *Pub. Tech. Inst. Belge pour Amél. Betterave*, 1964, **32,** (1), 1–40. Trials were carried out on small plots with weedkillers not yet tested or fully tested. Trials with PCA, 634 Dupont de Nemours and "Diuron" plus IPC mixture confirmed results obtained in 1962. The OMU plus PCA mixture, as pre-emergence, did some damage to sugar beet under 1963 conditions. CIBA 4147 proved highly selective for sugar beet, either in pre- or post-emergence. Reactions of some 15 individual weeds are detailed.

How the Caspari compost system works. D. STICKELBERGER. *Compost Science*, 1964, **5,** (1), 15–17.—The composting system developed by Dr. FRITZ CASPARI of Wilhelmsfeld, near Heidelberg, is here outlined. Basically the process consists of blending and briquetting sewage sludge and rasped garbage under pressure (400 p.s.i.). After curing, which involves biological reactions and temperature rise (160°F) killing pathogenic germs and eggs of ascarides, the briquettes are ready. They may then be stored in the open.

* * *

Sugar cane varieties—their adaptability and disease resistance. ANON. *S. African Sugar Assoc. Exp. Sta. Bull.*, 1964, (3, revised), 2 pp.—The object of this bulletin or leaflet is to indicate the suitability of different sugar cane varieties to the four major regions of the South African cane belt and their reaction to the more important diseases. The diseases considered are gummosis, smut, red rot, *Sclerophthora*, Pokkah boeng, sheath rot, mosaic, ratoon stunting, chlorotic streak and streak.

* * *

Efficiency of irrigation in sugar beet. V. L. IONESCU-SISESTI *et al. Lucrari Stunt Inst. Agron. n Balcescu. Serb.*; through *Biol. Abs.*, 1964, **45,** 5695.—Results are reported of growing sugar beet under irrigation in a 5-year experiments in the Danube plain on reddish-brown forest soil. Irrigation increased root yields 34–120% and sugar yield 28–121%. It improved "technical quality" although sugar level was slightly lower. Irrigation encouraged mildew.

* * *

Weeds of Mauritius. E. ROCHECOUSTE and R. E. VAUGHAN. *Mauritius Sugar Ind. Research Inst. Leaflet*, 1963, (8).—This paper, Part 12 of the series, deals with *Heliotropium amplexicaule*, a weed generally found growing along roadsides and waste places and becoming an aggressive noxious weed of cane fields in certain localities. The species is native to South America and is sometimes distributed as an ornamental plant. It was first noticed in Mauritius about 15 years ago, probably introduced as a garden plant. It seeds freely and fragments of root will grow. Eradication by hand is difficult, roots reaching a depth of 3 feet. The plant's reaction to chemical weedkillers is outlined. Some are effective but only at high rates of application. A full description of this weed is given, with drawings. It is said to be causing much concern to sugar growers in the humid zone of the island.

* * *

Translocation. R. DORRINGTON WILLIAMS. *Outlook on Agriculture*, 1964, **4,** 136–142.—This paper, which deals with "translocation in grasses" and is by a member of the Grassland Research Institute staff (Hurley, Berkshire, England) is likely to interest physiologists interested in translocation in cane, sugar cane being simply one of the larger grasses. Autoradiographic studies with carbon-14 in certain perennial grasses are discussed.

UREA AS A FERTILIZER

AN informative article under this heading, by J. K. R. GASSER[1], gives a good account of the history and uses of urea as a fertilizer, its advantages and disadvantages. Its use has increased in recent years and it is well known in some cane growing countries where nitrogenous fertilizers may be all-important.

In a state of nature urea is the chief breakdown product of nitrogen products in mammals and is excreted in the urine. Mature cattle may void about 140 g per head daily, sheep 45 g and humans 30 g. Urea in the urine of farm animals helps in producing farmyard manure and must have some manurial effect in the case of animals grazing on pasture. However, urea from animals on pasture or litter rapidly decomposes. Its use as an artificial fertilizer did not develop until it was prepared on a large scale, at first from calcium cyanamide and later, since 1945, by synthesis from ammonia and carbon dioxide.

The chief merit of urea as a fertilizer is its high nitrogen content (45% N). It is also freely soluble in water and is not corrosive so that it may be used as a leaf spray. It may be mixed with some other fertilizers and with many insecticides and fungicides. Among its disadvantages is the fact that it is hygroscopic and may cake in storage. Decomposition yields free ammonia which may effect germination and early growth of crops. Applied to the surface of soils loss of nitrogen takes place more freely than with other nitrogenous fertilizers. A more serious trouble is that a toxic product, biuret, formed during the synthesis and subsequent processing of urea, may be present. Biuret is formed from two molecules of urea by elimination of ammonia. Folial sprays made from urea containing biuret cause yellowing of the foliage or other forms of injury with certain crops. This biuret toxicity has been closely studied in recent years. When applied to the soil with maize it caused interveinal chlorosis, hyponastic leaf growth and severe stunting.

With regard to the use of urea with sugar cane and beet it is stated—"More recent experiments (PARISH & FEILLAFÉ, 1960; TSAI & SHENG, 1961) confirm the earlier findings reported by SINCLAIR (1937) that urea is less good than ammonium sulphate for increasing yields of sugar cane. With sugar beet, urea increases yields of sugar as much as standard nitrogen sources (ADAMS, 1960; LOOMIS *et al.*, 1960); ADMONT (1959) classified his soils as deep or shallow and found that urea is as good as ammonium sulphate on deep soils, but less good on shallow soils.

The article concludes with the following remarks: "Industrially urea is synthesized from readily available materials, ammonia and carbon dioxide, and at present is sold on the international market more cheaply per unit of N than any other solid nitrogen fertilizer. Urea is also the most concentrated solid N fertilizer, so that distribution and spreading costs are lower than with other forms. These advantages are at present offset by the disadvantages of loss of ammonia from urea and damage to crops, but once these problems have been solved satisfactorily (some possible ways have been indicated) urea appears to be a good source of fertilizer N."

Urea may also be used in feeding livestock—as a nitrogen supplement for animals on low protein pastures or silage. It must be used with discretion as it may be toxic if too much is eaten too quickly[2].

F.N.H.

[1] *Soils and Fertilizers*, 1964, **27**, 175–180.
[2] *Agric. Gaz. N.S.W.*, 1964, **75**, 957-965.

Breeding for tolerance to sugar beet yellows virus and beet mild yellowing virus in sugar beet. G. E. RUSSELL. *Ann. Appl. Biol.*, 1964, **53**, (3), 363–388.—Part I of this paper is devoted to "Selection and breeding methods" and Part II to "The response of breeding material to infection with different virus strains". A wide range of material within the genus *Beta* was tested for immunity and tolerance to beet yellows (BYV) and to beet mild yellowing virus (BMYV). No immune plants were found but a useful degree of tolerance was present in sugar beet. The level of tolerance of other species of *Beta* was not better than that in sugar beet (*Beta vulgaris*). Good tolerance to BYV was not necessarily associated with a good tolerance to BMYV.

* * *

Productivity of polyploid varieties of the sugar beet. N. A. NEGOVSKII. *Agrobiologiya*, 1963, **4**, 531–540; through *Biol. Abs.*, 1964, **45**, 4682.—The author traces the development of polyploid hybrids and discusses in detail strain tests of triploids, carried out in various countries between 1954 and 1961. Productivity of various hybrids is compared. The testing of a number of foreign diploids in the U.S.S.R. showed their general unsuitability to Soviet environments. Work on the development of local hybrids has been in progress since 1956.

* * *

New experimental results on weed control with "Alipur" and "Pyramin" in sugar beets. H. BEINHAUER. *Zucker*, 1964, **17**, 59–64.—In an extensive comparison of these two insecticides "Pyramin" was found to be more selective and superior to "Alipur" under most conditions.

* * *

The influence of straw fertilizing on sugar beet yield. R. HENZE. *Zucker*, 1964, **17**, 102–105.—Where sugar beet is grown in rotation with wheat the straw, after combine harvesting, was converted to artificial manure by the use of calcium cyanamide. Pros and cons of this treatment are discussed.

CANE RESEARCH IN TRINIDAD

Tate and Lyle Central Agricultural Research Station Annual Report, 1963.

This comprehensive and detailed report from Trinidad (272 pp; 8 × 10¾ in) contains a great deal that is likely to be of interest and value to those engaged in the cultivation and production of sugar cane, especially those engaged in research. Apart from introductory matter it is divided into four main parts—agronomy, entomology, plant physiology and soil microbiology—plant pathology.

The activities of this progressive research station (at Waterloo Estate, Carapichaima in Trinidad) are mainly devoted to the more pressing problems facing the cane grower such as: how is the froghopper (*Aeneolamia varia saccharina*), the worst cane pest in Trinidad, to be controlled; which fertilizers should be used, how much, when and where to apply them; how are weeds to be controlled in plant cane and ratoons and which herbicides should be used; which of the newer varieties should be extended to greater acreages; how may juice qualities be improved? It is considered that the control of froghopper, weeds and of mineral nutrition has made good progress, for many of the practices, which only three years ago were in the research or development stage, have become standard estate practice.

A wide range of investigations on froghopper, some of which fall in the category of fundamental research, are given in detail in this report. As far as practical recommendations are concerned it is pointed out that biological methods of control are unpractical at present, although not ruled out for future use, and that estates will need to rely on chemical means of control. Six of the newer insecticides gave acceptable control of froghopper nymphs and were cost-competitive with the standard "Trithion". Recommendations for their use are given. Aerial applications of "Malathion" or wettable "Sevin" should also be considered for control of adult froghoppers.

In regard to weed control emphasis has been on the use of pre-emergence herbicides, preventing weed germination in plant and ratoon cane rather than attacking the weeds after germination has commenced. It is stated that the aim for weed control in the future is to prevent *all* weeds from germinating in cultivated fields and it is stated—"We are, in Trinidad, only a few years from achieving this goal, once we can master the logistical problems." "Atrazine", "Diuron", "Pesco 1815", and "Fenac" are at present in the forefront in Trinidad.

Growth in cane has been the main concern of the Physiology Department. Great emphasis has been placed in the search for endogenous "gibberellin-like" growth factors and it has been confirmed that sugar cane tissue contains such substances, which differ from known gibberellins.

With regard to soil microbiology, during 1963 emphasis shifted from the quantitative to the qualitative aspect with particular reference to the isolation and identification of soil fungi. Species of *Aspergillus*, *Fusarium*, *Gliocladium*, *Monilia*, *Penicillium*, *Phoma* and *Trichoderma* were the most common fungi in the soils which were studied. "Dowpon" and "Atrazine", two herbicides commonly used on the estates, were found not to effect the qualitative composition of the fungal population of the soil.

It would seem that there is a great deal of mutual cooperation and liaison between this research station and sugar estates in Trinidad and that a happy relationship between them exists. Furthermore the Agronomy Department of the Station has undertaken certain lines of work with food crops and drug plants in connexion with the Trinidad and Tobago Ministry of Agriculture—as a public service. A new plant growth medium has been developed, details of which will be published later, in which very satisfactory crops of both temperate and tropical vegetables appear to have been raised, viz.—lettuce, endive, carrots, celery, beetroot, tomato, capsicum, beans, pigeon pea and sweet corn.

F.N.H.

Perspectives in sugar cane disease control K. V. SRINIVASAN. *Indian Sugar*, 1963, **13**, 557–560.—The difficult question of the control of red rot (*Physalospora tucumanensis*) which continues to be a serious disease in northern India is discussed. The readiness with which new strains appear is stressed and the mechanism of infection explained. Wilt disease (*Cephalosporium sacchari*), which causes most damage in the south, is also discussed.

* * *

Tongaat's Wewe dam—an ambitious undertaking. ANON. *South African Sugar J.*, 1964, **48**, 101–103. Information is given on this dam on the Tongaat River in Natal which will act as a reservoir to supplement the flow when this is less than the amount required for irrigation. Its purpose is to bring the maximum area of cane under overhead irrigation in the minimum of time. Storage capacity could be as much as 1160 million gallons. It will be one of the largest privately owned dams in southern Africa.

* * *

Cytospora **leaf sheath rot of sugar cane.** S. FLORES C. *Bol. Azuc. Mex.*, 1963, (174), 3–6.—This fungus disease (*Cytospora sacchari*), first recorded in Mexico in 1947 and common in low-lying badly-drained areas, is described. Results of some work carried out at Louisiana State University are summarized, and a list of susceptible and resistant varieties of sugar cane in Mexico is given.

History of sugar cane in Mexico. (A) F. CRUZ C. *Bol. Azuc. Mex.*, 1963, (174), 14–16; (176), 20–21. (B) V. LEDESMA. *ibid.*, (177), 12–13.—These articles form a series dealing with the history of sugar cane cultivation from the earliest days in Mexico, and cover the States of Morelos and Chiapas, and Puebla, respectively.

* * *

Ratoon stunting disease in Taiwan. H. P. LIU. *Taiwan Sugar Quarterly*, 1963, **10,** (4), 9–11.—This paper deals with purification of a nucleoprotein associated with diseased cane. The disease, which occurs all over the island, was first recorded there in 1954.

* * *

Sugar cane cultivation in alkaline soils of North India. R. R. PANJE *et al. Indian Sugar*, 1964, **13,** 673–675.—The successful method employed consisted of ploughing, irrigating and making furrows 20 cm deep to take the planting sets, which were covered with 4–5 cm of soil and then irrigated. Six weeks later, with the shoots established, the trenches were filled in with cane trash and given subsequent irrigation during growth. Good yields were obtained, the trash conserving moisture and heavy waterings removing alkali. Good yields were also obtained by using black polyethylene between the rows, but the cost was too high.

* * *

Evaluation of "Fenac" for control of Johnson grass and other weeds in sugar cane. R. W. MILLHOLLONY. *Sugar J.* (La.), 1964, **26,** (10), 22–26.—"Fenac" (2,3,6-trichlorophenylacetic acid) with its outstanding weed control properties is considered safe to use in plant cane, for pre-emergence control of Johnson grass seedlings (*Sorghum halepense*) provided it is applied in early spring (4 to 8 lb per acre). It may cause injury to sugar cane roots if excessive rates are applied or more than one application a year. "Fenac" was more effective than related compounds with similar chemical structures.

* * *

Dusting experiment at Pongola. ANON. *South African Sugar J.*, 1964, **48,** 115, 180–181.—Details are given of a gigantic dusting operation by air of 16,000 acres of cane and 9000 acres of grazing land in an attempt to control the green leaf-sucker, *Numicia viridis*, first recorded as a pest of sugar cane in South Africa in 1962. "Malathion" powder was used. As this is not effective against eggs part of the area will have to be treated a second time. Some minor difficulties that arose and had to be overcome are mentioned. It is hoped that studies made on the perimeter of the cane area will yield important data on the development and migration of *Numicia* populations.

Three harvesters for field trials. G. S. BARTLETT. *South African Sugar J.*, 1964, **48,** 379–383.—As a result of the South African Mechanical Harvesting Delegation to Australia, Hawaii and the United States, three machines are to be imported to South Africa for field trials. They are the Crichton and Massey-Ferguson from Australia and the J. and L. "Bluebird" from Louisiana. Details about them are given.

* * *

Sugar beet storage on concrete bases. J. R. MASTERS. *British Sugar Beet Rev.*, 1964, **32,** 180–182.—Advice is given on the best methods of construction and on size of base according to estimated beet tonnage.

* * *

Spring mechanization in the fens. M. E. MAWBY. *British Sugar Beet Rev.*, 1964, **32,** 183–185.—Difficulties in using some forms of modern machinery (e.g. thinners) in the fens because of the very friable peaty soil are pointed out and means of overcoming them suggested.

* * *

Petroleum mulch trial. R. FLETCHER. *British Sugar Beet Rev.*, 1964, **32,** 186.—This mulch is actually a water emulsion of petroleum-derived resins and is applied as a band spray with simple equipment mounted on a normal precision drill. It dries to form a continuous black film over the soil, conserving moisture and warming up the soil because of its dark colour. The beet seedlings readily break their way through it. Small scale trials gave increases of two tons per acre of clean beet. Further trials are envisaged.

* * *

Beating the stones. W. D. KNOWLES. *British Sugar Beet Rev.*, 1964, **32,** 195–196.—Details are given of making and fitting a steel attachment to a precision drill for sugar beet to enable it to function properly in very stony or flinty ground.

* * *

Sugar cane diseases and varieties in Mauritius. A. L. NAIRAC. *Mauritius Chamber of Agriculture, President's Report* 1963–64, 16–17.—The year 1963 is referred to as uneventful, so far as cane diseases were concerned. The extent to which different varieties are attacked by ratoon stunting disease is indicated. Much progress has been made in the campaign against Fiji disease in Madagascar, susceptible canes having been replaced in the commercial plantations by resistant varieties, notably Pindar. Good control in scattered village plantations is referred to. An up-to-date analysis of the variety position in Mauritius is given. Mauritius varieties covered 71% of the total

area grown. The leading variety, M147.44, increased from 26% to 29%; Ebène 1/37 still ranked second, going from 21% to 18%; M134/32 dropped from 13% to 9%. Three other Mauritius varieties showed small increases (1–2%). The two Barbados varieties represented 17% as against 18% in 1962.

* * *

Sugar cane irrigation. K. CARMICHAEL. *Producers' Rev.*, 1964, **54,** (5), 7–11.—The advantages of sugar cane irrigation in Queensland are stressed. Average increases in yield are 10–12 tons of cane per acre. Figures are given showing the acreages of cane under irrigation, surface and spray, for the various cane growing districts or shires, the total amounting to 91,732 acres.

* * *

Isis varieties performance. ANON. *Producers' Rev.*, 1964, **54,** (5), 45.—In the Isis district of Queensland the Hawaiian cane H48-3166, with its high yield, has been prominent in the drive for extra output. It is unsuited for dry districts and exhibits dry weather distress quicker than the hardier canes. Q76 and Q68 have been accepted as general purpose canes and POJ 2961 as a special purpose cane.

* * *

Sugar industry as major potash user. ANON. *Producers' Rev.*, 1964, **54,** (5), 45.—Last year Australia's consumption of potash jumped by 15,000 tons of which the sugar industry used 10,000 tons. Queensland uses 52·1% of Australia's total potash consumption—some 70,000 tons.

* * *

Sterile cultivation of excised roots of sugar cane. O. W. STURGESS. *Tech. Comm. Bureau Sugar Exp. Sta.*, 1964, (1), 1–14.—The cultivation of roots, excised from cane nodes, in sterile nutrient solutions is described. This work was undertaken with a view to assisting root-infection studies with chlorotic streak disease.

* * *

Studies with chlorotic streak disease of sugar cane. O. W. STURGESS. *Tech. Comm. Bureau Sugar Exp. Sta.*, 1964, (2, 4 & 5), 17–27, 39–55.—These papers continue earlier studies. No. 2 (XI) is subtitled "Sterile cultivation of roots excised from diseased and healthy nodes", No. 4 (XII), "Additional factors affecting transmission and the probable existence of a soil-borne vector" and No. 5 (XIII), "Results from the thermotherapy of diseased cane". The opinion is expressed that the soil-borne vector is probably a nematode.

* * *

Sterile cultivation of excised cane roots infected with ratoon stunting disease. O. W. STURGESS. *Tech. Comm. Bureau Sugar Exp. Sta.*, 1964, (3) 29–38.—Experimental work recorded supports the view that the disease is due to a virus, the roots being the main sites of virus concentration. The mechanism underlying root infection and disease development is complex and not fully understood. The virus may be readily transmitted experimentally to excised roots.

* * *

Factors affecting the incidence of downy mildew in beets in Sweden, 1946-1963. K. BJÖRLING and G. MÖLLERSTRÖM. *Socker Handl.* II, 1964, **19,** 17–33. During the 18 years, attack by downy mildew (*Peronospora farinosa* synonym *P. schachtii*) varied greatly—the number of plants attacked ranging from less than 0·1% to about 35%. The extent of attack depends upon 3 main factors: (1) weather conditions, (2) number and distribution of initial infection sources during the spring and (3) nature of control measures. The chief source of infection is infected beet seed crops.

* * *

Breeding for new commercial sugar cane varieties at Canal Point, Florida, 1963-1964 crossing season. P. H. DUNCKELMAN. *Sugar Bull.*, 1964, **42,** 213–222. Details are given of the widened scope of the USDA sugar cane breeding programme for the 1963/64 crossing season. Most of the new parent varieties originated at Canal Point in 1957 and 1958. Important considerations were cold and disease resistance, high sugar content early in the season, good juice quality, erect stalks, strong root systems and low fibre content.

* * *

The plant nematode problem of the American tropics. G. STEINER and E. M. BUHRER. *J. Agric.* (Univ. Puerto Rico), 1964, **48,** 69–126.—Sugar cane is one of the main crops discussed. A theory put forward is that the beneficial results from the constant replanting of cane, as commonly practised, may be due in reality to nematode infestation of old stands, and not to soil exhaustion. Over 400 references are given.

* * *

Immunity of sugar cane to the reniform nematode. J. ROMÁN. *J. Agric.* (Univ. Puerto Rico), 1964, **48,** 162–163.—The reniform nematode (*Rotylenchulus reniformis*) has a wide range of host plants in Puerto Rico and in other countries. It attacks pineapples severely. Sugar cane is quite immune and therefore might be rotated with pineapple.

* * *

Artificial ripening of sugar cane with "Dalapon". R. A. YATES. *Trop. Agric.*, 1964, **41,** 225–230.—An account is given of trials carried out first in British Guiana and then in Queensland to test the value of "Dalapon" for ripening cane. In British Guiana there was a response in cane quality (using 1 to 4 lb/acre of 85% "Dalapon") only under conditions of moisture stress and low humidity. In Queensland this did not apply, probably because of low night temperatures.

IMPROVEMENT OF WHITE SUGAR CRYSTAL QUALITY IN VACUUM PANS

By T. RODGERS and C. L. LEWIS

Paper presented to the 17th Tech. Conference, British Sugar Corporation Ltd., 1964.

PART I

THE encouraging results from tests started two years ago at King's Lynn Factory on mechanical circulation of massecuite, and which have been reported previously[1,2], have led to further installations. As a result, the following was the position last campaign: Brigg has 2 stirrers fitted in low-head pans, Cantley has 4 stirrers in parallel-sided pans, Ipswich has 2 stirrers in low-head pans, and King's Lynn has 4 stirrers in 2 parallel and 2 low-head pans.

Below, when considering differences in results, we compare relevant points in the design, and drawings are shown of all pans. It is as well to have these pan shapes in mind when considering the overall practical results.

We shall first of all consider the experience at King's Lynn where, for the first time last off-season, 100% "stirred" sugar was stored in silos until September, and continually despatched by bulk transport until emptied. When the first pan stirrer was installed at this factory in 1961, the most noticeable feature was the very low moisture and ash in the white sugar produced, compared with that from the other pans operating under exactly similar conditions. It had previously been suspected that the well-known difficulties experienced with silos—caking of the sugar and, in bad cases and especially near silo walls, an actual increase in invert sugar after considerable storage periods—were caused by excessive moisture in the ingoing sugar. Before 1961 a considerable amount of work was done on sugar drying in our Corporation, including the use of chemical air drying, to reduce sugar moisture, but this was not really successful, because there appeared to be a minimum value below which it was impossible to reduce the moisture. This minimum varied slightly between factories but a value of 0·025%, as measured by our standard 3-hour test (which we now know does not measure all moisture present), was considered very good. When we then found results in the range 0·012–0·015%, with correspondingly lower "bound moistures", for sugar from the stirrer pan, it became apparent that if our suspicion of the correlation between sugar moisture and storage quality was correct, we had here a tool which could help tremendously to overcome previous difficulties.

1962 saw the installation of stirrers in all pans at King's Lynn, so that the storage results on sugar during 1963 were of the greatest interest and utmost significance. The quality of the sugar, and its free running characteristics, were superior to anything experienced previously with the silo installations. In all samples taken up to September, when the silos were empty, the increase in invert sugar was negligible, and caking of sugar on the sugar floor was a minimum. Similarly, the transport vehicles were untroubled with caking on the walls, a condition which occasionally occurs, particularly with freshly produced sugar. It is normal practice at silo factories to pass the reclaimed sugar through a granulator before despatch, mainly to remove any bound moisture that has been released during storage. In 1963 this granulator was used at King's Lynn only because it is also part of the conveying system, and it was found quite unnecessary to heat the air to get very dry sugar. The ultimate proof is in the experience of the factory staff in handling the sugar, and in this context they are of the undoubted opinion that silo storage was better than ever before experienced at the factory. As for storage in 1964, it appears very much as though the satisfactory results at King's Lynn have continued.

In the meantime, silos were erected in 1963 at Cantley and filled for the first time in the campaign. Again storage results are most satisfactory and appear to be equally as good as those in King's Lynn. At Cantley, much of the sugar goes direct to packeting plant, and at present this operation is quite trouble-free without any pre-treatment of the sugar.

In assessing the effect of stirrers on white sugar quality, we can use analytical results, and so be more specific in our estimates. This can be done on the 1963/64 campaign's production, using the results from Cantley as well as King's Lynn, where 80% and 100% respectively of white sugar production was with stirrers. It is reasonable to consider those factories which have reported success with the installations, as the fact that Brigg and Ipswich with their 66% and 50% production respectively have been relatively unsuccessful must be due to other reasons which will be discussed later. The spectacular improvements at Cantley and King's Lynn, where no other important alterations affecting sugar quality have been made in the same period, can only be attributed to improved massecuite circulation.

In the British Sugar Corporation a rather elaborate white sugar quality formula, taking into account all the important physical and chemical characteristics of a sugar, has been evolved by D. HIBBERT, Head of the Central Laboratory. There are in fact two formulae,

[1] RODGERS & LEWIS: *I.S.J.*, 1962, **64**, 359–362; 1963, **65**, 12–16, 43–45, 80–83.

[2] *idem ibid.*, 1963, **65**, 261–264, 293–296, 324–327.

one being an index of evaluation for the domestic market, the other for the industrial market. To compare the effect of stirrers, we have used these indices as measured over the last four campaigns taking the individual factory values for King's Lynn and Cantley against the average values obtained for the remaining 12 factories. The physical and chemical measurements which are the components of each index are the average campaign results as measured by Central Laboratory, who also produce the indices. The results of these comparisons are shown in Figs. 1 and 2.

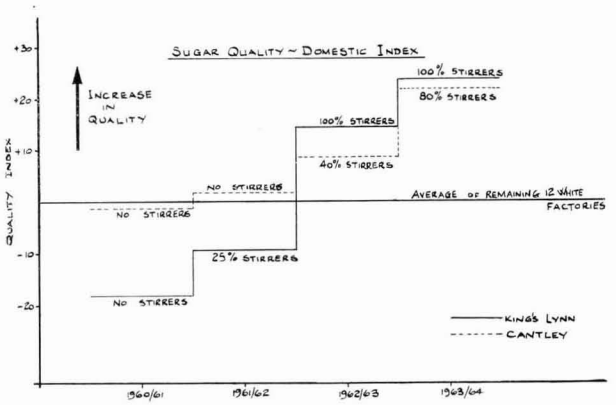


Fig. 1

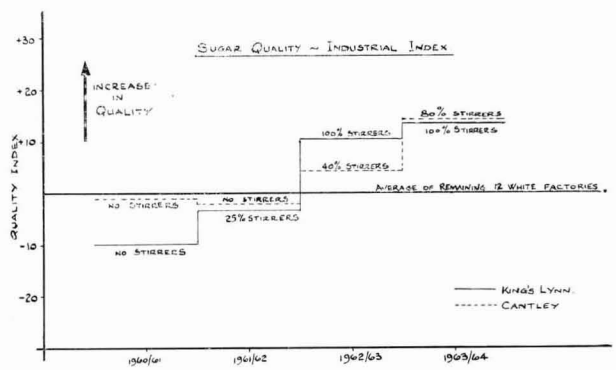


Fig. 2

Absolute values have not been used, as this is not necessary. We have used the 12-factories index as a base for the comparison, as this eliminates seasonal variations, as well as the fact that there is a natural tendency for improvement at all factories from year to year owing to minor effects. This illustrates, as accurately as possible, the sole effect of the stirrer installations on the relative white sugar qualities between the two factories concerned and the remaining Corporation factories. The improvement is so obvious that it needs no further comment.

As mentioned, the indices include physical characteristics such as M.A. and C.V. We now know that the chemical improvement is due to the almost complete elimination of conglomerates, thus leaving less surface impurities on the crystals because of easier purging in the centrifugal, and a fairly accurate way of measuring this improvement is to determine the ash and/or moisture in the dried sugar, in this respect the initial moisture giving a sufficiently accurate indication. We have therefore constructed Figs. 3 and 4, again using Central Laboratory campaign average results for King's Lynn and Cantley with the 12 factories average, as previously explained. Of course, this comparison assumes that each factory is using at least the minimum wash water in the white centrifugals to remove that syrup which is easily purged, but this can be accepted as being so in all B.S.C. white factories. These graphs again show a very good correlation between the reduction of ash and moisture in white sugar and the installation of mechanical circulation.

Stirrer Design

The original installations consisted of a four-bladed propeller fixed to the bottom of a 6-inch diameter mild steel shaft, the whole suspended from the gearbox bearing, through a gland formed in the centre of the top dome of the pan. The gearbox is of the worm reducer type, nominal size 17-inch centres, capable of transmitting 80 h.p. The drive is by an 80 h.p. slip-ring motor, and in recent arrangements the power is transmitted from motor to gearbox through a suitable V-rope drive. The electrical starter is of the resistance type. Needless to say, the pan top dome has to be modified to carry a baseplate which in turn carries the driving gear.

The capital cost of such a unit is a little less than 20% of the complete pan installation. In addition, there is the cost of power and maintenance. Maintenance costs have been negligible, and there is every indication that they should remain low. It can be ambiguous to fix a cost for power in our industry with back-pressure turbo-alternators, but they surely must bear their proportion of the cost of new generating plant when this eventually becomes necessary owing to continually increasing power demands. The maximum reduction in total cost of such an installa-

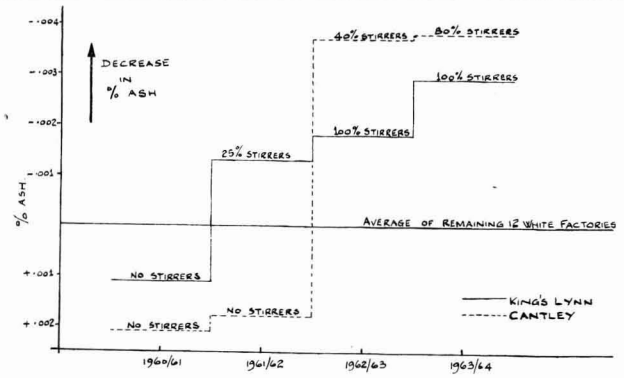


Fig. 3

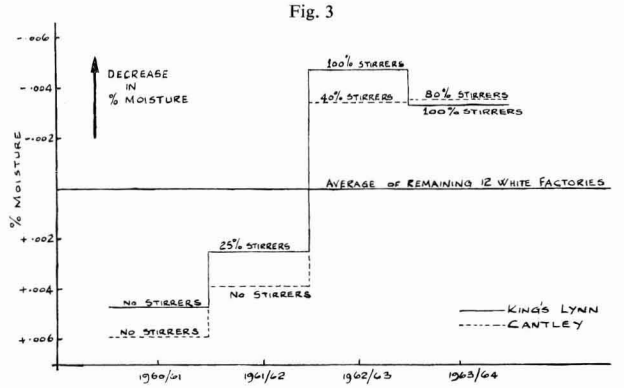


Fig. 4

tion would therefore be achieved by minimizing the power required to get the optimum results.

For this reason investigations were carried out in the 1963/64 campaign on power requirements throughout the boiling of a strike, and this was done on the four pans of varying shapes and sizes at King's Lynn. The results, in some cases at varying speeds, are shown in Table I. These results are also plotted as a graph in Fig. 5.

It can be seen, possibly more clearly from the graph, that the results are fairly consistent, and that the h.p. consumed lies between 30–35 for 90% of the boiling time. It is a little higher at graining point, and of course climbs very steeply when the pan is "Brixing-up" over the last few minutes. The only curves on the graph which lie outside these general comments are for Pan No. 2 running at 93 r.p.m. and Pan No. 3 at 100 r.p.m.; neither of these pans however have given outstandingly good results at these speeds, on the contrary they are more difficult for the boiler to control.

Generally speaking, Pan No. 1 running at 75 r.p.m. has given satisfactory results, so that if we design our motor to suit a typical power curve from this pan, the motor should be adequate for our purpose.

This typical curve is shown in Fig. 6. From this it can be seen that while the pan is "running up", the power consumed is 32/33 h.p., and that a 50 h.p. motor would adequately cover practically all the boiling time. The power demand only exceeds the rating for the last 2/3 minutes of the boiling, and the motor could be capable of handling this on a temporary overload basis.

The decision has been taken therefore to fit future white pan installations with a 50 h.p. motor, and in doing so the size of starter can be correspondingly reduced. This is the minimum power for which we would care to cater with the present stirrer design. However, by fitting the properly designed motor, the power factor will be less adversely affected, and when using the stirrer as a mobility meter in an automatic control system, the motor power measurement will be more sensitive to variations in massecuite mobility.

Table I

Power/Time relationship with stirrers at King's Lynn

PAN No. 1						PAN No. 2				PAN No. 3				PAN No. 4			
75 r.p.m.		75 r.p.m.		75 r.p.m.		93 r.p.m.		100 r.p.m.		80 r.p.m.		80 r.p.m.		80 r.p.m.	
Time	*h.p.*	*Time*	*h.p.*	*Time*	*h.p.*	*Time*	*h.p.*	*Time*	*h.p.*	*Time*	*h.p.*	*Time*	*h.p.*	*Time*	*h.p.*
Grain	41·5	Grain	42·4	Grain	42·4	Grain	53·5	Grain	45·5	Grain	35·2	Grain	33·6	Grain	32·0
28	32·0	13	33·6	15	32·0	15	41·5	15	44·0	15	30·4	20	30·4	20	28·0
60	32·8	28	36·0	45	32·0	40	40·0	20	40·0	35	29·6	50	30·4	30	28·0
80	33·6	33	32·0	75	32·8	65	42·4	35	37·6	55	29·6	75	29·6	45	29·6
110	36·0	48	32·8	95	34·0	90	44·0	60	37·6	75	28·8	90	29·6	70	29·6
122	35·2	63	32·0	115	36·0	105	44·0	80	37·6	100	33·6	115	29·6	100	29·6
136	36·8	83	32·0	135	37·6	120	44·8	110	40·0	125	32·0	140	31·2	125	34·4
151	36·0	117	32·8	150	40·0	150	72·0	135	45·5	155	33·6	160	35·2	155	36·0
160	45·5	128	32·8	165	56·0			150	48·8	180	32·8	164	35·2	180	48·0
165	57·5	140	34·4	180	56·0			160	60·8	195	48·0	170	45·5		
		147	37·6					165	72·0						
		150	40·8												
		152	44·8												
		155	52·0												
		156	60·8												
		157	72·0												

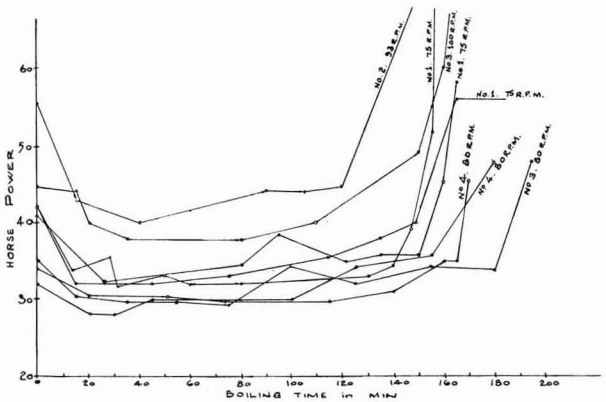


Fig. 5

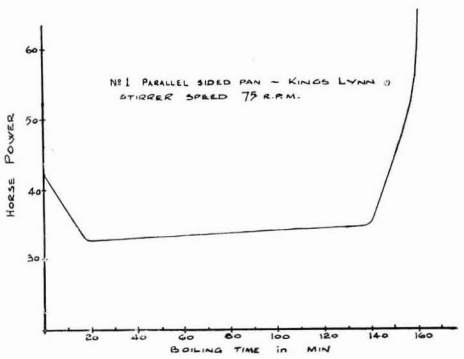


Fig. 6

The total capital cost of motor and starter will then be reduced by 15% compared with the initial installations.

There follows, of course, the question of the gearbox. From the graph in Fig. 6 it seems probable that a 60 h.p. rating would suffice. If a more efficient type than the present worm reducers could be accommodated, it should be possible to make a further slight reduction in motor h.p. The question is at present under discussion with gearbox manufacturers, but it is necessary to take into account that the total weight of shaft and impeller (approximately $1\frac{1}{2}$ tons) is suspended on the gearbox bearing. Any new box must have a bearing capable of handling this load.

No serious mechanical trouble has yet occurred on any installation, so that there is no need to alter the design from the reliability aspect. Current installations will retain the V-belt drive as a means of speed variation. However, unless tests in the 1964/65 campaign reveal some new information in respect of variation in speed, this is a feature that can possibly be left out of future installations.

(To be continued)

DEVELOPMENT OF SUGAR CANE PRODUCTION IN EMERGENT TERRITORIES

By M. N. LUCIE SMITH, M.A., B.Sc.

Paper presented to the Massey-Ferguson Mechanized Sugar Cane Production Conference, 1964

Introduction

FOR the purposes of this paper, the term "emergent territories" has been taken as meaning countries which have had no previous history of cane sugar production on a commercial scale. Many of these will be newly independent countries which previously were debarred from producing sugar, owing to the metropolitan country's adherence to some form of market control. The export market is still largely taken up by the established producers, but, in cases where domestic consumption is sufficient to support a sugar industry, new countries look to sugar production as a means of reducing imports and conserving foreign exchange.

This is the main attraction of developing a local sugar industry since the recurrent saving in exchange resulting from the substitution of domestic sugar for the imported article can be substantial, even for a country with a comparatively small population and a low consumption per head, and is one that will increase with rise in the population and in the standard of living. An initial outlay of foreign currency, mainly for the factory is, of course, necessary at the outset but this is recovered within a very few years once production commences.

There are other major advantages to be derived from a sugar industry in an under-developed country. One, of course, is employment, as sugar is a labour-intensive crop. However, besides creating employment, sugar, by virtue of its being an industrial as well as an agricultural product, assists the general development of a country by providing a cadre of technicians and skilled tradesmen and by serving as a starting point for other industries. In the first regard, a new sugar venture requires, and must train, engineers, chemists, laboratory technicians, electricians, fitters, mechanics and many other types of artisan. In the second regard, by-products of the

sugar industry may serve as raw material for subsidiary industries, such as distilleries, pulp and paper mills, cattle feed manufacture, confectionery works and manufacture of various chemicals or motor spirit.

Difficulties of establishing a new industry

The establishment *de novo* of a sugar industry in a country which may lack many facilities is not an easy undertaking. Careful consideration must be given to a variety of factors, such as the availability and extent of suitable land; the existing vegetal cover as affecting cost of clearing; the topography in relation to transport, mechanical cultivations, irrigation, soil conservation and drainage; outside communications as affecting both the importation of machinery, equipment and supplies and the distribution of sugar; supply of water for industrial, irrigation and domestic use; availability of labour; climatic conditions; and soils.

In many instances essential data will be lacking and preliminary work must be undertaken in the way of topographical and soil surveys, soil borings, water table investigations and collection of hydrological and meteorological data.

In any case, in a new country, pilot plots must be established, firstly to bulk-up planting material and, secondly, to provide data as to suitable varieties and practices as well as the cane quality to be expected under local conditions. The latter information is required to estimate yields and financial returns and also to plan the capacity of the factory in relation to the fibre throughput, sucrose in the cane and purity of the juice.

Adequate preliminary investigation, followed by careful planning and estimating, are of paramount importance to the success of a new sugar venture. There have been several recent instances of poor success of a sugar project arising from causes which could probably have been obviated by a pilot phase of sufficiently long duration—unsuitable agricultural practices, an irrigation system unfitted to the soil characteristics, harvesting and transport equipment unsuited to the local conditions and so on.

However, it is rarely possible to devote to a new project the optimum investigational time that would be desirable to eliminate, so far as is possible in any agricultural undertaking, the occurrence of unforeseen difficulties in the subsequent implementation of the scheme. Firstly, the local government, which is bound to be involved to a greater or lesser extent, is naturally not fully conversant with all the complexities of developing a modern sugar industry and, equally naturally, is usually impatient of any delay once the decision has been taken to establish a sugar industry. A second and more cogent reason for haste is that the development of a new sugar industry is a very costly undertaking and, if loan capital has to be raised, it becomes a matter of importance to attain production as soon as possible in order to meet the very substantial cost of servicing that capital.

From the foregoing it will be obvious that a considerable amount of detailed preliminary work must be carried out in a limited amount of time if a sugar industry is to be successfully developed in a new country. Essential data must be collected on the meteorology, hydrology, topography and soils of the areas as well as on the behaviour of sugar cane under the prevailing conditions. Civil Engineering Works for drainage, irrigation and, perhaps, flood protection have to be planned and executed. Costs and the economics of the scheme have to be evaluated. The planning and construction of the factory, the provision of housing and other services for a comparatively large supervisory and labour force, and the construction of a road system are other factors demanding attention. Arrangements must be made for the introduction of appreciable numbers of temporary expatriate technicians and training schemes initiated to enable their early replacement. Finally, introduced varieties of cane must be tested and the better ones bulked up for commercial planting and, at the same time, cultural methods devised to suit the local conditions. In the latter regard, not one of the least problems is the selection of agricultural equipment suitable to carry out the operations that have been found desirable under existing conditions.

Current projects and the outlook

Recent years have seen a great many new sugar projects, particularly in Africa. Some of these have not yet proceeded beyond the investigational stage, other are in active preparation and yet others are in production, some very successfully and some rather shakily. The successful establishment and rapid expansion of sugar production in Southern Rhodesia and Swaziland are generally known. The East African territories are also expanding their sugar projects; the Kilombero Scheme in Tanganyika is now in production and a new factory was due to start operation in 1964 in Uganda. The Sudan has sugar projects at Guneid and Khashm-el-Girba. New sugar factories have recently been opened in Egypt as well as a bagasse pulp mill. A Dutch firm commenced production from one factory in Ethiopia in 1954, followed by a second unit in 1962. It is understood that Ghana expects to start production shortly from the two projects at Akuse and Komenda. The sugar project in Nigeria managed by Bookers was due to reach initial introduction around the end of 1964. Several other African projects are in the reconnaissance or experimental stage. The Ceylon Government has projects at Gal Oya and Kantalai.

The above is by no means a comprehensive list of recent sugar developments. Several newly independent countries are known to be currently examining the prospects for domestic sugar production and a number of fresh sugar schemes may be expected during the next few years. Sugar cane is a crop that can be grown under a wide variety of conditions in the tropics and sub-tropics—it is reasonable to suppose, therefore, that most tropical or sub-tropical countries which, at present, do not produce their own sugar

are likely to do so at some future date, provided always that domestic consumption is sufficient to support such an industry.

Mechanization of new projects

At first thought it would seem that any but the most essential mechanization should be avoided in a developing country with low labour rates and some under-employment. However, it is probably not in the interests of either the sugar industry or the country concerned that a reasonable degree of mechanization should not be introduced right at the start.

Except in a practically rainless area, well provided with irrigation water, sugar cane is a seasonal crop. Reliance on hand work means, therefore, a large imbalance in labour and probably the need for seasonal migrant labour. Seasonal workers are expensive on overheads, since housing and other services must be provided, and often prove a source of embarrassment to all authorities concerned, as some send for dependants and because of estate amenities, stay on in the area when employment is not available. In any case, the supply of migrants will tend to diminish as a country is developed and industrialized.

Labour rates also are not static and, although at the time of establishment of an industry, hand-labour may be more economical than mechanization, eventually the reverse may obtain. When this happens, it is very often difficult to introduce mechanization, for political and other reasons.

Much the same remarks apply to the actual labour supply. There may be ample labour at the start of a project, but as a country develops, even though an under-employment problem may persist, the number of persons wanting unskilled manual labour will probably diminish.

In the establishment of a new project it would seem wise therefore, to plan the layout for full mechanization, but to mechanize initially only to the extent that may be justified by the labour situation and the need to iron out the seasonal imbalance. A partially mechanized estate can be fully mechanized as and when warranted.

In any event, a new sugar project, for reasons of land availability, is likely to be situated in an area of sparse population and, if production on a commercial scale is to be realised within a reasonable time, a fair degree of mechanization from the start is inevitable.

Agricultural equipment

The first purchases of equipment for a new project will usually be large crawlers for bush clearing and land-forming. These may later be used for the heavier cultivation operations, such as ploughing, but, because of the high first cost and high cost of maintenance and operation of tracked equipment, the tendency will be to rely upon wheeled tractors of around 60 h.p. for cultivation and haulage.

Equipment must be chosen to suit the agricultural practices found applicable under local conditions—there obviously can be no question of adopting an agricultural system simply because the necessary equipment is available. It is here that difficulty arises if the wheeled tractor force is based on machines of U.K. manufacture. Most manufacturers in this country turn out a standard all-purpose tractor, perhaps in one or two different sizes, and few, if any, manufacture their own implements. Implements available from many U.K. agricultual engineering firms for medium wheeled tractors are generally those developed for farming in this country and not entirely suitable for cane under very different soil and climatic conditions—such equipment as is available was mainly developed for the older established sugar areas where deep drains in heavy soils necessitated the use of crawler tractors. Several North American manufacturers, on the other hand, make a range of tractors, some specialized for cane cultivation and each with a complete range of implements for cane.

Cane is grown under widely varying conditions and hence under different systems and with different equipment according to these conditions. However, probably most of the world's cane is produced from alluvial areas and it is reasonable to suppose that future extension will mainly be in such areas. Alluvial areas lend themselves to the Louisiana system of banked cane which, by the elimination of deep drains, enables cheap mechanization on the basis of the medium powered wheel tractor. A Louisiana system, modified according to local requirements (e.g. irrigation), is likely to find extensive employment in new development and, in fact, some of the older established industries are changing over to Louisiana banks where practicable. Such an extension would entail a requirement for suitable tractors and suitable equipment but, as has been said, these are not generally available from U.K. sources. So far as I am aware, only one type of high clearance tractor is available from this country and that is an outside conversion of a popular standard model; as regards a range of high clearance implements for the Louisiana system, I do not know of any supplier in the United Kingdom. [At the Conference where this paper was presented, a new Massey-Ferguson "Hi Hi" tractor with 33 inches clearance and especially designed for cane, was introduced.—ED.]

Perhaps I might illustrate the above by reference to the Bacita Sugar Project in Nigeria, with which I have been connected The crawler tractors are Caterpillar D7's, supplemented by a number of International Harvester machines transferred from our British Guiana estates. The wheel tractor force was planned to be composed entirely of Massey-Ferguson 65's. Unfortunately we have been unable to secure our requirement of high clearance tractors—we started with American conversions of the MF.65, but these have given continual trouble at the rear end owing to lubrication difficulties and the linkage was not engineered to compensate for the increased clearance. Even the "MF High Clearance" tractor made here (which is not a high clearance tractor in Louisiana parlance, but a standard tractor with slightly larger wheels) cannot be used for any post-

emergence cultivation as we have been unable to secure high arch tool-carriers, the factory production of which has been delayed too long. Finally, suitable two-row cultivators for Louisiana banks are not yet obtainable from Massey-Ferguson. As a result, we have been obliged to use high clearance tractors and implements of a different make from the U.S.A. for all post-emergence cultivation.

However, we retain our high regard for the MF.65 as an excellent tractor for other purposes. At present, we are operating sixty-six MF.65's on the 6000-acre project, nearly all standard High Clearance models. In case it is of interest, I mention that sixteen of these are for pre-emergence operation, eight for general transport, six for mounting mechanical loaders, eight for in-field haulage of factory cane, two for in-field haulage of seed-cane, ten for road haulage of factory cane, seven for road haulage of seed-cane and planting, six for distribution of molasses and filter cake in the field with "Manurain" tankers[1], and three for marshalling cane-trailers in the factory yard. Additionally we have thirteen other tractors of full high clearance.

[1] *I.S.J.*, 1964, **66**, 273.

THE INFLUENCE OF IONIZING RADIATION ON SUCROSE AND SUGAR COLOURING MATTER

By STANISLAW ZAGRODZKI and HELENA ZAORSKA

(Department of Sugar Industry and Food Technology, Technical University of Lodz, Poland)

Part of a report presented at Symposium of Nuclear Chemistry, Warsaw, 1964.

THE action of ionizing radiation on carbohydrates has been a subject of numerous investigations[1-8]. The emphasis of these studies has, however, been upon the variation of the biologically important products in food rather than on quantitative and kinetic aspects of radiolytic processes[9-13].

It was previously reported[14-17] that γ-radiation induces colour formation in solutions of sucrose in water. One of the purposes of this work was to investigate what compounds may be recognized as precursors in the coloration processes and whether colouring is due to matter contained in sugar products or to certain compounds formed in the course of radiolysis.

We have carried out experiments on the influence of γ-radiation on crystalline sucrose, its aqueous solutions and solutions of sugar colouring matter. The results obtained differ slightly from those reported previously in the literature. The purpose of this work has also been to distinguish between direct action of radiation on sucrose and processes induced by the products of radiolysis of water and sucrose.

Experimental

Irradiation of crystalline sucrose

All irradiations were carried out with γ-rays from a 1400-curie ^{60}Co source. The dose rate determined with Fricke dosimeter was 3·2 krads/min. Samples of 52 g sucrose were irradiated in glass vessels 100 ml in volume. The dose ranged from 1 Mrad to 15 Mrads.

Coloration of the samples, evolution of gases with a characteristic odour and destruction of crystal surfaces were observed after irradiation. These phenomena were appreciably enhanced in the case of higher doses. A 1-Mrad dose caused a yellow coloration of sucrose with slight flesh shade. Solutions of such irradiated saccharose remained colourless. The sucrose developed a pink-pearl colour after 5 Mrads dose, dilute solutions again being colourless. Concentrated solutions (50%), on the other hand, were slightly yellowish. Evolution of gases of characteristic smell was observed when sucrose irradiated with 5 Mrads was dissolved. Crystals, after receiving the higher dose of 15 Mrads, gave bright yellow solutions when dissolved in water.

Fig. 1 illustrates the colour variation of samples irradiated with the 1, 5 and 15 Mrad doses. The difference between the above samples and unirradiated sucrose is clearly visible.

[1] PHILLIPS: *Nature*, 1954, **173**, 1044.
[2] PHILLIPS *et al.*: *J. Chem. Soc.*, 1958, 3522.
[3] PHILLIPS and MOODY: *J. Chem. Soc.*, 1958, 3534; 1960, 754, 762; *Int. J. Appl. Rad. Isot.*, 1959, **6**, 78.
[4] WOLFROM *et al.*: *J. Amer. Chem. Soc.*, 1959, **81**, 1442.
[5] *idem: Radiation Res.*, 1959, **10**, 37.
[6] GRANT and WARD: *J. Chem. Soc.*, 1959, 2654, 2659, 2871.
[7] KHENOKH *et al.*: *Doklady AN SSSR*, 1960, **131**, 684; **135**, 471.
[8] PHILLIPS and CRIDDLE: *J. Chem. Soc.*, 1963, 3984.
[9] KHENOKH: *Doklady AN SSSR*, 1955, **104**, 746.
[10] WERTHEIM *et al.*: *J. Agric. Food Chem.*, 1957, **5**, 944.
[11] ARKAEV: *Gigiena i sanitaria*, 1958, **23**, 51/10.
[12] LIGGET *et al.*: *J. Agric. Food Chem.*, 1959, **7**, 277.
[13] PIJANOWSKI: *Przem. Spoz.*, 1963, **17**, 640.
[14] PEAT: *Advances in Carbohydrate Chem.*, 1946, **2**, 44.
[15] SINGH *et al.*: *J. Amer. Chem. Soc.*, 1948, **70**, 517.
[16] BARKER *et al.*: *J. Chem. Soc.*, 1959, 2648; *Nature*, 1959, **183**, 376.
[17] NAIK-KURADE *et al.*: *Food Res.*, 1959, **24**, 618.

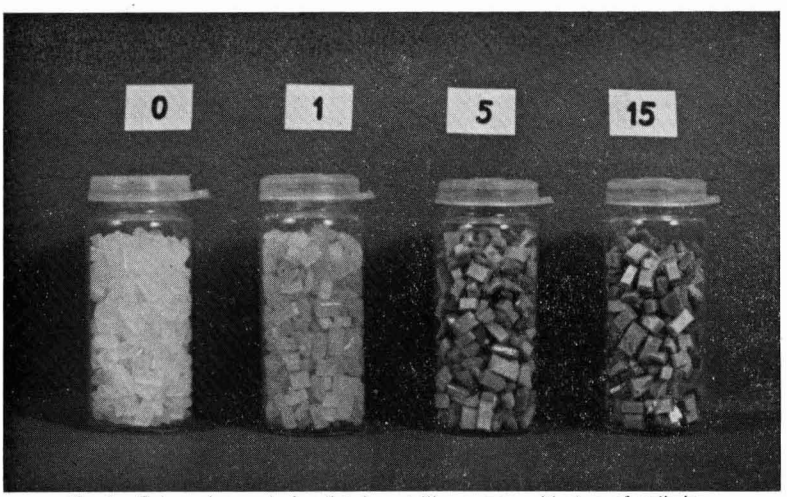


Fig. 1. Colour changes in irradiated crystalline sucrose with dose of radiation.

The stability of radiation-induced coloration of sucrose crystals has been tested in several experiments. Heating the samples to 40°, 50° and 60° for 24 and 48 hours leads only to partial bleaching of crystals. No colour changes have been observed for unirradiated sucrose treated in the same way. The results of the above experiments are presented in Table I. As may be seen from the Table, all the samples show irreversible changes.

The chemical changes in irradiated crystals of sucrose have been determined by dissolving them in water. Solutions of 26 g sucrose per 100 ml were prepared and the amount of decomposed sucrose, concentration of acids and reducing matter, pH of solutions and the rate of hydrolysis were studied. The results of analytical estimations are collected and presented in Table II.

Decrease in sucrose, amount of acids and concentration of inversion products are calculated for 52 g of sucrose. Studies on the rate of inversion were carried out at 25·5°C, i.e. at the same temperature used in the course of radiolysis.

Irradiation of sucrose solutions

High purity, recrystallized sucrose and redistilled water were used in all the experiments. The solutions were investigated in the range of concentrations 13 g – 52g/100 ml.

100 ml samples were irradiated in closed glass vessels. Solutions were subjected to total doses of 30 krads–15 Mrads.

The following parameters were measured for irradiated solutions and compared with those for unirradiated ones:

optical rotation,
content of reducing matter,
content of acid groups,
pH of solutions, and
conductivity.

It was found that temperature of irradiated solutions reached 25·5° C. The solution containing 26 g of sucrose per 100 ml was used as the basic one. The values of optical rotation for irradiated solutions are seen in Table III.

The results of other measurements are listed in Table IV.

Further experiments were undertaken to determine the influence of concentration on radiolytic yield of decomposition of sucrose solutions.

The yield of radiolysis expressed as the amount of decomposed sucrose against the dose of radiation is shown in Fig. 2. Curves correspond to the solutions 13 g, 26 g and 52 g/100 ml.

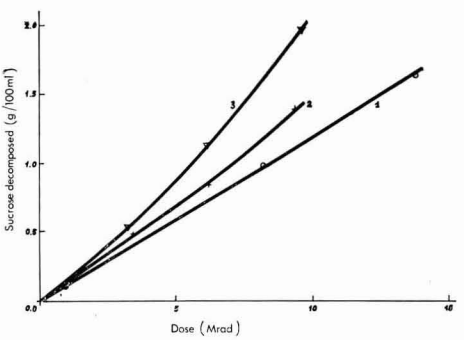


Fig. 2. Amount of decomposed sucrose *vs.* dose. Initial concentration of sucrose (1) 13 g/100 ml, (2) 26 g/100 ml, (3) 52 g/100 ml.

The radiation decomposition of sucrose is also presented in Figs. 3 and 4. The dependence of sucrose decomposition on the concentration of solution is seen in Fig. 3. In Fig. 4 the percentage of decomposed sucrose is plotted against the concentration for 2, 6 and 10 Mrads respectively.

The experimental data show that pH of solutions depends only very slightly on concentration. In contrast, concentration seems to exhibit a strong effect on the amount of reducing matter.

It was found also that hydrolysis occurs after irradiation and is initiated by organic acids formed under the influence of γ-rays. The rate of this process is closely correlated with the dose of radiation.

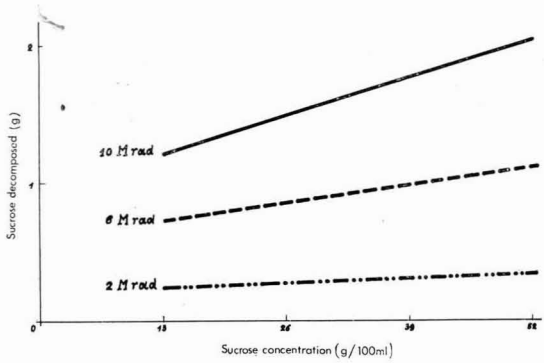


Fig. 3. Decomposition of sucrose *vs.* concentration of solution.

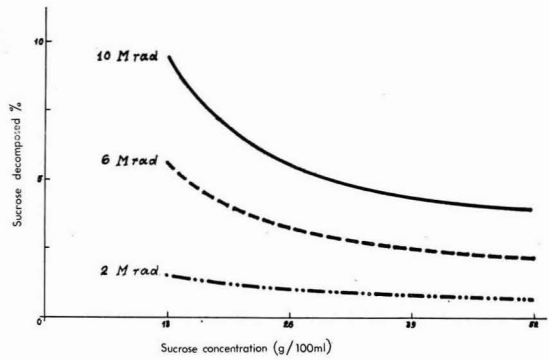


Fig. 4. Percentage of decomposed sucrose *vs.* concentration of solution.

Solutions of sugar colouring matter

The colouring matter subjected to γ-radiolysis was isolated from sugar industrial intermediate products. The most important compounds forming sugar colour have been reported[18–23] to be melanoidins, caramel, polyphenols, Maillard reaction products and hexose alkaline degradation products.

Isolation was carried out by treating industrial solutions[24] with activated carbon. The adsorbent was then extracted with water-pyridine azeotrope. The pyridine was removed and the aqueous solutions thus obtained were used in irradiation experiments. Radiolysis was carried out in closed glass vessels of 100 ml. The concentration of colouring matter in solution was expressed by optical density, measured using a Pulfrich photometer. In Fig. 5 appears the dependence of optical density (in logarithmic scale) for different wavelengths *vs.* the dose.

It has been found that action of γ-rays leads to a decrease in the optical density of solutions. A decrease of more than 10% has been observed for a dose of 200 krads, while for 8 Mrads the optical density falls to about 50% of the original value.

Discussion

The experiments lead to some conclusions concerning the dependence of radiolysis yield of sucrose decomposition on concentration of solutions and dose of radiation. It was noted that crystalline sucrose is more resistant to γ-rays than are its aqueous solutions. Amounts of decomposed sucrose and organic acids formed in the crystalline state were found to be lower than those in solutions.

It is well known that breaking of bonds in the sucrose molecule, as a result of quantum adsorption of γ-rays, gives a number of compounds. Because of their catalytic action the organic acids identified in radiolysis products play an important rôle in hydrolysis of sucrose, especially in the case of long irradiation.

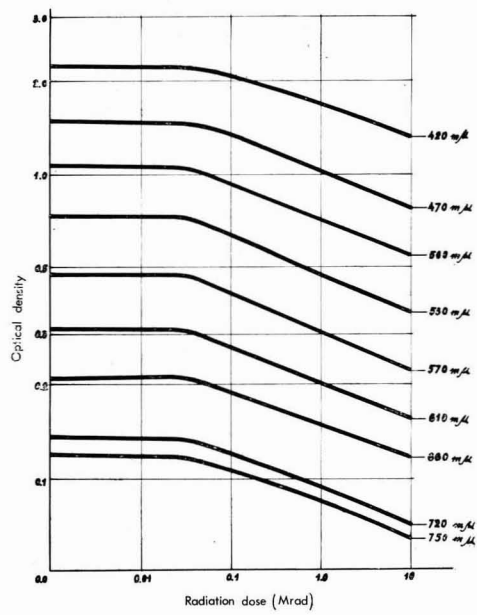


Fig 5. Optical density of aqueous solutions of sugar colouring matter *vs.* dose of γ-radiation.

[18] Schneider *et al.*: *Zucker-Beihefte*, 1953, **2**, 14.
[19] Dubourg *et al.*: *Proc. 10th Meeting C.I.T.S.*, 1957, 82.
[20] Hirschmüller: *ibid.*, 21.
[21] Henry and Pieck: *ibid.*, 129.
[22] Ahari and Genotelle: *Ind. Alim. Agric.*, 1961, **78**, 742, 744.
[23] Carruthers *et al.*: *I.S.J.*, 1963, **65**, 297.
[24] Zaorska: *Proc. 12th Meeting C.I.T.S.*, 1963, 235; *I.S.J.*, 1964, **66**, 260-262, 285-286.

Table I
Effect of heating on colour changes in irradiated sucrose

	Colour of crystalline sucrose				
	Before heating	*Temperature and time of heating*			
		40°C, 24 hours	60°C, 24 hours	80°C, 24 hours	80°C, 48 hours
crystalline sucrose unirradiated	colourless	no change	no change	no change	no change
1 Mrad	yellowish flesh-shade	no change	no change	milk-yellow	milk-yellow
5 Mrads	pearly-pink	no change	no change	distinct reduction of pink colour	grey-yellow
15 Mrads	pink-brown	no change	no change	reduction of pink colour	grey-brown

Table II
γ-radiation-induced decomposition of crystalline sucrose

	Dose of radiation		
	1 Mrad	5 Mrads	15 Mrads
Decrease in sucrose per 52 g	0·1365 g	0·465 g	0·954 g
Acids formed per 52 g (μeq)	63	314	884
Inversion products per 52 g (mg)	105	524	1240
pH of solution (26 g sucrose per 100 ml). .	4·03	3·41	3·09
Rate of hydrolysis in a 26 g/100 ml solution expressed as % of sucrose hydrolysed in 24 hours	0·075	0·345	0·899

Table III
Optical rotation of sucrose solution (26 g per 100 ml) irradiated with γ-rays

	Dose of radiation absorbed in solution (Mrads)						
	unirradiated	0·032	0·194	0·859	1·165	3·445	6·20	9·52
Rotation of solution, 20°C, sodium light, degrees.....	34·620	34·613	34·580	34·431	34·387	33·762	33·127	32·160
Decrease in rotation, degrees.....	—	0·007	0·040	0·189	0·233	0·858	1·493	2·460
Proportion of undecomposed sucrose according to direct polarimeter reading (%)	100·0	99·980	99·887	99·453	99·327	97·520	95·690	92·900
Proportion of decomposed sucrose according to direct polarimeter reading (%)	—	0·02	0·113	0·547	0·613	2·48	4·31	7·10
Effective decrease in sucrose corrected for rotation of inversion products (%)	—	0·015	0·0846	0·410	0·504	1·860	3·230	5·315
Effective decrease in sucrose corrected for rotation of inversion products (g)	—	0·0039	0·0220	0·1065	0·131	0·484	0·840	1·382

Table IV
γ-radiolysis of sucrose solution (26g/100 ml)

	Unirradiated solution	*Dose of radiation (Mrads)*					
		0·032	0·194	0·859	1·165	3·445	6·20	9·32
Reducing matter mg/100 ml	—	6·5	37	162	221	650	1170	1763
Concentration of acid groups (μeq/100 ml)	—	3·20	19·3	85	116	342	615	925
Conductivity of a solution of 20·8 g sucrose/100 ml (μ simens)	0·003	0·014	0·081	0·188	0·332	0·746	1·225	1·668
pH	6·82	4·84	4·05	3·69	3·54	3·09	2·90	2·74
Radiation yield of sucrose decomposition including hydrolysis induced by acids G–($C_{12}H_{11}O_{22}$).....	—	3·23	3·24	3·29	3·34	3·57	3·85	4·15
Radiation yield of sucrose decomposition less the amount of sucrose hydrolysed by acids G–($C_{12}H_{11}O_{22}$)	—	3·23	3·23	3·22	3·22	3·20	3·17	3·14

Sucrose hydrolysis obeys a first-order reaction equation

$$V = \frac{dx}{dt} = k\,(a - x)$$

where V = rate of hydrolysis, x = amount of sucrose hydrolysed, t = time, a = initial concentration of sucrose, and k = rate constant.

Rate constant k generally depends on temperature and, in this case, also on the H^+ ion concentration. A reduction in pH causes a significant increase in the inversion rate.

The experimental data indicate that factor k increases with dose. This may be due to increase in the acid concentration. Sucrose hydrolysis is also caused by products of water radiolysis. However, this takes place only during irradiation. It was calculated that in both processes the rate of hydrolysis is proportional to the amount of non-decomposed sucrose. The average radiation yields* for all three processes as calculated for 48 hours' irradiation at 25·5°C were as follows:

for 13g/100 ml solutions $G\,(-C_{12}H_{22}O_{11}) = 3{\cdot}3$
for 26g/100 ml solutions $G\,(-C_{12}C_{22}O_{11}) = 4{\cdot}1$
for 52g/100 ml solutions $G\,(-C_{12}H_{22}O_{11}) = 5{\cdot}5$

while the radiation yields less the amount of sucrose hydrolysed by acids were

for 13g/100 ml solutions $G\,(-C_{12}H_{22}O_{11}) = 2{\cdot}8$
for 26g/100 ml solutions $G\,(-C_{12}H_{22}O_{11}) = 3{\cdot}1$
for 52g/100 ml solutions $G\,(-C_{12}H_{22}O_{11}) = 3{\cdot}9$

* The radiation yield, G, denotes the number of atoms or molecules of a product that results when 100 eV is absorbed by the system.

SUGAR HOUSE PRACTICE

Seeding low grade massecuite—true or false. G. P. JAMES and G. MASLEN. *Proc. 31st Conf. Queensland Soc. Sugar Cane Tech.*, 1964, 297–299.—A special device for measuring the apparent crystal volume of *C*-massecuite at the time of dropping is described. It is a modification of a device earlier described by GILLETTE[1] and incorporates a plunger and a weighted beam. The crystals are compressed into a uniform mat by the plunger. Measurements showed that at Isis the method of establishing grain[2] gave a reproducible result in only 60% of the strikes, but even here the spread was 8%. Thus, true seeding is not achieved. It is considered that the results obtained are typical for Queensland factories.

* * *

Production of filtering agents from diatomite and tripolite from Soviet deposits. A. K. KARTASHOV, V. E. SKRIPLEV and V. A. CHERNENKO. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.*, 1964, **12,** 35–71.—Details are given of experiments in the production of a filtering agent from Soviet deposits which is claimed to be as good as any non-Soviet filter-aid.

* * *

Testing vacuum pans of new design from the Admiralteiskii factory and VAMTs. M. L. VAISMAN, V. N. GOROKH, B. F. US and E. S. KISLENKO. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.*, 1964, **12,** 138–174.—Results of comparative tests with two new pans are discussed. The VAAZ (Admiralteiskii) calandria pan has a smaller syrup space than conventional pans, the conical tube plates having an angle of slope of 11°35′ to horizontal instead of 20°. A rotary catch-all with deflector plate is located in the conical upper section, the shape of which reduces the volume of the vapour space and the overall pan height. The VAMTs multi-sectioned coil pan uses only 20-25% of the usual amount of syrup per strike with conventional types; the steam consumption is lower since no water or juice is needed to dissolve false grain, and high density massecuites can be boiled (e.g. a 1st massecuite from a syrup of up to 70°Bx.) The two types were tested and compared for 1st massecuite boiling. The results, restricted to steam consumption, heat transfer and throughput, are discussed at length. The highest average daily throughput of the VAMTs was achieved with 2 sections in operation, when the throughput exceeded the highest throughput of the VAAZ pan by some 34%.

* * *

Investigation of the heat exchange and crystallization processes in the cooling of massecuite in standard crystallizers. M. L. VAISMAN, V. D. POPOV, I. S. GULYI and I. A. ROSTRIPENKO. *Trudy Vsesoyuz. Nauch.—Issled. Inst. Sakhar. Prom.*, 1964, **12,** 174–190. An unused 3rd massecuite disc-type crystallizer with a heat exchange surface was compared with one of identical type that had been in operation for 7 years. The temperature drop in the old model was considerably smaller than in the new one (0·6–1·0°C/hr compared with 1·5–2·5°C/hr). In the latter half of the cycle marked differences occurred between the temperatures in the end and middle sections of both crystallizers. The temperature of the cooling water rose to a lower level in the old crystallizer because of lower heat transfer, while the changes in the value of the heat transfer coefficient were greater in the new crystallizer, the heat transfer decreasing with use as the surfaces became dirty. The non-uniformity of cooling and the existence of temperature fields in the massecuite plus considerable temperature differences throughout the crystallizer and across the disc radii (causing abundant deposition of false grain) are attributed to the fact that the process is governed by crystallizer design whereas the latter should be dictated by the technology of the process. This is demonstrated by curves showing the pattern of apparent supersaturation of the inter-crystalline molasses; that there was little fluctuation in the supersaturation in the old crystallizer is attributed to marked heat resistance and hence little overcooling of massecuite. Despite considerable local overcooling of massecuite, the molasses exhaustion in the new model was better than in the other. Clean, salt-free water should be used and the cooling intensity should be increased, where required, not by raising the flow rate but by reducing heat resistance.

* * *

The effect of filtering and draining properties of screens on the performance of automatic and continuous centrifugals in sugar production. B. N. TERESHIN. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.*, 1964, **12,** 190–202.—The effects of screen properties and of sugar layers formed on the screen on centrifugal performance and basket imbalance are discussed theoretically whereby molasses separation is considered as one-dimension, axial-symmetric (cylindrical) filtration of an incompressible fluid in a non-distortable porous medium. Two formulae are derived for calculation of the amount of liquid filtered per unit time (one for streamline and one for turbulent flow, i.e. in the latter case where the layer is of considerable thickness or the mat is non-continuous and where variation in pressure due to velocity is considered). It is shown that with batch loading of large and medium sized crystals it is advisable to increase the layer thickness to a maximum level after which there is risk of interruptions in the continuity of flow of liquid which then starts to stream into unfilled pores. If the resistance of the screens is considerable, the molasses will not be separated sufficiently rapidly and the layer on the screen will form slowly. While screen resistance is only 1% of the resistance of the layer, any sugar remaining on

[1] "Low Grade Sugar Crystallization" (California & Hawaiian Sugar Refining Corp. Ltd., Crockett, Calif., U.S.A.), 1948.

[2] CAMERON: *I.S.J.*, 1952, **54,** 334.

the screen after discharge will, together with the separation surface between layer and screen, constitute a considerable resistance; gradual build-up of a sugar layer on this will cause great imbalance during acceleration. Screen washing after each discharge and the use of pressed steel screens of large open surface and mesh impermeable to sugar crystals are therefore recommended for automatic centrifugals. For baskets using mechanical ploughs the screen should be in the form of a band of width equivalent to the basket height. The advantages of pressed steel over woven screens are discussed. The effects of screen resistance on multi-stage push-type centrifugals and on continuous conical centrifugals are also dealt with.

* * *

Investigation of some problems in the hydrodynamics of evaporators. I. N. ZASYAD'KO. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.*, 1964, **12**, 202–227. Tests were made with a 13-tube experimental evaporator having five downtakes of three different diameters, variable locations for steam feed and incondensible gas discharge. The tests were conducted on water and sugar juices of 25–30 and 55–60°Bx at a heat flow in the range 4000–50,000 kcal/sq.m./hr. The maximum circulation velocity was obtained at an apparent level of 115–120% of the length (3·8 m) of the boiling tube irrespective of the heat flow, downtake cross-section area or juice concentration. The number of boiling tubes in which reverse circulation of the fluid occurred (down flow) depended on the downtake cross-section area, fluid level and evaporator heat load. At high apparent levels (100–150%) a so-called "starvation" condition occurred when the downtake cross-section area was inadequate. This was characterized by considerable resistance in the downtake section of the tube system, inefficient discharge of the circulation fluid from the upper tube plate and marked expansion of the fluid in the space above the tubes, resulting in down flow in the boiling tubes. At 60–70% levels the downtake cross-section area hardly affected circulation velocity, while at 100–120% it increased circulation only with "active" discharge of the water or juice from the upper tube plate. At a downtake:riser cross-section ratio of 90% with "active" discharge of the fluid from the upper tube plate it would be possible to increase the velocity in a quadruple-effect evaporator from 0·18–0·7 m/sec (at 10–20% ratio and 110–120% apparent level) to 0·28–0·94 m/sec, which closely approaches the limits of velocities ensuring complete extension of the boiling zone beyond the boiling tubes. Under such conditions the scaling of the heating surface is considerably reduced. However, with increase in the level there is an increase in the risk of entrainment. The installation of a special vertical section below the upper tube plate did not increase circulation in the experimental unit.

* * *

Mathematical relationships in the process of massecuite centrifugalling. YU. D. KOT. *Trudy Vsesoyuz. Nauch.-Issled. Inst. Sakhar. Prom.*, 1964, **12**, 227–237.—A mathematical study was made of a number of factors affecting the curing of massecuites having relatively large crystals (≃1 mm) and a low molasses viscosity (5 poises). The ideal curing process was divided into three periods: (1) where molasses separation is at its most intensive, the process resembling that of vacuum or pressure filtration, and a massecuite blanket is formed with gradual increase in the density from the centre to the periphery, (2) where the pores in the packed massecuite are free from molasses and become filled with air, and (3) where the molasses separation velocity is low and decreases rapidly because of moisture loss and a rise in molasses viscosity. The size of capillaries in the crystal layer depends on the massecuite porosity, while the pore volume constitutes (according to data in the literature) about 25% of the total space filled with massecuite. The molasses separation rate increases as the end of period (2) approaches, as a result of increase in centrifugal force concomitant with increase in the inner radius of the layer of packed massecuite. It is shown that during period (2), with spinning of suspensions with a non-distortable uniformly packed layer, the molasses separation rate increases exponentially with time, and the mass will be a three-phase system. In factory experience there is no period (3) since capillary forces in the massecuite layer cause a hydraulic seal at the screen and period (2) has not ended by the end of the curing process. In tests it was found that packing of the mass and binding of crystals in a 2nd massecuite continue even after the molasses content falls to 10% (by weight). This means that throughout the centrifugalling process the size of the capillaries decreases gradually.

* * *

Vibrating screens for sugar mill juices. W. P. STILZ. *Sugar J.* (La.), 1964, **26**, (11), 40–43.—The use of vibrating screens for raw juice and hot clarified juice treatment is discussed and their requirements, mechanical features and advantages over conventional strainers are considered.

* * *

Continuous centrifugals operating problems. A. G. KELLER. *Sugar J.* (La.), 1964, **26**, (11), 46–49.—Two major complaints regarding the performance of conical continuous centrifugals are considered. The first concerns higher final molasses purities than with batch machines. This is shown to be not so much a case of an inefficient centrifugal as a case of careless water or steam washing or inadequate massecuite temperature control. The second complaint concerns the excessive wear of screens. Filtration of solutions of crystallizer sugar and of final molasses from three different Louisiana cane raw sugar factories yielded an insoluble residue which contained principally very fine particles of silica sand, of unknown source, which may be the cause of the abrasion. To overcome this, studies are being made of the possibilities of using harder screen material or of hardening screen surfaces.

Crusher feeding. ANON. *Sugar J.*, (La.), 1964, **26,** (11), 80–81.—At one sugar factory a Fulton crusher is used for extraction as well as for cane feeding and preparation. Difficulties associated with variable mill feeding properties of different cane varieties were overcome by adopting a two-pressure system on the mill hydraulics whereby two pneumatically-operated air valves were added to each of two oil accumulators, one for each cap. An air regulator set for a required air pressure was installed and a relief valve was placed between the low-pressure air valve and the accumulator to vent high-pressure air when switching to the low-pressure valve. All four valves are controlled by the mill operator. The system has operated successfully for 3 years.

* * *

Progress in Florida. ANON. *Sugar y Azúcar*, 1964, **59,** (5), 48–54.—An account is given of individual plants recently in operation, under construction and projected, which form the considerable expansion in the Florida sugar industry.

* * *

First-second (lime-phosphoric acid and carbon-filter aid) treatment automatic & continuous. M. R. IRIMIA. *Sugar y Azúcar*, 1964, **59,** (5), 60.—At Fellsmere refinery melt liquor is passed through a Fischer & Porter flow indicator-transmitter which governs phosphoric acid addition. The treated melt passes through an in-line mixer and lime sucrate is added, under the control of a pH recorder-controller. Liquor from the clarifiers goes to a storage tank of sufficient capacity for 25 minutes' retention, and thence to a tank where carbon and filter-aid slurries are added in proportion to flow rate. The liquor then passes through a heater to the filter station.

* * *

Performance and evaluation of mill sanitation. J. C. P. CHEN. *Sugar y Azúcar*, 1964, **59,** (5), 65–66, 80–81. Chlorine gas mill sanitation had been discarded at Hacienda Casa Grande, Peru, because of rapid gas elimination from the hot imbibition water and corrosion problems. In the 1959–60 season an organic chlorine formulation (OCF) containing "Chloramine T" and covered by U.S. Patent 2,802,757[1] was used; in 1960/61 a system of steam jets was adopted and in 1961/62 a combination of OCF and steam jets. It was found best to use the glucose ratio as the criterion for judging effectiveness. Where surplus bagasse is available use of steam produces a net gain in extra sugar; however, OCF treatment was more effective although the economics of its use depend on the value of the extra sugar recovered. Elimination of enzymes, bacteria, etc. reduces slimes and gummy material and aids clarification.

* * *

Screening of clarified juice. C. G. M. PERK. *S. African Sugar J.*, 1964, **48,** 303.—Continuous clarifiers leave no provision for removal of suspended matter from the overflow, and this will contain more than with batch clarifiers from which floating scum, bagacillo, etc. was raked. Screening of the overflow is recommended to remove suspended matter including bagacillo which has an adverse effect on raw sugar keeping quality since it increases its hygroscopicity.

* * *

Refined sugar boiling operation: process engineering overcomes limitations of manual manipulation of (a) complex batch process. N. ROSENBERG and P. GELBER. *Food Processing*, 1963, **24,** (5), 90–95; through *S.I.A.*, 1964, **26,** Abs. 124.—An automatic control system developed by Refined Syrups and Sugars Inc. contains the following elements: continuous measurement of massecuite syrup Brix by a Waters "InLine" refractometer which controls the calandria steam supply and signals the seeding point (82·5°Brix); an axial-flow turbine circulator; controlled liquor addition according to the circulator torque. Automatic control has reduced the boiling time from 130 min to 105 min. The successive stages of boiling are described.

* * *

Push-button filter press trims sugar-polishing costs. T. W. WETT and B. OXNARD. *Chem. Processing* (Chicago), 1963, **26,** (3), 38–39; through *S.I.A.*, 1964, **26,** Abs. 130.—A plate filter press with a plate-shifting mechanism along one side and free draining of filtrate is described with photographs. The filter medium is a steel wire cloth precoated with "Super Cel" and asbestos. The filter is used to treat 2000-gal batches of liquid sugar prepared by dissolving granulated sugar with or without activated carbon.

* * *

The application of continuous centrifugals. W. HEIKE. *Die Lebensmittelind.*, 1964, **11,** 124–125.—The advantages of continuous (conical) centrifugals over batch machines are discussed with the aid of some molasses purity data for both types of machine. The importance of the thickness of the layer of massecuite on the basket wall for efficient sugar-molasses separation is considered and the ability of the operator to select the required thickness by observing the colour gradation from basket to the upper edge is mentioned. The high percentage of crystals damaged in conical centrifugals (at least 25%) prevents these machines being used for 1st product, although with efficient use of the wash water device a high purity middle product sugar is obtainable. The daily throughput of continuous centrifugals is discussed and the economics of these and batch machines are compared.

* * *

Calculation of pressure loss in smooth tube pre-heaters. H. HAUCKE. *Zeitsch. Zuckerind.*, 1964, **89,** 259–263. Pressure drop (Δp) across a smooth tube pre-heater is given by $\Delta p = \frac{n.v^2.l}{d}.f$, where n = number of tube bundles, v = flow rate, l = length of tubes, d = i.d. of a new tube, and f is a factor dependent on

[1] *I.S.J.*, 1958, **60,** 115.

the solution being heated and on the state of the tubes (a table gives values for different sets of conditions). The formula lends itself to easy calculation of pressure drop with a slide rule.

* * *

Guide for machinery maintenance in a sugar factory. F. REID R. *Bol. Azuc. Mex.*, 1964, (177), 14–17.—The object and need for maintenance of machinery are briefly discussed and its importance in the factory or refinery emphasized. Personnel required for a maintenance unit are specified and their duties classified and summarized for the off-season and crushing periods.

* * *

The "EimcoBelt" cane mud separation process and its application in the sugar industry. M. L. FABRÉ, C. E. SILVERBLATT and D. A. DAHLSTROM. *Bol. Azuc. Mex.*, 1964, (177), 18–23.—An account is given of the development and uses of the "EimcoBelt" filter, in which the filter cloth is separated from the drum and the cake on it discharged at a secondary roller. Operational data are recorded; these include a cake of 68–72% moisture containing 3·0 or 3·2% sucrose and throughput of 29 lb or 18 lb cake/hr/sq.ft. filter surface, depending on whether the process includes chemical treatment or not. Advantages of the process compared with screen filters are discussed; they include clear filtrate (with consequent increase of capacity by elimination of recycling), flexibility over a wide range of throughputs (e.g. 75–250 kg/hr/sq.m.) which permits reduction of bagacillo usage even to nil, long life of the filter cloth and its easy and rapid changing, continuous and highly efficient cloth washing, ease of installation, and the benefit of the manufacturer's experience and investigation. Economic analysis of operation of the system shows lower running costs for power and maintenance, reduced filter-aid consumption and sucrose inversion, and higher capacity.

* * *

Improvement in steam generator efficiency in the sugar factory. O. CHIOETTO. *Ind. Sacc. Ital.*, 1964, **67,** 52–54. It is proposed that condensates at, say, 70°C be used in plate-type heat exchangers to serve as economizers, recovering heat from boiler flue gases which would otherwise be lost. The potential fuel savings are calculated.

* * *

High speed (centri)fugalling of "A" and "B" massecuites. K. K. SHARMA. *Indian Sugar*, 1964, **13,** 713–715.—Aspects of high-speed centrifugals are discussed and experience at Bagpat Cooperative Sugar Mills Ltd. with two 1460 r.p.m. machines is described with a record of the centrifugal cycle and massecuite, molasses and sugar characteristics.

* * *

Cooling of granulated sugar by means of a fluidized bed cooler. T. TANAKA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1964, **14,** 44–54.—A fluidized bed cooler for granulated sugar was compared with a rotary cooler of the same capacity (6½ tons/hr). Its overall heat transfer coefficient was higher (9°J *vs.* 80 kcal/sq.m./hr/°C) and sugar temperature lower [36°C *vs.* 43°C (summer) and 24°C *vs.* 31°C (winter)]. Sugar quality was higher, with less damage by abrasion, although power requirements were greater.

* * *

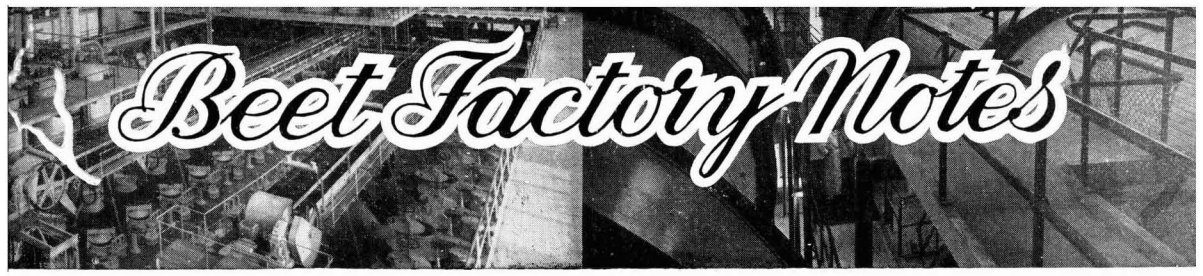
Reburning test of waste lime cake by rotary kiln. N. MIZUNO. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1964, **14,** 55–68.—Pilot plant tests were conducted on reburning lime cake for re-use in the Steffen process. The lime produced was superior to the usual burnt lime. Waste lime cake and limestone need different conditions and should not be burnt together. The exhaust gas from an ordinary kiln can be used for carbonatation; however, that from the pilot rotary kiln was too low in CO_2 concentration (20·2% when reburning lime cake and 23·0% when burning limestone).

* * *

Purification of affination syrup by centrifugation. H. ITO, M. KAMODA and M. ANDO. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1964, **14,** 69–75. Affination syrup, diluted to 60°Bx and heated at 80°C for 30 min, was centrifuged at 70°C and 3100, 8000 and 17,500 *g* for 15 min. Purity was raised only by 0·3–2·33 points and much of the impurities was not removed. After adding 0·16–6·25% milk-of-lime on syrup, it was heated at 80°C for 30 min and centrifuged at 3100 *g* for 15 min; 0·16% lime raised the purity by 2·34 points but purity decreased with more lime. The syrup was first acidified with 0·04–2·0% of 30% phosphoric acid and neutralized with milk-of-lime before centrifuging; this raised the purity up to an optimum level of 0·5% phosphoric acid. "Separan AP-30" was added after liming to give concentrations of 3 and 5 p.p.m. on syrup and the samples centrifuged; the second gave a purity rise of 3·86 without decomposition of reducing sugar or sucrose. Addition of 30% phosphoric acid followed by neutralization with lime and addition of "Separan" resulted in a substantial purity rise in the case of 1% of acid on syrup and 5 p.p.m. of "Separan", but the reducing sugar and sucrose contents of the syrup fell.

* * *

Adaptation of milling capacity to the boiler house capacity, and control of the demand for (additional) fuel. T. SUMOHANDOJO. *Balai Penjelidikan Perusahaan Gula. Warta Bulanan*, 1963, 243–246; through *S.I.A.*, 1964, **26,** Abs. 236.—It is demonstrated theoretically that a cane factory needs additional fuel if the heat content of the bagasse, equal to 4250 — 10 pal — 48 wal under mean conditions in Java, is less than brs × grs × WBrix/100 gal, where brs = % Brix in raw juice, grs = raw juice % cane, WBrix = total heat consumption in process (kcal/kg of Brix), gal = bagasse % cane, pal = pol % bagasse, wal = moisture % bagasse. The formula assumes that the boiler is working at full capacity and that the crushing rate is constant.



Possibilities of improving the juice purification scheme at the Livezi sugar factory of the "Oltenia" combine. F. DOMSA. *Ind. Alim. Prod. Veg.*, 1962, **13,** 359–364; through *S.I.A.*, 1964, **26,** Abs. 113.—The factory, equipped with rotary vacuum filters, has experienced difficulties due to poor filtrability of the clarification muds and scaling of evaporators, in spite of relatively normal juices. Two modified processes, involving juice re-cycling to increase the juice volume to 145% and 220% respectively on diffusion juice, are described in detail. The additional plant required consists of a BRIEGHEL-MÜLLER colloid stabilization tank, thin juice boiling tank and de-liming ion-exchange columns, a saturator for over-carbonatation of half of the 1st carbonatation juice (in the 2nd process only), a distributor to divert half of the clarification muds (in the 1st process), and re-cycling pumps.

* * *

The relationships between foaming of consumer sugar solutions and the content of surface-active substances (literature review). E. RENGER. *Zeitsch. Zuckerind.*, 1964, **89,** 270–271.—Thirty-two references are given to the literature in this survey of work carried out on the foaming of industrial sugar liquors caused by saponins.

* * *

Automated C-product boiling. R. SCHNEIDER. *Zucker*, 1964, **17,** 303–309.—Automatic control of low-grade boiling with or without a Quentin molasses plant has proved satisfactory, yielding uniform crystal and a low fines content. It is claimed that boiling time can be cut by 20%. The process approaches very closely to ideal boiling, with very little deviation from rated values as between manual and automatic operation. The scheme uses conductivity measurement for control of the actual boiling, while the massecuite level is controlled through differential static pressure; for this, the membrane of a measuring transformer was built into the pan wall, one side of the membrane being under pressure of massecuite, while the other is subjected to the pressure (vacuum) above the massecuite level by means of a connecting tube. The various stages in the boiling are described and a measuring and control diagram is presented.

* * *

Problems of thermal degasification of water in boiler plants. H. ANDERS. *Zucker*, 1964, **17,** 309–311.—The mechanics of oxygen and carbonic acid removal from boiler feed-water by thermal degasification are discussed and the two basic types of degasifier (mixed and flash) are described, together with notes on other sub-types within each group.

Anomalous reaction of ion-exchangers in the sugar industry. P. SMIT. *Anomalien bei Ionenaustausch-Vorgangen* 1961 (publ. Akademie-Verlag, Berlin), 1962, **1,** 257–268; through *S.I.A.*, 1964, **26,** Abs. 259. The deterioration of anion-exchange resins in process is discussed[1], mainly in connexion with volume changes. The following measures are recommended: avoidance of sudden changes of concentration, temperature or pH; use of columns increasing in cross-section upwards; removal of colloids from the influent juice; development of resins of more stable structure.

* * *

De-liming of sugar factory juices in a sodium cycle. H. ZAORSKA. *Roczniki Technol. Chem. Zywnosci*, 1964, **10,** 167–177; through *S.I.A.*, 1964, **26,** Abs. 260. Laboratory tests were carried out on $CaCl_2$ solution or thin juice using "Imac C-12" and the Polish MK-3 cation exchange resins. The capacity of the resins was respectively 41 and 17 litres of 0·01N $CaCl_2$/100 g of dry resin, corresponding to 75% de-liming of the spot (instantaneous) effluent. Similar capacities were determined on a thin juice containing 7·5 meq/litre of Ca^{++}. The regeneration required respectively 1500 and 1250 ml of 2N NaCl/100 g of dry resin. It is concluded that the use of "Imac C-12" instead of MK-3 gives a 50% saving in salt and water consumption.

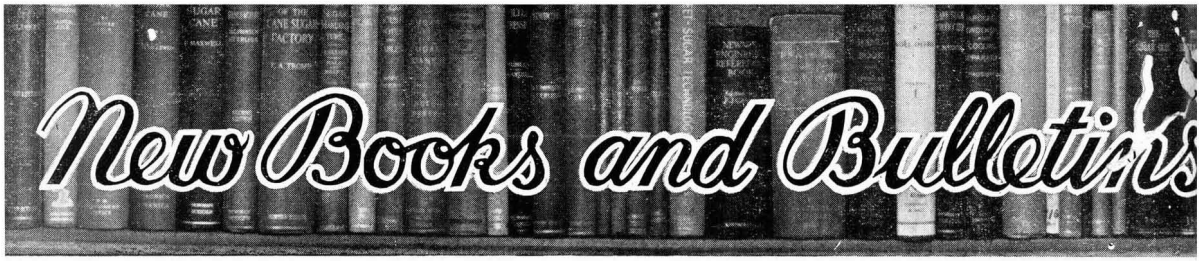
* * *

Influence of ion-exchange resin structure on the capacity for decolorization of sugar solutions. J. ŠTAMBERG and Z. VAŠÍČEK. *Anomalien bei Ionenaustausch-Vorgangen* 1961 (publ. Akademie-Verlag, Berlin), 1962, **1,** 269–295; through *S.I.A.*, 1964, **26,** Abs. 261.—The properties of the three principal types of anion-exchange resin are described with numerous graphs of tests on dilute molasses solutions over a number of cycles[2] including additional results showing the influence of varying the degree of cross-linkage in the preparation of the resins on the decolorizing power and degree of swelling. None of the classes are superior in all respects.

* * *

Corrosion problems in the sugar industry. E. LECLERC. *Sucr. Belge*, 1964, **83,** 385–395.—Electrochemical and physical aspects of the corrosion of steel by aggressive solutions are discussed, with a note of the factors affecting it, i.e. those dependent on the metal and on the solution as well as other factors. Corrosion of bacterial origin is considered as are the principles of protection against corrosion.

[1] See *I.S.J.*, 1962, **64,** 369.
[2] See *I.S.J.*, 1963, **65,** 270, 302.



Zuckerwirtschaftliches Taschenbuch 1964. (Economic Sugar Pocket Book.) K. GUMPERT and G. BRUHNS. 184 pp.; 4 × 5¾ in. (Verlag Dr. Albert Bartens, Berlin-Nikolassee, Lückhoffstr. 16, Germany.) Price: DM 12.-; 22s 0d.

The 11th edition of this publication has been modified to meet the requirements of the EEC, French and English sub-titles appearing with the German at the head of all titles, graphs and diagrams as well as in the sub-section titles in the contents page. In addition, details are given of the sugar factories in each of the EEC countries as well as the addresses of East German and U.S. factories. In all other respects, the layout is virtually unchanged. The three main sections contain statistics covering world, European (in some cases EEC and EFTA countries are compared), West and East German beet, cane, molasses and sugar production, sugar consumption, sugar and molasses imports and exports, sugar balances and prices, and other aspects of the sugar industry. Data for 1962/63 are included and in some cases 1963/64 estimated figures are given. Section two gives information on the International Sugar Agreement, world sugar prices and West German regulations governing sugar and molasses sales and delivery. Section three contains the addresses of international and West German organizations as well as factory addresses (see above). The book contains 73 tables and graphs. Its use as a source book is enhanced by its compactness. It is truly a pocket book since it will fit into a pocket easily without bulging, it being only ¼ inch thick and having a flexible plastic cover.

* * *

Improved Canes in Cultivation. J. T. RAO and –. VIJAYALAKSHMI. 93 pp.; 22 plates; 8¾ × 11¾ in. (The Indian Central Sugar Cane Committee, 19–20 Rohtak Rd., New Delhi 5, India.) 1964. Price: Rs 20; $6; 40s 0d.

This is in effect a third edition of "Coimbatore Canes in Cultivation" by DUTT and RAO, which first appeared in 1950, the title having been modified. Full descriptions are given of 37 varieties at present in commercial cultivation in India. The older varieties, covering less than 10,000 acres on an all-India basis, have been omitted. Each variety is described individually with the following headings: (1) botanical, (2) varietal position, (3) agricultural, (4) breeding quality. There is also a "Key to morphological characters", a "Key to stem epidermal characters" and a "Comparative table giving the important morphological characters of the varieties".

The illustrations at the back of the volume, particularly the bud photographs and coloured illustrations of portions of the stem, are valuable features of this work. As many Indian or Coimbatore varieties are in cultivation outside the Indian subcontinent, this book should have a wide appeal.

F.N.H.

* * *

Trade in Agricultural Commodities in the United Nations Development Decade. Vol. I, 287 pp. Vol. II, 196 pp.; 8½ × 11 in. (Food & Agriculture Organization of the United Nations, Rome, Italy.) 1964. Price: 35s 0d.

These two volumes, constituting Parts I–IV of a special supplement to the FAO Commodity Review (to be published later this year), set out the main issues in agricultural trade facing the United Nations Conference on Trade and Development. Part I presents a general picture of postwar trade in agricultural commodities and outlines the prospects and main issues for the United Nations Development Decade. Part II gives an account of these trends and prospects for each main primary commodity or commodity group, Part III deals with problems and prospects in the field of processing of agricultural products, and Part IV presents comprehensive statistics of the flows of agricultural trade between developed, developing and centrally planned regions, all sub-divided by main geographical areas. During the UN Development Decade the world sugar consumption during the 1960's is expected to grow at a lower rate than in the 1950's, a figure of 54·8–58·1 million metric tons being anticipated in 1970, i.e. a rate increase of 2·7–3·2% annually, compared with 3·8% in the decade ending in 1959. The tendency towards national self-sufficiency in sugar will increase, and the possibility of a fall in the volume of net imports below the present level by 1970 is mentioned. Among the measures that can be adopted to stimulate expansion in developing countries is negotiation of a new international sugar agreement; the most beneficial form would be a multilateral contract agreement under which importing countries would undertake to purchase, and exporting countries to sell, specified quantities or percentages of sugar at negotiated minimum and maximum prices. Other possible steps include reduction of government fiscal imports and increasing the proportion of refined sugar in the total exports, thereby raising the foreign exchange earnings of cane countries exporting sugar.

LABORATORY METHODS AND CHEMICAL REPORTS

Chromatography of sugars on a thin layer of silicic acid. E. RAGAZZI and G. VERONESE. *Il Farmaco, Edizione Pratica*, 1963, **18,** 152–160; through *S.I.A.*, 1964, **26,** Abs. 158.—The plates (12 × 18 cm) are prepared from 2 g of "Kieselgel G" suspended in 5 ml of M/15 phosphate buffer at pH 8. R_f values for glucose, fructose, sucrose and raffinose are as follows: 4:5:1 *n*-butanol:acetone:water, 0·22, 0·26, 0·14, 0·04; 4:5:1 *n*-butanol:dioxane:water, 0·41, 0·46, 0·36, 0·12. Exceptionally good demarcation of spots (1–200 μg) is obtained. Eight different spray reagents were tested, aniline-diphenylamine phosphate giving the best results.

* * *

Determination of saponin in sugar beet products. A. J. VAN DUUREN. *Mededelingen Inst. Suikerprod.*, 1963, **33,** (1), 11 pp; through *S.I.A.*, 1964, **26,** Abs. 163. A colorimetric method is described. An alcoholic solution containing 0·5–2·0 mg of saponin is evaporated to 5 ml; 4 ml of water and 1 ml of 12N HCl are added, and the mixture is heated at 100°C for 75 min. The alcohol is removed under vacuum. The residue, with 5 ml of 12N HCl, is extracted with chloroform in small portions which are made up to 10 ml. If the solution is coloured (>pale yellow) the sapogenin is adsorbed onto a column of 2·5 g of "Microcel" which is washed with $CHCl_3$ and eluted with ethanol (to 20 ml). Four ml portions of $CHCl_3$ extract (or 8 ml of ethanol extract) are evaporated to dryness in duplicate dishes. To one is added 3·0 ml of 3:6:1 99% acetic acid : acetic anhydride : H_2SO_4 mixture containing 2% of anhydrous Na_2SO_4, and to the other, 3·0 ml of 9:1 99% acetic acid:H_2SO_4 "blank" reagent. The extinction of the first is measured against the second at 525 mμ after 8 min. Sapogenin[1], obtained by HCl hydrolysis and $CHCl_3$ extraction, and recrystallized from dilute ethanol, is used as a standard. Methods for extracting saponin from beet factory products are given. The saponin contents of press juice, thin juice, raw sugar and white sugar were 8800, 5–90, 18 and 1 mg/kg respectively.

* * *

Selection and basis of a method of determining the degree of dispersion of powdered sugar. L. D. KNOPOVA. *Khlebopekar. Konditer. Prom.*, 1963, (12), 9–13; through *S.I.A.*, 1964, **26,** Abs. 276.—Methods of estimating the particle size of ground (milled) icing sugar are reviewed. The principal methods are sieving, microscopy and sedimentation. Suitable suspending agents are mineral oil, vegetable oil, kerosene or anhydrous glycerine. Granulated sugar was ground in a ball mill and tested. The finest grains measured 1–3μ, and larger grains indicate incomplete grinding. Owing to the tendency of the fine grains to form stable clusters, the sedimentation method is unsuitable and a combination of sieving and microscopy is recommended; the fractions determined by these two methods overlap to a considerable extent.

* * *

α′-Pyrrolidone-α-carboxylic acid in (beet) molasses. S. ŻAGRODZKI, A. KURKOWSKA and H. WÓJCIK. *Roczniki Technol. Chem. Zywnosci*, 1964, **10,** 199–212; through *S.I.A.*, 1964, **26,** Abs. 286.—The paper chromatographic analysis of pyrrolidonecarboxylic acid (PCA) and its hydrolysis were studied. The separation was carried out with methanol:25% NH_3 (9:1) for 6 hr in the case of Steffen's filtrate or model mixtures, or 12 hr in the case of beet molasses. The PCA was determined by micro-alkalimetry of the eluate with 0·002N NaOH and thymolphthalein at a mean error of ± 2·2%, in fair agreement with iodometric analyses of unconverted glutamic acid. The PCA and glutamic acid contents of a normal molasses were respectively 0·80 and 0·13%. Hydrolysis of PCA at 95°C was a minimum at pH 3; at pH 13 or 0·5 at 75% yield of glutamic acid was obtained after 20 hr.

* * *

Optical studies on the growth of sucrose crystals in solution. Preliminary studies. J. BERRY. *Thesis, University of London*, 1963, 174 pp; through *S.I.A.*, 1964, **26,** Abs. 290.—Changes in solution refractive index in the neighbourhood of growing single crystals of sucrose, mounted in narrow parallel-sided glass cells, were studied by photographing the interference fringes by means of a Mach-Zehnder interferometer. The technique enabled the fringes to be located in a single plane, with quantitative measurement of the refractive index at points along the surface. The solution concentration at the surface was in all cases greater than the solubility, and was generally (but not always) a maximum at the corners of the crystal. The concentration in the convection stream rising from the crystal was ~1% less than in the bulk of the solution. The streaming effect is related to increases in the growth rate of the crystal.

* * *

Influence of electrolytes on the viscosity of sucrose solutions. M. HORAWSKI. *Roczniki Technol. Chem. Zywnosci*, 1964, **10,** 33–45, + 1 folded graph; through *S.I.A.*, 1964, **26,** Abs. 291.—The study[2] is reported in more detail. It is pointed out that, whereas the addition of an electrolyte to a sucrose solution may either increase or decrease the viscosity, in the present study the electrolyte was added in place of part of the water component, so that the "pure" and "impure" solutions both contained the same weight proportion of sucrose (e.g. 70%); the viscosity was therefore increased in all cases by the addition of the electrolyte. Values for the coefficients A and *a* are tabulated for

[1] *See I.S.J.*, 1963, **65**, 122.
[2] *I.S.J.*, 1962, **64**, 344.

the 18 electrolytes studied (KOH, NaOH; KCl, NaCl, LiCl; $CaCl_2$, $MgCl_2$; KNO_3, $NaNO_3$; $Ca(NO_3)_2$; Na_2CO_3, K_2CO_3; Na, K, Mg, Ca and Sr acetates; Ca lactate), and the viscosity increases due to the electrolyte at varying sucrose concentrations are shown in a graph as linear semi-logarithmic plots against the mole fraction of electrolyte. The viscosities of 70–76% pure sucrose solutions at 40°C were formulated by the method of least squares as: $\log V = 0{\cdot}10869\ S - 5{\cdot}56561$, where S = % sucrose and V is in cP.

* * *

Crystallization rate in sugar-water solutions—numerical values and comparison of results. H. TONN. *Zeitsch. Zuckerind.*, 1964, **89**, 263–264.—The crystallization rates of sugar solutions of varying concentrations and sugar:water ratios have been calculated at 60, 75 and 90°C using the author's formula[1], and graphs are presented showing the relationships between concentration and sugar:water ratio, and between temperature and the concentration and sugar:water ratio at saturation. Comparison between the tabulated values and calculated and measured values of MOLLER & SCHMIDT[2] are in close agreement.

* * *

Studies on betaine. I. Exchange capacities of ion exchangers for betaine. S. IWASHINA and Y. YAMAMOTO. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1964, **14**, 32–43.—Static tests showed that betaine was not adsorbed by an anion exchange resin except for a slight physical adsorption on "Asmit 259". Cation exchange resins with sulphonic groups only adsorbed it when in the H form and were more efficient when less cross-linked, since this results in larger pore size.

* * *

Acids in beet and juices. V. Determination of acids by displacement chromatography on anion exchangers. H. D. WALLENSTEIN and K. BOHN. *Zeitsch. Zuckerind.*, 1964, **89**, 253–259.—Displacement chromatography was used to separate and determine quantitatively non-nitrogenous organic acids from beet and beet juices. "Amberlite IRA 400 CG II" resin in OH^- form was used with 0·017N HCl as displacement acid. An automatic fraction collector separated the acids into 6–7 ml fractions, each being titrated with N/20 NaOH using phenolphthalein indicator. The last fraction, containing HCl, was back-titrated with silver nitrate. The acids were determined qualitatively by paper chromatography using 3:1:2:2 benzyl alcohol:3-butanol:*iso*-propanol:water + 2% formic acid as solvent and bromophenol blue as developer. The sequence in which the acids appear in the effluent, which is constant, is a valuable guide to identification and a table of 29 acids is presented showing the relationship between the acid pK and the affinity series. Displacement chromatography enabled only one inorganic acid (phosphoric) to be determined quantitatively. The total acids content was also determined. The effects of three possible sources of error were also studied. Artificial mixtures of acids of known composition were examined using the technique; while scattering of the results was within about 5% for most acids, losses were higher with oxalic and other acids occurring in small quantities. Parallel molasses analyses revealed a somewhat higher error than with the artificial mixtures.

* * *

Estimation of the separability of marc and juice in the processing of sugar beet brei. R. WASMUND. *Zeitsch. Zuckerind.*, 1964, **66**, 265–270.—A laboratory-scale plant was used in tests to determine the effects of various factors on the extraction of juice from beet brei. The basic stages in the process were: beet rasping, mixing with water addition and vacuum extraction of the juice from the brei in a filter. With a saw blade of 20 teeth/inch, giving raspings 0·5–3 mm long and up to 1 mm thick, a large number of cells remained unopened. The most suitable sieve used in the filter had 0·35 mm dia. holes. The brei was applied on the sieve in a continuous blanket and was then sprayed with water; it was pressed by a roller travelling at 1 m/sec. The juice was extracted under vacuum while movement was imparted to the roller by compressed air. If the roller is not clean, portions of the brei blanket may adhere and break the vacuum required for juice withdrawal. With six rollings the brei could be reduced to 13–17% dry solids. Difficulties were encountered in extracting residual moisture which could be carried out only slowly because of choking caused by the dough-like brei blanket. Sugar losses fell from 1·1% at 40°C to 0·55% at 80°C when raw juice from a brei filter was used to spray the brei in a second filter. The large amount of air over the filter and the vacuum effect caused foaming. This could be remedied by pre-treating the brei in a centrifugal; the brei was then re-mixed and filtered as above.

* * *

Control of CaO content in carbonatated juice by conductimetric method. Y. C. CHENG. *Rpt. Taiwan Sugar Expt. Sta.*, 1964, (33), 107–119.—Owing to wide variation in ash composition and excessively high K contents of cane juice, the relationship between specific conductance and CaO content of carbonatation juice are often only poorly correlated. This may be improved to give a limited range of error by including the K content, although the presence of phosphate or organic acid radicals can lower conductance of the Ca salt to some extent. The relationships were expressed as:

$$Ca = 1{\cdot}773\ C_1 - 0{\cdot}4388\ K + 543{\cdot}6 \text{ and}$$

$$Ca = 4{\cdot}614\ C_2 - 0{\cdot}5130\ K + 159{\cdot}0$$

for 1st and 2nd carbonatation juices, respectively. Since ash is also related to specific conductance, the relation Ca (mg/litre) = 1245 Ash % + 49·3 results.

[1] *I.S.J.*, 1964, **66**, 302.

BY-PRODUCTS

The growing Australian demand for furfural—a potential secondary industry. B. J. QUINN. *Proc. 31st Conf. Queensland Soc. Sugar Cane Tech.*, 1964, 37–43. The production of furfural is discussed, with details of its chemical properties and uses and the raw material used (bagasse being considered as available in sufficient quantities at a reasonable cost). The steam requirements constitute a major item in the cost of furfural manufacture and the author therefore suggests investigating the economics of a plant adjacent to a sugar factory.

* * *

Briquetting of molassed dry pulp. S. MÉSZÁROS. *Cukoripar*, 1964, **17**, 42–43.—The equipment used for molassed dry pulp briquetting is briefly discussed and factory experience drawn on to show how to increase the amount of molasses added.

* * *

Selection and preparation of suitable strains of lactic acid bacteria for beet pulp inoculation. B. HYLMAR and L. VOKOUNOVÁ. *Listy Cukr.*, 1964, **80**, 88–93. A mixture of homofermentative lactic acid bacteria strains was made up and tested for beet pulp silage inoculation. Details are given of the strains and optimum growth conditions.

* * *

"Blackstrap molasses" as produced versus standard grade "Cane molasses". S. L. CROCHET. *Sugar y Azúcar*, 1964, **59**, (5), 56–59, 80.—Blackstrap and cane feeding molasses or cane molasses are defined, the first as final molasses as produced at the cane sugar factory and the second and third as laid down by the Association of American Feed Control Officials. The author recommends adoption of definitions based on Brix, i.e. blackstrap having a density of not less than 85°Bx and cane molasses being a dilution of blackstrap to not less than 79·5°Bx. Use of molasses as a cattle feed supplement is discussed.

* * *

Beef production in the cane belt of Natal. A. W. LISHMAN. *S. African Sugar J.*, 1964, **48**, 352–359. The value of waste cane tops for "finishing" beef cattle during late winter and early spring (6–7 lb chaffed cane tops per 100 lb live weight) is stressed. Recommendations for rations are given.

* * *

Heat conductivity of soft bagasse board and the sound absorption of acoustic tiles from bagasse. C. I. NEE and W. C. HSIEH. *Rpt. Taiwan Sugar Expt. Sta.*, 1964, (33), 121–133.—Following the procedure specified in ASTM C-177-45, a thermal conductivity below 0·38 B.Th.U.in./hr/sq.ft./°F is obtained for ½-in insulating bagasse board. The acoustic tiles were tested by the reverberation method (as used by ASTM) and by the standing wave method. Measured over a decay range of 45 db, the tiles gave a noise reduction coefficient of 0·5–0·55 by the first method, factors affecting the coefficient including size of fibre, state of fibre felting, density of board, and size and number of holes drilled.

* * *

Sucrose chemistry. [Sucrose esters. L. NOBILE. *Ann. Chim. Roma*, 1963, **53**, 1299–1314; through *J. Appl. Chem. Abs.*, 1964, **14**, i-504.—The properties of sucrose esters in relation to their use in food, pharmaceutical, cosmetic and detergent products, are considered. The relative effects of different sucrose esters, sucro-glycerides and standard products on foaming, dispersion, wetting, emulsifying and surface tension properties are shown in graphical form.

* * *

The importance of sugar-containing fodder in the production of mixed fodders. K. NAUMANN. *Zucker*, 1964, **17**, 311–314.—The rules and regulations covering the amounts of different types of sugar-containing fodder permitted in mixed fodders in West Germany are discussed. Particular attention is paid to the importance of molasses and the determination of sugar in molasses-containing fodder.

* * *

Bagasse production goes commercial in Jalisco. F. SERNA S. *Sugar y Azúcar*, 1964, **59**, (6), 60.—Expansion of a kraft paper mill at Atenquique, Jalisco, Mexico, is permitted by use of bagasse as a raw material to be mixed with wood pulp. A pipeline to supply sugar mills with fuel oil is planned, when more bagasse will become available for utilization for pulping.

* * *

Alkyloxymethyl ethers of sucrose and glucose as surfactants. G. R. AMES, H. M. BLACKMORE and T. A. KING. *J. Appl. Chem.*, 1964, **14**, 245–249. Alkyl chloromethyl ethers react with excess of sucrose in dimethylformamide solution to give, under suitable conditions, mono- and di-alkyloxymethyl ethers. Certain of these show a high degree of surface activity and of detergency in the presence of conventional builders (Na_2SO_4 + sodium tripolyphosphate + sodium carboxymethylcellulose). In laboratory tests they were more effective than sodium dodecylbenzenesulphonate. The properties of some glucose alkyloxymethyl ethers are also reported.

* * *

Microbial technical cell substances synthesis. Continuous fermentation of sugar cane molasses. M. LORENZ and J. STÖCKER. *Chem. Tech.* (Leipzig), 1963, **15**, 652–654; through *J. Sci. Food Agric. Abs.*, 1964, **15**, i–324.—A technical plant is described for the production of fodder yeast containing 50·8% of crude protein in a yield of ~11 kg of dry yeast per litre of molasses wort containing 2% of reducing sugars. The medium contains diammonium phosphate, NH_4 sulphate (20% of the required N) and ammoniacal liquor; the pH is 3·9–4·2 and the temperature 30–32°.

UNITED KINGDOM

Refining esters of solid polyhydric alcohols. NORTH AMERICAN SUGAR INDUSTRIES INC., of New York 36, N.Y., U.S.A. **962,671.** 18th May 1961; 1st July 1964.

Carboxylic esters of polyhydric alcohols (sucrose, raffinose, etc.), prepared by transesterification in primary solvent (pyrrolidone, dimethyl acetamide, N-methyl pyrrolidone or dimethyl formamide), are purified by (neutralizing and) treating the reaction mass, while it contains some [at least 20% (30–80%) by weight of the] primary solvent, with (0·8–4 times the weight of primary solvent of) a secondary solvent in the form of an (aromatic) hydrocarbon (boiling at $< 350°C$ at atmospheric pressure) with 0–50% by weight of an organic solvent containing carbon, hydrocarbon and oxygen only and having no more than 11 carbon atoms, no more than 4 oxygen atoms and no more than 2 OH groups. This secondary solvent has an Aniline Point no greater than 130°F and mixing of the secondary solvent takes place at a temperature sufficiently high (50–140°C) to cause the primary and secondary solvents to dissolve in each other sufficiently to cause the unreacted polyhydric alcohol to precipitate. (The latter is then separated at 20–100°C.)

* * *

Purifying sugar. ROHM & HAAS CO., of Philadelphia, Pa., U.S.A. **962,910.** 1st September 1960; 8th July 1964.

Undefecated juices are subjected to ion exchange treatment at a temperature of at least 35°C with a cation exchanger (a sulphonated copolymer of styrene and divinyl benzene) in a metallic salt form containing exchangeable cations of group IIa of the Mendeleev Periodic Table (Ca or Mg). The product is heated to a higher temperature and a soluble hydroxide, phosphate, carbonate or bicarbonate of an alkali metal or ammonia or an alkaline earth metal [NaOH, $Ca(OH)_2$] added, to precipitate the group IIa cations. The precipitate is then removed and the solution evaporated and the sugar crystallized.

* * *

Dielectrically heated drying apparatus through which articles to be dried are continuously advanced. SVENSKA SOCKERFABRIKS AB., of Malmö C, Sweden. **964,180.** 5th September 1961; 15th July 1964.

The dielectrically heated drying apparatus, through which the articles (e.g. sugar cubes) to be dried are continuously advanced, comprises a high frequency generator and a pair of electrodes connected to it to form its output condenser. Between the electrodes is a passage for the articles to be dried, one electrode being arranged as a conveyor for transporting them through the passage. The other electrode is a box-like member inductively coupled to the oscillating circuit of the high frequency generator and by means of an external wall surface, together with the other electrode, defines the passage for the articles to be dried. One or more further electrodes having the same potential as the first are located adjustably opposite to and spaced from one or more of the remaining external wall surfaces of the box-like electrode to form with them a compensation condenser which is connected in parallel with the output condenser.

For drying, air is supplied to the box-like electrode through a looped pipe which forms an element of the inductive coupling between the oscillating circuit of the high frequency generator and the box-like electrode, while for discharging drying air there is a slot in the external wall surface extending along a portion of the conveyor and slightly oblique to its longitudinal direction.

* * *

Production of L-glutamic acid. AJINOMOTO CO. INC. and SANRAKU DISTILLERS CO. INC., of Tokyo, Japan. **968,428.** 19th July 1962; 2nd September 1964.

A micro-organism (*Brevibacterium lactofermentum*, *Saccharomyces bisporus*, or *Torula* spp.) capable of decomposing and/or absorbing biotin, gram-positive and capable of producing L-glutamic acid, is contacted with saccharidic material (raw sugar or molasses) containing more than 10γ biotin per 100 g sugar (in aqueous solution at pH 4–12 and at 20–50°C). Solid matter is removed and the medium used with an assimilable N source for culture of a glutamic acid-producing micro-organism while shaking under aerobic conditions. The glutamic acid is then recovered.

* * *

UNITED STATES

Glutamic acid fermentation. H. OKADA, K. RAKINAMI, Y. HIROSE, T. TSUNODA and K. KONO, *assrs.* AJINOMOTO CO. INC., and SANRAKU DISTILLERS CO. INC., of Tokyo, Japan. **3,138,540.** 21st August 1962; 23rd June 1964.

Molasses containing biotin is reacted with sufficient of a peroxide [H_2O_2 or a (alkali metal or NH_4) persulphate] to partly oxidize the biotin (sterilized by heating to above 100°C) and incorporated with an N source in a culture medium for L-glutamic acid-producing micro-organisms.

Copies of Specifications of United Kingdom Patents can be obtained on application to H.M. Patent Office, 25 Southampton Buildings, London, W.C.2. (price 4s. 6d. each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. (price 25 cents each).

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.

Apparatus for thin layer chromatography. T. J. Sas & Son Ltd., Victoria House, Vernon Place, London, W.C.1.

The basic concept of thin layer chromatography is to coat a glass slide with a given thickness of adsorbent layer, and then apply the sample to the layer. The glass is then placed in a solvent, and by capillary action the sample ascends the adsorbent, leaving traces which are readily identifiable.

The two types of T.L.C. spreader on the markets fall into the "fixed" bridge and "movable" bridge types, the former being advantageous if preparative T.L.C. is contemplated.

The "Sas-App" apparatus being precision engineered, has many advantages, the most important being tabulated as follows:—

1.—Calibrated adjusting screws. 2.—Automatic allowance for aberrations in the surface of the slide—even the cheapest window glass may be used. 3.—Anodized aluminium base-plate allows easy cleaning and is proof against corrosion or chemical attack. 4.—The apparatus is adjustable to coat glass plates 10 or 20 cm in width. 5.—There is nothing to break or wear out.

A full range of accessories such as glass slides, vats, templates and adsorbents is also available.

* * *

Liquid density meter. Rotameter Manufacturing Co. Ltd., 330 Purley Way, Croydon, Surrey.

The new Mark 4 "Gravitrol" density meter is only 52 in long compared with the 75 in of the earlier instruments. In addition to higher sensitivity and long-term stability, it provides for temperature compensation throughout the density span.

The new instrument retains the same basic design principles, i.e. it consists of a simple measuring loop of corrosion-resistant material which is inserted directly into the pipeline carrying the slurry or other fluid, thus avoiding any contact with the atmosphere. Either all or part of the fluid can be passed through the measuring loop. Measurements are not affected by the size of particles suspended in the liquid. Under normal flow conditions the solid content will not gradually settle as often occurs with density measuring instruments of the buoyancy type. Variations in the velocity of fluids have no effect as long as the pressure limits are not exceded.

Calibration of the instrument can easily be checked by means of the weights provided and the instrument can be reset on site if any change in the process should result in the need for a revision of the density span.

The density span is adjustable over the range 10:1. With electrical transmission, the span can be adjusted between 0·01 and 0·1 g/ml; with pneumatic transmission it can be adjusted either between 0·025 and 0·25 or 0·05 and 0·5 g/ml.

* * *

Industrial weigher Type CWCI/IV. Herbert & Sons Ltd., Angel Road, Edmonton, London, N.18.

This new sophisticated unit can perform a variety of functions, with a high degree of accuracy. They include: continuous totalizing belt weighing, constant feed controlling, automatic weighing of separate small batches, and automatic weighing of large continuous flow batches, as well as check weighing and weighing of individual packages.

A patented electronic sensing device, mounted on the back of a sensitive dial mechanism, converts the dial reading into electrical impulses. These impulses can then be used to operate either electromagnetic counters, electric impulse decade counters, or completely electronic counting equipment. The raw material is kept in a storage hopper and is fed to the weighing machine by a vibratory feeder. A self-contained motor-driven conveyor is mounted on a suitable lever system which in turn is connected to the sensitive dial mechanism.

For continuous totalizing belt weighing, material is fed from the storage hopper through the vibrator to the continuously moving belt on the weighing machine. Impulses from the sensing device operate an electro-mechanical six-figure counter. The weight on the conveyor belt can be monitored at any time from the dial indicator and the totalized amount which has already passed over the machine can be read at any time from the six-figure counter. The present range of the machine extends from 0·5 to 100 tons per hour. In the lower capacity range the counter has 1/10 lb divisions, and in the higher range 1 lb divisions. Totalized amounts are correct to less than $\frac{1}{2}\%$ according to the product being weighed.

For constant feed controlling, photocell equipment fitted on the front of the dial indicator sends signals to the vibrator feeder, ensuring a constant flow of material across the conveyor belt within a very small margin of error.

Working to a set sequence, the machine feeds a given amount (say between 5 and 15 lb) onto the belt for automatic weighing of small separate batches. The vibrator and conveyor then stops while the weight is accurately checked and a printed record made. The conveyor then re-starts and feeds the material into a suitable container. When the container is moved and an empty one takes its place the sequence re-starts.

In automatic weighing of large continuous flow batches the machine is fitted with a number of batching

counters, each of which can be pre-set to any given amount (up to a maximum of six figures), each amount representing a different ingredient. The machine can then feed each ingredient consecutively to the amount set on the batching counter.

The machine can be fitted with a very simple type of electromagnetic impulse counter printer capable of printing the weight only on a ticket or alternatively on a continuous paper roll. A more intricate type of printer can also be fitted giving date, time of day, consecutive serial number and weight, on a ticket, paper roll, or ticket and paper roll. Both types of printer can be remote from the scale if desired.

* * *

PUBLICATIONS RECEIVED

RENOLD GENERAL PRODUCTS CATALOGUE. Renold Chains Ltd., Wythenshawe, Manchester.

A new catalogue of their products for power transmission and mechanical handling has been published by Renold Chains Ltd. The initial publication is in English but versions are planned to appear in 12 other languages for world use by the company's export organization. Included are full details of the Company's ranges of precision transmission chains to British, Continental and American standards, together with the stock range of pinions and wheels which provide stock drives up to 190 h.p. at 1500 r.p.m. with ratios from 1:1 up to 8·82:1. Power transmission accessories includes couplings, chaincases, lubricators and chain servicing tools. In the mechanical handling section are to be found details of stock series chains, attachments and wheels for mechanical handling with chain breaking loads up to 30,000 lb. This section also lists various transmission chains adapted for mechanical handling. Among other products of the Renold Group which are included are slat band chains, "Anchor" multiplanar link chains and Perry aluminium roller chains. The usefulness of the catalogue is enhanced by the inclusion of a drive selection chart and technical data on chain driving and drive selection.

* * *

DRYERS AND COOLERS. Ashmore, Benson, Pease & Co. Ltd., Stockton, Co. Durham.

Ashmores are in process of publishing a series of brochures describing plant which they are to manufacture under licence from Bartlett-Snow-Pacific Inc.[1] and which can be used in a very wide range of industries. The first brochure, "Dryers and Coolers", has now been completed and is available. It provides numerous illustrations and detailed specifications.

* * *

NEPTUNE LIQUID FUEL METERS. Neptune Meter Co. Ltd., Redcar, Yorks.

Forms 777a and 779-13 are booklets illustrating, describing and providing detailed specifications on totalizing meters for liquid fuels—petroleum, LP gas, etc.; these may find application where oil has to be burnt as a supplementary or replacement fuel for bagasse, which may be economically useful as a by-product raw material.

* * *

BELLISS & MORCOM MACHINERY. Belliss & Morcom Ltd., Icknield Sq., Birmingham 16.

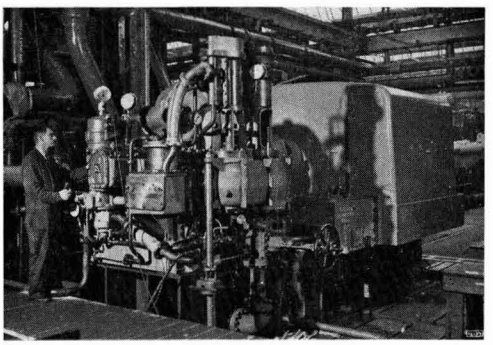
This new catalogue provides illustrations and general information on the Belliss & Morcom range of steam turbines and condensing plant, air and gas compressors, vacuum pumps, diesel engines, steam engines, etc. A separate leaflet describes each of the sections in greater detail.

BMA INFORMATIONS, II. Braunschweigische Maschinenbauanstalt A.G., Braunschweig, Germany.

The second issue of this well-printed catalogue/house magazine provides information on a number of topics connected with sugar, including: sugar drying, cane diffusion, the BMA candle filter, and "Instamat", a new dispersant.

* * *

Power plant for Australian sugar mills.—Steam turbine-driven alternators from W. H. Allen Sons & Co. Ltd., of Bedford, supplied or on order for Australia include a 2000-kW set for the Racecourse Co-operative Sugar Milling Association, Mackay, a 2000-kW set for the Marian Central Mill Co., Mackay, a 3000-kW set for the North Eton Co-operative Sugar Milling Association, Mackay (illustrated), a 2000-kW set for



the Cattle Creek Co-operative Sugar Milling Association, Finch Hatton, Mackay, a 3000-kW set for the Mossman Central Mill Co., Mossman, and a 3000-kW set for the Mulgrave Central Milling Co. Ltd., Gordonvale. In addition, a 2500-kW Allen steam turbine-driven alternator has recently been installed at the South Pacific Sugar Mill, Lautoka, Fiji. All are back-pressure machines, which not only generate the electricity requirements of the mills, but also supply low-pressure steam for the various sugar production processes.

* * *

Dorr-Oliver equipment in Taiwan.—In six different locations in Taiwan, Dorr-Oliver equipment is being used in the factory expansion programmes of the Taiwan Sugar Corp. It includes six 8 ft dia. × 16 ft long Oliver-Campbell filters and one 8 ft dia. × 16 ft long "RapiFloc" conversion. This is the first time that the "RapiFloc" system for cane mud filtration is being tried in Taiwan. All construction and installations have been handled locally by the Taiwan Machinery Manufacturing Company. The expanded facilities are in operation for the current campaign, except the "RapiFloc" system which is expected to be completed next year.

* * *

Western States batch centrifugals.—Seventeen Western States batch centrifugals are now processing white and low raw sugar at a 4000-ton Holly Sugar plant. These two stations, designed and supplied by Western States, include five 48 in × 30 in 1200 r.p.m. fully-automatic electrically-driven centrifugals for the processing of white sugar and twelve 40 in × 30 in 1800 r.p.m. fully-automatic fluid-driven machines for the processing of low raw sugar, plus supporting steel framework and mixer tanks. Both batteries include such features as automatic basket pre-flush, wash controls, anti-gyration switches, automatic reverse discharges, cycle insurance protection, and spare process timers mounted on the process panel. Each battery is equipped with its own individual sequence control to prevent overlapping starts of the centrifugals, and smooth out the flow of sugar from the machines to the conveyors.

[1] *See I.S.J.*, 1964, **66**, 338.

World Sugar Production Estimates 1964/65[1]

		(metric tons, raw value)		
BEET SUGAR				
Western Europe	*Campaign*	1964/65	1963/64	1962/63
Western Germany*	Sept./Jan.	2,,175000	2,108,000	1,521,199
Austria	Sept./Jan.	340,000	329,661	266,458
France	Sept./Jan.	2,400,000	2,085,331	1,689,554
Belgium-Lux'brg.	Sept./Jan.	520,000	354,607	334,751
Netherlands	Sept./Jan.	592,500	427,327	466,226
Denmark	Sept./Jan.	434,000	367,000	209,000
Sweden*	Sept./Jan.	295,700	245,396	206,667
Italy	July/Oct.†	925,000	941,760	1,019,576
Spain	July/Feb.	486,000	384,442	462,213
Yugoslavia	Sept./Dec.†	340,000	341,566	251,702
Greece	July/Jan.	68,700	39,278	26,667
Switzerland	Sept./Jan.	52,000	45,846	30,109
Great Britain ..	Sept./Jan.	1,000,000	834,187	774,996
Ireland	Sept./Jan.	146,000	145,408	136,823
Finland*	Sept./Jan.	59,400	57,731	44,271
Turkey	July/Jan.	721,000	512,610	433,052
Total		10,555,300	9,220,150	7,873,264
Eastern Europe				
Eastern Germany	Sept./Jan.	875,000	789,317	664,756
Czechoslovakia	Sept./Jan.	975,000	1,103,000	1,031,110
Hungary	Sept./Jan.	473,000	457,200	434,260
Poland	Sept./Jan.	1,700,000	1,454,000	1,357,778
Albania	Sept./Jan.	12,000	11,000	13,000
Rumania	Aug./Jan.	460,000	318,127	312,085
Bulgaria	Aug./Jan.	160,000	158,556	156,667
Soviet Union ..	Sept./Jan.	8,600,000	6,150,000	6,667,000
Total		13,255,000	10,441,200	10,636,656
Europe, total		23,810,300	19,661,350	18,509,920
Other Countries				
United States ..	July/Jan.	2,948,000	2,812,258	2,365,266
Canada	Oct./Dec.†	160,000	154,519	141,515
Uruguay	Nov./Mar.	45,000	39,400	37,270
Chile	Apr./Jun.‡	110,000	110,712	109,604
Azores	Jun./Oct.†	11,000	8,422	8,201
Japan	Oct./Feb.	155,000	162,294	154,482
China (Mainland)	Jan./Dec.‡	460,000	390,000	350,000
Pakistan		5,000	5,000	5,000
Iran	Oct./Mar.	190,000	156,910	147,547
Iraq		30,000	30,000	29,110
Afghanistan	Nov./Feb.	9,000	8,500	8,000
Israel	Apr./Jun.‡	36,100	36,533	34,489
Syria	May/July.‡	13,000	13,000	10,396
Total		4,172,100	3,927,548	3,400,880
World Beet Sugar Production		27,982,400	23,588,898	21,910,800
CANE SUGAR				
Europe				
Spain	Dec./Jun.	30,000	31,204	29,377
North and Central America				
Cuba	Jan./Jun.‡	3,800,000	3,500,000	3,820,323
United States ..	Oct./Apr.	1,125,000	1,069,270	773,825
Puerto Rico	Jan./Jun.‡	816,000	897,598	897,414
Hawaii	Jan./Dec.‡	1,043,000	1,061,400	998,595
Trinidad	Jan./Jun.‡	254,000	230,155	230,984
Barbados	Jan./Jun.‡	182,900§	164,083§	193,748§
Jamaica	Jan./Jun.‡	523,200	493,000	491,893
Antigua	Jan./Jun.‡	20,300	21,411	26,689
St. Kitts.....	Jan./Jun.‡	46,700	43,825	40,199
Other West Indies	Jan./Jun.‡	—	—	2,556
Virgin Islands ..	Jan./Jun.‡	14,500	14,098	14,362
Dominican Rep.	Dec./Nov.	880,000	870,900	798,020
Mexico	Nov./Jun.	2,355,500	1,931,549	1,732,347
Martinique	Jan./Jun.‡	76,000	76,087	77,777
Guadeloupe	Feb./Jul.‡	180,000	167,000	186,025
Haiti	Dec./Jun.	65,330	61,688	69,027
Guatemala	Dec./Jun.	145,000	139,043	127,000
El Salvador	Nov./Mar.	96,600	43,200	58,608
British Honduras	Dec./Jun.	34,000	34,129	28,286
Honduras	Dec./Jun.‡	27,000	26,517	24,059
Nicaragua	Dec./Jun.	93,000	93,000	87,448
Costa Rica	Dec./Jun.	95,000	98,000	85,566
Panama	Dec./Jun.	54,400	50,449	36,049
Total		11,927,400	11,086,402	10,800,800
South America				
Argentina	May/Nov.†	1,030,000	1,073,454	815,295
Brazil	Jun./May	3,370,000	3,250,000	3,226,284
Peru	Jan./Dec.‡	830,000	800,000	819,986
British Guiana..	Oct./Jun.	340,400	284,480	322,211
Uruguay	Jul./Oct.†	9,500	9,581	6,612
Surinam	Oct./Jan.	13,000	12,143	10,992
Venezuela	Jul./Jun.	362,200	308,889	322,222
Bolivia	May/Sept.†	84,000	75,509	54,648
Ecuador	Jun./Jan.	204,000	172,591	135,555
Colombia	Jan./Dec.‡	450,000	425,000	376,951
Paraguay	Jul./Nov.†	51,000	39,006	36,511
Total		6,744,100	6,450,653	6,127,267
Africa				
Egypt	Dec./Jun.	400,000	385,000	358,518
Sudan		35,600	21,689	14,426
Ethiopia & Eritrea	Nov./Jun.	67,000	66,700	65,791
Mauritius	Jul./Jan.	510,000	685,566	532,817
Réunion	Aug./Jan.	198,000	224,240	181,209
South Africa....	May/Feb.	1,275,000	1,147,314	1,082,519
Swaziland		90,000	85,638	72,819
Mozambique ..	May/Nov.†	158,000	181,770	186,322
Angola	May/Oct.†	65,500	68,233	73,233
Kenya, Uganda, Tanganyika ..	Sept./Aug.	220,000	212,000	200,000
Madagascar	May/Nov.†	115,000	117,390	89,170
Congo—				
(Brazzaville) ..	Oct./Apr.	—	5,000	26,000
(Leopoldville)	Nov./May†	30,000	37,000	44,400
Rhodesia	May/Nov.†	164,200	125,191	77,433
Madeira	Dec./Feb.	6,000	6,557	3,612
Total		3,334,300	3,369,288	3,008,269
Asia				
India—				
White sugar ..	Nov./Jul.	3,100,000	2,838,000	2,397,698
Khandsari ..	Nov./Jul.	280,000	280,000	300,000
Indonesia	Apr./Dec.†	650,000	653,529	591,930
Pakistan	Nov./Jul.	330,000	300,000	287,949
Burma	Nov./Jul.	67,000	65,000	63,000
Philippines	Nov./Jul.	1,941,200	1,682,848	1,554,820
Taiwan	Oct./May	870,000	795,101	767,841
China (Mainland)	Jan./Dec.‡	1,650,000	1,450,000	950,000
Thailand	Oct./Apr.	252,000	167,500	125,031
Viet Nam	Oct./Apr.	28,000	28,000	20,000
Japan	Nov./Jun.	60,000	57,800	49,721
Ryukyu		225,100	128,365	150,494
Ceylon		6,000	5,347	9,500
Total		9,459,300	8,451,490	7,267,984
Oceania				
Australia	May/Dec.†	2,050,000	1,705,000	2,048,000
Fiji Islands	May/Dec.†	320,000	300,700	253,000
Total		2,370,000	2,005,700	2,301,000
Cane Sugar Production		33,865,100	31,394,737	29,534,697
Beet Sugar Production		27,982,400	23,588,898	21,910,800
World Sugar Production		61,847,500	54,983,635	51,445,497

[1] F. O. Licht, *International Sugar Rpt.*, 1964, **96**, (33), 1–4.
* Including sugar production from foreign beets.
† 1964, 1963, 1962.
‡ 1965, 1964, 1963.
§ Including "fancy molasses".

BREVITIES

European Federation of Chemical Engineering congress.—The 4th Congress of the Federation is to be held in London during the 15th—24th June 1966, and its theme is to be the interaction of technology and economics in process plant. Six symposia will be arranged and those interested are requested to write for further details to the General Secretary, The Institution of Chemical Engineers, 16 Belgrave Square, London S.W.1.

* * *

Bulk storage capacity expansion in Hawaii[1].—The total capacity of the bulk sugar storage-shipping plants is to be raised from 166,500 to 250,000 tons, the new warehouse at Hilo contributing 11,500 tons of the increase. At Kawaihae capacity is to be increased from 14,000 to 30,500 tons by extending the warehouse and conveyor system. At Kahului, Maui, a new 32,000 tons plant will be built to augment the present capacity of 36,000 tons. At Mawiliwili, Kauai, work is expected to be completed in time to handle the start of the 1965 crop. The present capacity of 36,000 tons is to be increased to some 59,500 tons by literally "raising the roof" of the existing plant. Total cost of the expansion programme is expected to be about $2,000,000.

* * *

Chile beet crop, 1963/64[2].—Industria Azucarera Nacional S.A. has reported that its output of white sugar from the 1963/64 harvest amounted to 99,640 tons, representing a saving in foreign exchange equivalent to approximately $20 million, U.S. currency. Total beet production amounted to 658,122 tons.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 17th December* 1964)	s d
Anglo-Ceylon (5s)	6/–
Antigua Sugar Factory (£1)	13/6
Booker Bros. (10s)	17/9
British Sugar Corp. Ltd. (£1)	19/7½
Caroni Ord. (2s)	1/11
Caroni 6% Cum. Pref. (£1)	15/3
Demerara Co. (Holdings) Ltd.	4/3
Distillers Co. Ltd. (10s units)	22/6
Gledhow Chaka's Kraal (R1)	19/6
Hulett & Sons (R1)	32/–
Jamaica Sugar Estates Ltd. (5s units)	3/10½
Leach's Argentine (10s units)	20/6
Manbré & Garton Ltd. (10s)	35/6
Reynolds Bros. (R1)	19/6
St. Kitts (London) Ltd. (£1)	17/3
Sena Sugar Estates Ltd. (5s)	6/9
Tate & Lyle Ltd. (£1)	32/–
Trinidad Sugar (5s stock units)	2/10½
United Molasses (10s stock units)	23/6
West Indies Sugar Co. Ltd. (£1)	9/3

CLOSING MIDDLE

New York Stocks (*at 16th December* 1964)	$
American Crystal ($5)	17⅛
Amer. Sugar Ref. Co. ($12.50)	20¼
Central Aguirre ($5)	24⅜
Great Western Sugar Co.	34¾
North American Ind. ($10)	13⅝
South P.R. Sugar Co.	27⅞
United Fruit Co.	16⅞

Sugar factory for Congo (Brazzaville)[3].—Soc. Fives Lille-Cail of Paris is to build a sugar factory with a refinery section in the Congo (Brazzaville), for SOSUNIARI.

* * *

Bulk transport container size.—B. W. Dyer & Company, the New York sugar brokers and economists, have pointed out the increased sizes of units carrying bulk sugar. Stainless steel-covered hopper rail cars of 270,000 lb capacity were tested in the spring of 1964 and can be used for sugar. Many rail cars now carry 190,000 lb of sugar yet less than 10 years ago a rail car of 100,000 lb capacity was considered large. Tank cars carrying 30,000 gal of liquids are in operation whereas a few years ago the standard tank car held only 10,000 gallons of liquid sugar. Raw sugar is now frequently carried in cargoes of about 20,000 tons while only a few years ago the standard cargo was about 10,000 tons.

* * *

New sugar factory for Mexico[4].—Together with a German firm, the Dutch Company Stork-Werkspoor N.V. is to build a sugar factory in Mexico, situated near Chetumal in the State of Quintana Roo. The factory will at first have a capacity of 200,000 tons of cane, to be doubled later. The total costs of the project amount to about 10 million pesos.

* * *

Indian Sugar Commission[5].—A Government Commission in India is at present conducting an enquiry into all aspects of the sugar industry in that country including the price of cane, the acreage cultivated, production, internal distribution and exports. Much work is involved in assessing these problems and a final report on the Commission's findings has yet to be published. The Commission has already made certain recommendations to the Government, however, on the measures necessary to increase production and it has been decided to fix the basic minimum price of sugar cane for the year at Rs. 5·36 per quintal (£4.1.8d per long ton), basis 10·4% sugar content or below at factory gate with an increase of 4 paisa per quintal for every 0·1% above 10·4%. The basic previous minimum price of cane was fixed in March 1964 at Rs. 4·96 per quintal, basis 9·4% sugar content. As an incentive to enable crushing to commence earlier in the season, the Government also decided to allow a rebate of 50% in the basic excise duty on any production of sugar during October and November 1964 which exceeds the quantity produced during the corresponding period of 1962.

* * *

U.S. beet acreage limitation[6].—The U.S. Department of Agriculture has announced establishment of a national sugar beet acreage limitation of 1,375,000 acres for the 1965 crop. The Department said that this action was recommended by major sugar beet growers' associations and all but one of the sugar beet processors.

* * *

Co-operative factories for India[7].—The State Government of Gujerat, India, has decided to set up three sugar factories, each having a crushing capacity of 1000 tons of cane per day, at a total cost of about six crores of rupees (£4,500,000). All would be set up on a co-operative basis, two to be located in Surat District and the third in Junagadh District. It has also been decided to expand substantially the capacity of the two existing factories at Bardoli and Kodinar. Goa is also to have a co-operative factory, costing £225,000, which is to be set up near Chellam, in the Sanguem area.

---

[1] *Hawaii's Sugar News*, 1964, **14**, (6), 2.
[2] *Fortnightly Review* (Bank of London & S. America Ltd.), 1964, **29**, 1016.
[3] *Zeitsch. Zuckerind.*, 1964, **89**, 594.
[4] F. O. Licht, *International Sugar Rpt.*, 1964, **96**, (30), 16.
[5] C. Czarnikow Ltd., *Sugar Review*, 1964, (687), 200.
[6] *Public Ledger*, 24th October 1964.
[7] *Indian Sugar*, 1964, **14**, 341.