# THE International Sugar Journal

MARCH 1969

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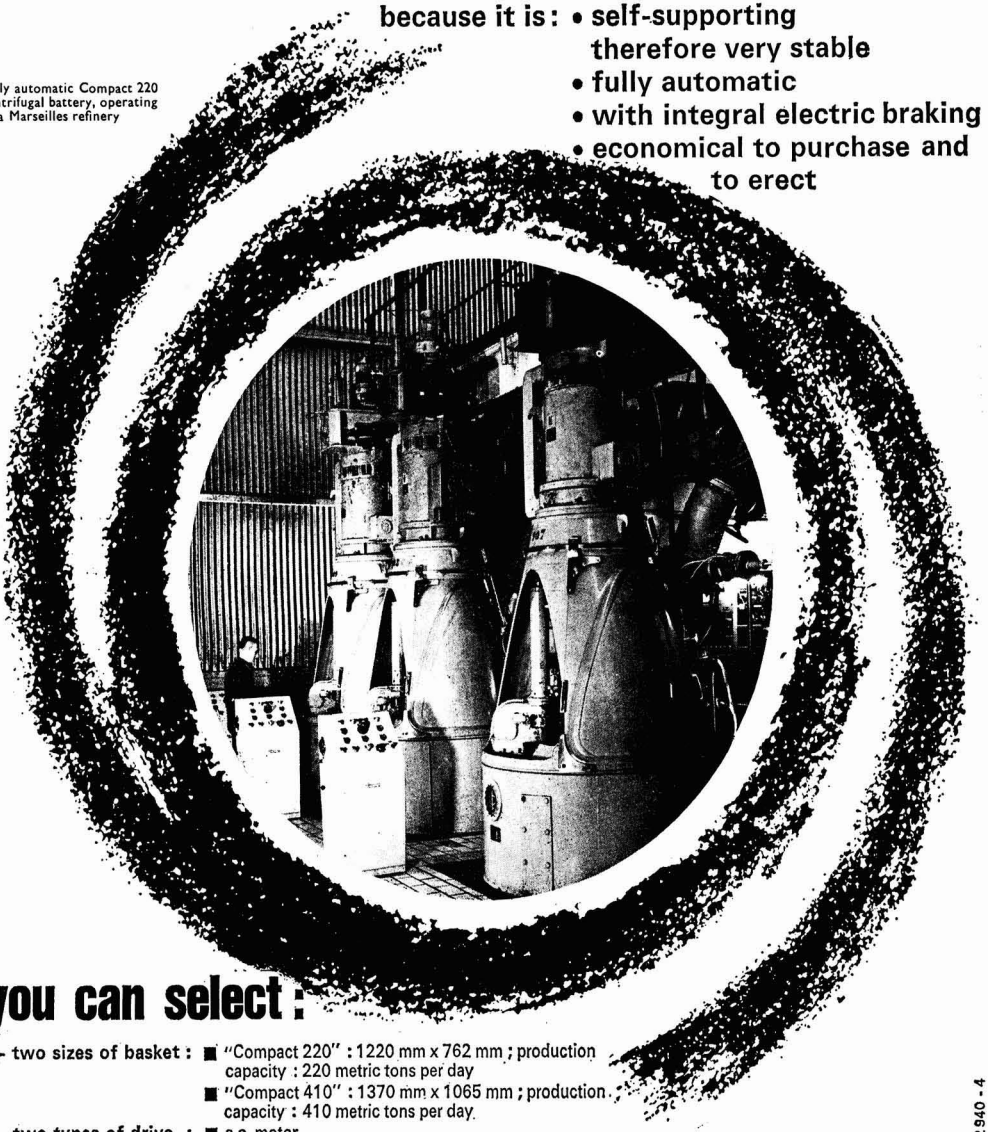

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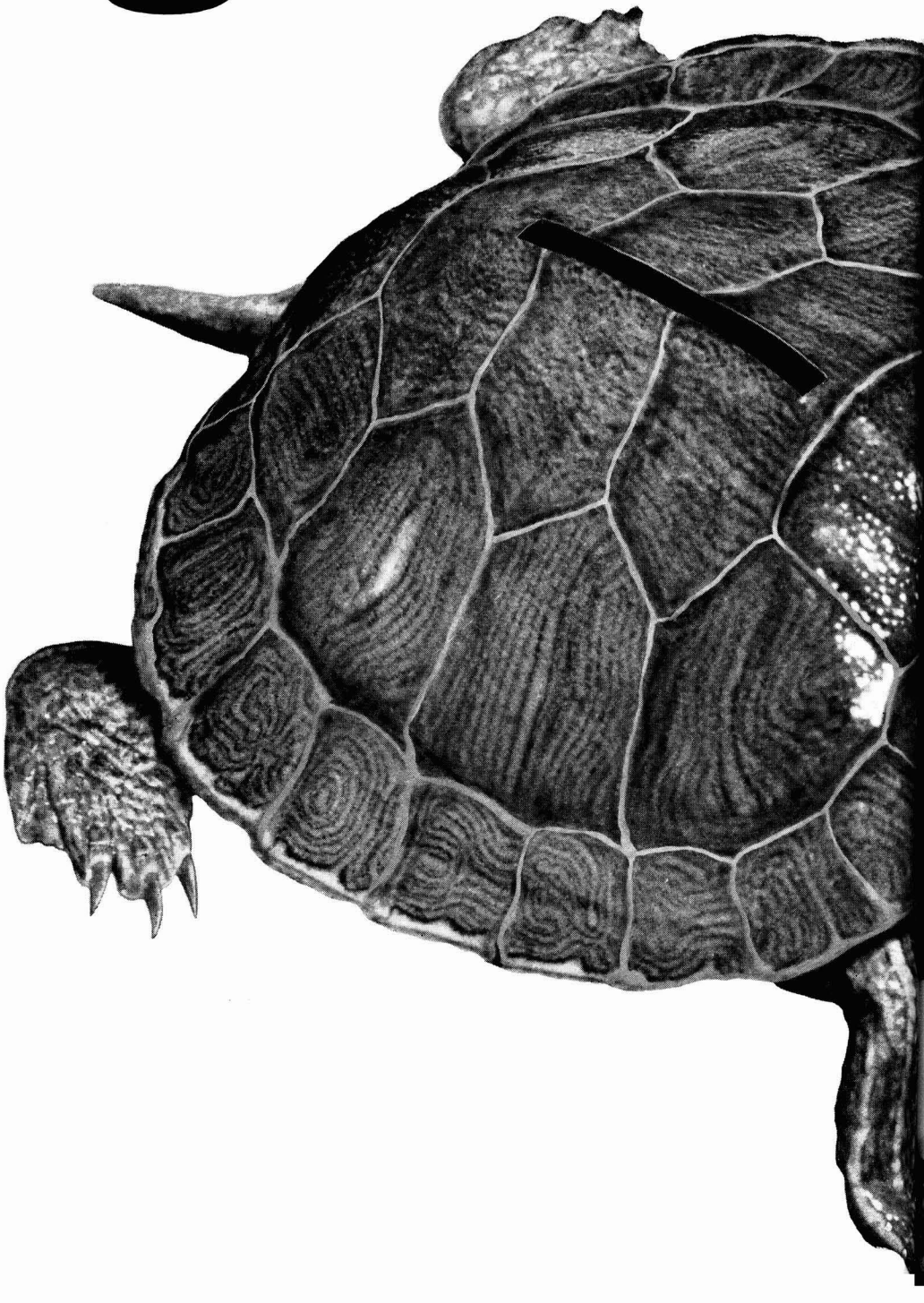

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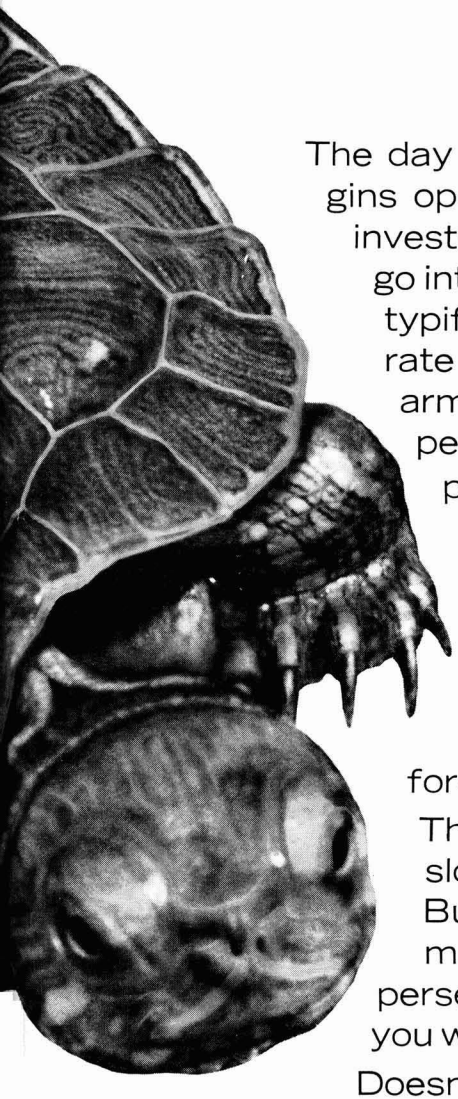

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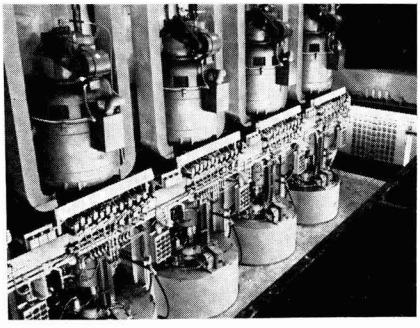

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"Zuclar solved a serious clarification problem early last crop. Thereafter its regular use at ½ ppm on cane weight was very helpful especially considering the small quantity required." — *Mr. Henry Connolley, Seven Estate Ltd., Jamaica.*

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"This is our fourth year using Fabcon's Boiler Water Treatment Program and third year of Cooling Water Treatment. In both cases results have been excellent with minimum water testing and man hours required for effective use."— *Mr. George Mongol, Innswood Estate, Jamaica.*

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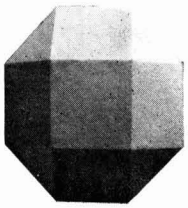

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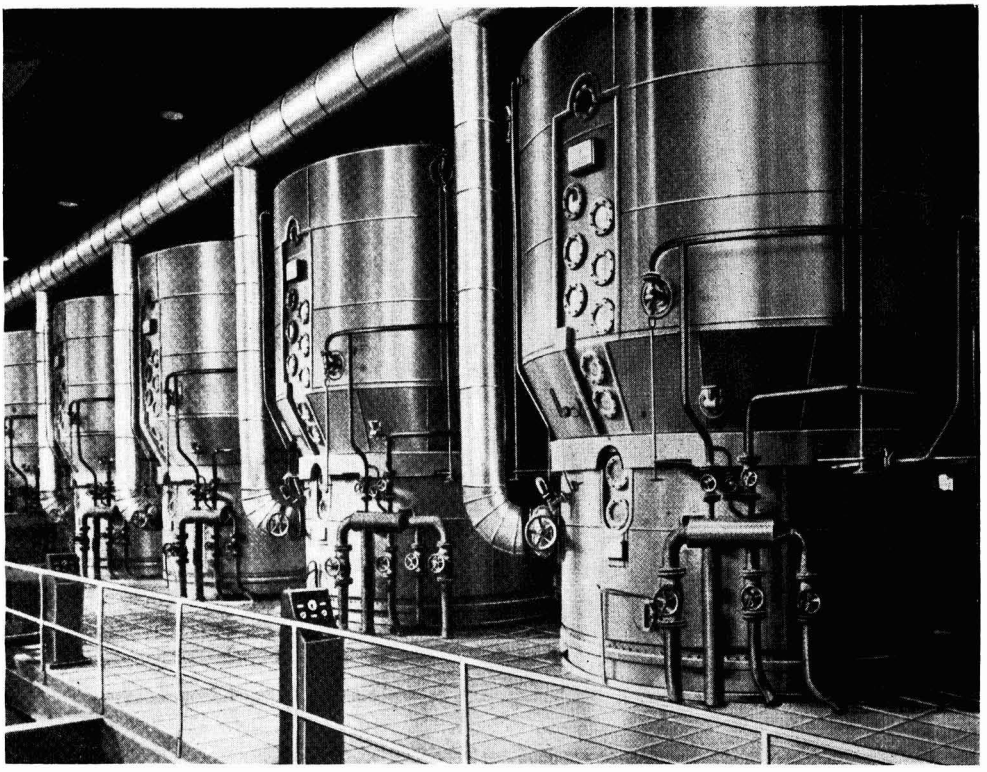

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# International Sugar Journal

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## *Contents*

# SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

**La circulation forcée dans des appareils à cuire. 2-ème partie.** S. HILL, W. M. NICOL et P. D. FIFE. *p.* 67–71

Les auteurs discutent la viscosité de masses cuites et son mesurage, et donnent des valeurs calculées des viscosités des masses cuites employées dans les essais. Des essais avec des masses cuites de haute pureté sont discutés, avec des données sur de vitesses d'écoulement dans des appareils à cuire fournis d'agitateurs à helice des trois types essayés. Des lignes d'écoulement dans un appareil à cuire à surfaces de chauffe rubanées et un appareil à cuire à faisceau sont reproduites. On a examiné l'effet de position de l'agitateur à helice et l'optimisation de l'agitateur à helice à écoulement axuel, et a comparé les performance des quatre agitateurs à helice (la quatrième étant un agitateur à helice à écoulement axuel modifié).

* * *

**Des mesures prises à l'Ile Maurice afin d'améliorer la filtrabilité de sucre brut. 2-ème partie.** J. DUPONT DE R. DE SAINT ANTOINE. *p.* 72–75

L'auteur considère l'effet du travail dans l'atelier de cristallisation sur la filtrabilité de sucre brut, et décrit des moyens par lesquels on a obtenu des améliorations. Entre les aspects examinés sont: la refonte des sucres B et C, la production de moins de massecuite B, l'effet de la grosseur des grains sur la filtrabilité, la circulation mécanique contre la circulation naturelle et son effet sur la qualité des cristaux, la température de la vapeur d'échappement, et le tamisage de sucre après le turbinage. Le contrôle strict de la qualité des sucres bruts est aussi considéré.

* * *

**L'effet de brûlage et de stockage sur la détérioration de la canne. 3-ème partie. Sur des relations entre le sucre et les invertases.** T. Y. RIZK et W. C. NORMAND. *p.* 75–76

Les auteurs examinent une tentative de corréler les résultats des essais décrits dans les premières deux parties de cet article. Des données tabulaires montrent que dans la canne brûlée et non-brûlée il y avait quelques relations quantitatives entre les compositifs sucrés et l'activité des invertases à différents temps de stockage. Ils suggèrent que l'évaluation de variétés de canne à l'avenir pourrait se baser sur le rapport entre les invertases acide et neutre (rapport A/N) ou quelque autre critère d'évaluation de l'activité des invertases.

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**Zwangsumlauf in Kochapparaten. Teil 2.** S. HILL, W. M. NICOL und P. D. FIFE. *S.* 67–71

Die Verfasser besprechen die Füllmassviskosität und ihre Messung, und geben berechnete Viskositätswerte für die Füllmassen, die in den Versuchen angewandt wurden. Versuche mit Füllmassen von hoher Reinheit werden diskutiert, und Fliessgeschwindigkeiten in mit den drei Arten Schraubenrührwerken versehenen Kochapparaten werden dargestellt. Strömungsprofile in einem Kochapparat mit Bandheizflächen und in einem Heizkammerkochapparat werden wiedergegeben. Man hat den Effekt der Lage des Schraubenrührwerks und der Optimisierung des Schraubenrührwerks mit Aschsenfliessen untersucht, und die Leistungen der vier Schraubenrührwerks (der vierte ist eine Modifizierung des Schraubenrührwerks mit Achsenfliessen) verglichen.

* * *

**Einige in Mauritius ergriffene Massnahmen, um Rohzucker-Filtrierbarkeit zu verbessern. Teil 2.** J. DUPONT DE R. DE SAINT ANTOINE. *S.* 72–75

Man diskutiert die Einwirkung der Kochstationarbeit auf die Filtrierbarkeit von Rohzucker und beschreibt Mittel, wobei Verbesserungen gemacht worden waren. Unter den besichtigten Themen sind: das Einschmelzen des *B*- und *C*-Zuckers, die Erzeugung von kleineren B-Füllmassmengen, die Einwirkung von Korngrösse auf die Filtrierbarkeit, mechanische gegen natürliche Zirkulation im Kochen und ihr Effekt auf Kristallqualität, Abdampftemperatur, und Zuckerabsieben nach der Schleuderung. Strenge Rohzuckerqualitätskontrolle wird auch diskutiert.

* * *

**Einwirkung von Brennen und Lagerung auf Rohrverschlechterung. Teil 3. Beziehungen zwischen Zucker und den Invertasen.** T. Y. RIZK und W. C. NORMAND. *S.* 75–76

Ein Versuch, die Ergebnisse der in den ersten zwei Teilen des Aufsatzes beschriebenen Versuche zu korrelieren, wird besichtigt. Tabellarische Daten zeigen, dass in gebranntem wie auch in nichtgebranntem Rohr gab es einige quantitative Beziehungen zwischen Zuckerkomponenten und der Aktivität der Invertasen bei verschiedenen Lagerungszeiten. Die Verfasser suggerieren, dass die Schätzung von Rohrsorten in der Zukunft auf dem Verhältnis zwischen der saueren und der neutralen Invertase (dem A/N Verhältnis) oder irgendeiner Norm der Schätzung von Invertase-Aktivität beruhen werde.

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**Circulación por fuerza en tachos. Parte II.** S. HILL, W. M. NICOL y P. D. FIFE. *Pág.* 61–71

Los autores discuten la viscosidad de masa cocida y su medida, y presentan estimaciones de las viscosidades de masas cocidas usado en sus ensayos. Experimentos con masas cocidas de altas purezas se discuten, con detalles de velocidades de flujo en tachos equipado con los tres tipos de impulsor examinado. Ilustraciones se reproducen del flujo en tachos con elementos de caldeo en la forma de una calandria y de cintas. Se examinen el efecto de la situación del impulsor y optimización del diseño del impulsor axial, y se comparen los cumplimientos de los cuatro impulsores (siendo el cuatro un tipo axial modificado).

* * *

**Medidas adoptado en Mauricio para mejorar la filtrabilidad de azúcar crudo. Parte II.** J. DUPONT DE R. DE SAINT ANTOINE. *Pág.* 72–75

Se discute el efecto de la obra en el departamento de cocción sobre filtrabilidad de azúcar crudo y medidas se describen que han permitido mejoramientos. Aspectos incluídos son refundición de azúcar B y C, producción de menos masa cocida B, el efecto del tamaño de los cristales sobre filtrabilidad, circulación por fuerza y natural en cocción y su efecto sobre calidad de los cristales, temperatura del vapor de escape, y separación de terrones después de centrifugación del azúcar. Se trata también del control riguroso de la calidad de los azúcares crudos.

* * *

**Efecto de quemadura y almacenaje sobre deterioración de caña. Parte III. Sobre relaciones entre sacarosa y invertasa.** T. Y. RIZK y W. C. NORMAND. *Pág.* 75–76

Se examina una tentativa a correlatar los dados de experimentos que se describen en los dos primeros partes de este artículo. Los dados, en forma tabular, demuestran que en caña quemada y no-quemada existen parentescos importantes entre sacareros y actividad de las invertasas durante varios periodos de almacenaje. Se sugiere que, en tiempo venidero, el control de calidad de caña puede apoyar sobre la relación entre invertasa ácida y neutral (relación ácido/neutral, en oposición a la invertasa.

THE
# INTERNATIONAL SUGAR JOURNAL

VOL. LXXI MARCH 1969 No. 843

## Notes & Comments

**International Sugar Organization.**

The first Session of the Council of the International Sugar Organization was held in London from 20th–31st January 1969.

The Session was attended by delegates of 31 of the 32 present Members of the Organization, by observers from Bolivia, Congo (Brazzaville), Finland, Ghana, India, Libya, Malawi, Norway, Philippines, Thailand and Venezuela, the European Economic Community, the United Nations Conference on Trade and Development (UNCTAD) and the Food and Agriculture Organization of the United Nations (FAO).

The Council elected Sr. ADRIAN LAJOUS of Mexico as its Chairman and Mr. R. E. LATIMER of Canada as its Vice-Chairman for 1969.

Mr. ERNEST JONES-PARRY was appointed as Executive Director of the International Sugar Organization.

Having regard to the outstanding contribution of Dr. RAUL PREBISCH, the Secretary General of UNCTAD, to the successful negotiation of the International Sugar Agreement, 1968, the Council resolved to express its high appreciation to Dr. PREBISCH for his devoted and fruitful efforts to bring about the new International Sugar Agreement and to transmit that resolution to the Secretary-General of the United Nations and the Director General of FAO. The terms of this resolution were brought to the notice of Dr. PREBISCH when he addressed the Council on 27th January 1969.

The Council elected the members of the Executive Committee for 1969 and agreed to delegate to that Committee all its powers under the Agreement except those expressly listed in Article 16(1) and except those relating to the final approval of accessions to the Agreement.

The composition of the Executive Committee for 1969 is as follows: *Exporting Members*, Australia, Brazil, China (Taiwan), Cuba, Czechoslovakia, Mauritius, Mexico, S[illegible]th Africa; *Importing Members*, Canada, Japan, Ken[illegible]a, New Zealand, Portugal, Sweden, USSR, and [illegible]

The C[illegible]il co[illegible] ar[illegible] applicati[illegible]s for acc[illegible]r to the [illegible]m[illegible] f[illegible] by the Governments [illegible] Bolivia [illegible] mp[illegible] had In[illegible] nd [illegible] Philippines and agreed on the conditions of accession within the terms of Article 64 of the Agreement.

Furthermore, in order to encourage increased Membership of the Agreement, machinery was set up to consider ways and means of achieving this end, including a study of forms of co-operation which could be established with non-Members for that purpose.

Having made the estimate below of the import requirements of the free market for 1969, and in the light of all factors affecting the demand and supply position in that year, the Council assigned initial export quotas to the exporting Members at a level corresponding to 90% of their basic export tonnages in Article 40, which, it was considered, would bring supply and demand into balance.

**First estimate of net import requirements in 1969**
(metric tons)

| | | |
|---|---|---|
| Europe | | 1,098,000 |
| N. America | | 990,000 |
| C. America | | 20,000 |
| S. America | | 225,000 |
| Asia | | 4,106,000 |
| Africa | | 1,267,000 |
| Oceania | | 162,000 |
| I | TOTAL | 7,868,000 |
| | O.C.A.M* | —110,000 |
| II | TOTAL | 7,758,000 |
| | Adjustment† | +600,000 |
| III | TOTAL | 8,358,000 |
| | Allowance‡ | +155,000 |
| IV | GRAND TOTAL** | 8,513,000 |

The above column was based upon: (i) official estimates of net import requirements as reported by respective Governments by the date of the preparation of the Committee's Report, i.e. 28th January 1969, and (ii) estimates as adopted by the Statistical Committee, whenever official estimates were not available.

* The amount of imports by individual importing members of the African and Malagasy Sugar Agreement (O.C.A.M.) is not available to the Committee. The total net import requirements of all net importing members of O.C.A.M. and therefore included in the list and the total of the Guaranteed Price Quota of the exporting members of O.C.A.M. (110,000 metric tons) is deducted from the world total of net import

requirements. This was done so that only imports from the Free Market by the importing members of O.C.A.M. remain in the net import requirements from the Free Market in 1969.

† This figure represents the difference between the *actual* net imports for the years 1962 to 1967 inclusive and the *estimates* of net import requirements as made at the time by the Council in respect of the same years. It is based on "the standard error of estimate" as determined by the Secretariat. On average, the *estimated* imports during the period under reference were lower than the actual imports by 632,000 metric tons. This figure, rounded down to 600,000, has been added to the total net import requirements of the estimate of 1969 which have been determined on the same basis as in the past.

‡ This allowance refers to the non-statistical disappearance of sugar between the exporting countries and the importing countries; i.e. the amount of sugar which will need to be *exported* in order that the requirements of importers as listed in item III can be fully met. It takes account of the fact that in the past the landed amount of sugar has been consistently lower than the amount of sugar shipped. The corresponding figure during the years 1960–1967 inclusive was, on average, 2·6% of the world total of net imports; this figure has been rounded down to 2% and added to the total of the estimated net import requirements under item II, i.e. 7,758,000 metric tons.

** In order to assess net import requirements, the following imports were grouped as "imports under special arrangements" and excluded from the estimates:

(a) imports by the UK under the Commonwealth Sugar Agreement of 1951 (Article 35)
(b) imports from Cuba by Socialist countries (Article 36)
(c) imports under the African and Malagasy Sugar Agreement (Article 37)
(d) imports by the USA under the US Sugar Act (Article 38)
(e) imports from the USSR by Socialist countries [Article 39(3)]
(f) Imports by East Africa from Uganda [Article 40 (5)]

The balance position in respect of 1969 would appear to be as follows:

| | | |
|---|---|---|
| Estimates of import requirements ..... | | 8,513,000 tons |
| Supplies from non-Members | 1,400,000 tons | |
| Basic export tonnages not subject to adjustments (Article 40, Col. II) ..... | 22,000 tons | |
| Cuban exports to Czechoslovakia, Hungary and Poland [Article 36(3)] .. | 250,000 tons | |
| USSR exports to free market [Article 39(2)] ..... | 1,100,000 tons | |
| Supplies from Members at 90% of basic export tonnages ..... | 5,819,000 tons | |
| Total supplies likely to be available at 90% of B.E.T. ..... | | 8,591,000 tons |

* * *

**Peru sugar quota hazard.**

On the 3rd October, the Government of President BELAUNDE was overthrown by a military Junta, and within hours, the new Government had expropriated all the property of the International Petroleum Company including its Talara refinery and industrial complex. The main reason for the expropriation, and indeed for the coup, was the dissatisfaction of the armed forces and of anti-BELAUNDE political groups with the terms of an agreement under which IPC, a $200 million subsidiary of Standard Oil Co. of New Jersey, was to be sold local crude oil for refining. The IPC has repudiated a claim of $144 million in tax arrears and has begun legal proceedings for the annulment of the expropriation.

The matter concerns sugar in that there is a clause in the US Sugar Act which forbids the importation of sugar from countries that have seized US-owned properties without adequate compensation. Action is at the discretion of the President for the first six months and is mandatory thereafter. Thus, if the court has not reached a decision by the beginning of April, and if adequate compensation has not been paid to the IPC, it appears that under US law Peru must lose its quota which is set at present at 354,253 short tons, raw value, for 1969.

* * *

**World sugar balance.**

F. O. Licht K.G. have recently published their first estimates of world sugar movement for 1968/69[1] and these appear below together with amended figures for previous seasons, all expressed in thousands of metric tons, raw value, and referring to the periods of September/August in each case.

| | 1968/69 | 1967/68 | 1966/67 |
|---|---|---|---|
| Initial Stocks ..... | 18,905 | 18,611 | 18,663 |
| Production ..... | 68,786 | 67,735 | 65,724 |
| Imports ..... | 22,664 | 21,597 | 21,226 |
| | 110,355 | 107,943 | 105,613 |
| Exports ..... | 22,946 | 21,629 | 21,446 |
| | 87,409 | 86,314 | 84,167 |
| Consumption ..... | 70,003 | 67,409 | 65,556 |
| Final stocks ..... | 17,406 | 18,905 | 18,611 |

C. Czarnikow Ltd. comment[2]: "The further increase in Licht's estimated stocks at the end of August 1968 (due mainly to revised figures for some countries, mainly in Australia) was something of a surprise to the market, especially when it is recalled that the original forecast made in January 1968 put the figure at only 16·8 million tons. Values have not been affected by these statistics, however, and it is to be presumed that any adverse effect caused by the higher initial stocks figure has been cancelled out by the estimated reduction of 1·5 million tons in the course of 1968/69."

Three further points of interest could be noted: first, that of production figures in the region of 68–69 million tons, the great majority remains in the country of origin and only 22–23 million tons is exported. Second, of this export figure only a minor amount is put on the free market (the I.S.O.'s estimate for 1969 is 8,591,000 tons at 90% B.E.T. quotas), and third, the final stock figure as a percentage of production is reduced from 28·3% at end-August 1967 to 27·9% at end-August 1968 and is expected to fall to 25·3% at end-August 1969, or fractionally over the three-months supply which is considered by many to be the minimum amount necessary for reasonable facility in raw sugar trading, refining and distribution.

[illegible] invertasa. T. Y. RIZK [illegible] pág. 75–76

[illegible] artículo.

# Forced circulation in sugar pans

By S. HILL, W. M. NICOL and P. D. FIFE
(*Tate & Lyle Limited, Research Centre, Keston, Kent*)

## PART II

### Massecuite Viscosities

When a massecuite approaches its final condition towards the end of the crystallization the volumetric crystal content is usually between 35 and 50%. The effective viscosity then greatly exceeds the viscosity of the suspending syrup which is itself greater than the viscosity of the feed solution on account of the accumulation of dissolved impurities. In a refined sugar massecuite the influence of impurities is small but in low purity massecuite their influence is very great.

An attempt to measure directly the effective viscosity of a refined sugar massecuite failed, because sedimentation of the crystals during the measurement could not be prevented. The effective viscosity was therefore derived by determining the viscosity of the syrup and estimating the effect of the crystals from the data of KELLY and MCCANTEE[4]. These data give $\eta/\eta_0$ for a range of fractional crystal volumes between zero and 0·5 for a range of crystal sizes—0·25 to 0·8 mm—in saturated sugar solution.

When a sugar massecuite is discharged from the pan the syrup is supersaturated. Further crystallization is slow enough to permit measurement of the effective viscosity but this must be done immediately and rapidly as the massecuite cannot be reconstituted if significant further crystallization has occurred.

At low purity the syrup viscosity is great enough to prevent unduly rapid sedimentation, so the effective viscosities of those low purity massecuites which were available could be determined directly with a Brookfield viscometer. These massecuites were 1st, 2nd and 3rd crop "recovery" massecuites from Tate & Lyle Refineries Ltd.

Raw sugar massecuites were not available for immediate measurement so the following procedure was adopted. Samples from a typical strike of the whole massecuite, and of the crystals and syrup (molasses), separated as rapidly as possible immediately after completion of the strike, were received. The molasses was reheated to its vacuum pan temperature and its viscosity determined. From chemical analysis of the massecuite, the molasses and the crystals, the crystal content of the massecuite in its original state was determined. Reference to the KELLY and MCCANTEE data then gave the effective massecuite viscosity.

The viscosities of nominally similar commercial sugar massecuites vary considerably, firstly because Canada, [illegible] res are variable, secondly Sweden, USSR, and [illegible]tries in the amount;
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**Table III. Viscosities of Massecuites**

| *Crystallization* | | *Viscosity (poises)* |
|---|---|---|
| Refined sugar ..... | | 65 |
| Recovery | 1st crop..... | 170 |
| | 2nd crop ..... | 1,000 |
| | 3rd crop ..... | 30,000 |
| Raw sugar | *A* strike..... | 100 |
| | *B* strike ..... | 250 |
| | *C* strike ..... | 1,000 |

### Experiments with High Purity Massecuites

(1) *Validity of the scaling factors*

The validity of the scaling factors for power and circulation rate were tested by comparing the full scale (horse power)/(circulation rate) curves obtained over a range of impeller speeds with the 1/10 and 1/6 scale models of a 174-inch diameter pan (No. 2 pan). The two sets of data are plotted in Fig. 4. Agreement is within the estimated limits of error.

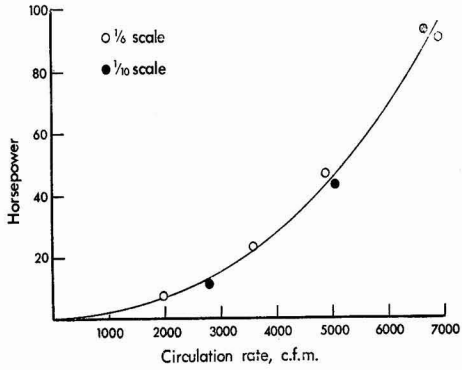


Fig. 4. Comparison of power and circulation data from 1/6 and 1/10 scale models of a modified axial-flow impeller in No. 2 pan

(2) *Tangential flow*

Tangential flow above the element is less effectively suppressed by the supports of the element in a ribbon pan than by the tubes of a calandria. Photographs, shown in Fig. 5, were taken of three horizontal planes with the massecuite up to strike level in the No. 2 (ribbon) Pan. There is little tangential flow just above the ribbons and at the middle level. Only near to the surface is the tangential flow, induced by the rotating impeller, comparable to the flow in the diametral plane. At this level the latter is very small (see for example, Fig. 6) so tangential flow, even in a ribbon pan, can be neglected.

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*Proc. 9th Conf. Queensland Soc. Sugar Cane Tech.*, 1942, 51–56.

### (3) *The general flow pattern*

The distributions of velocities in a ribbon and a calandria pan can be seen in Figs. 6 and 8 respectively. These distributions were found to be almost independent of the design, speed and position of the impeller.

In a ribbon pan the greater part of the upward flow is confined to the outer two or three circular spaces (Fig. 6). The liquid is centrifuged and thrust by the impeller against the conical bottom of the pan, whence it continues up the cone and the cylindrical wall. For example, at the strike volume in the No. 2 pan the velocity in the outermost inter-ring space is twice that in the innermost space. This is shown by the velocity distribution curve of Fig. 9 which applies to the region just above the heating element in a model of No. 2 pan. With a low viscosity (white sugar) feed solution at the initial (low) level, the direction of flow in the inner spaces is actually downwards, with zero velocity in the fifth space from the centre.

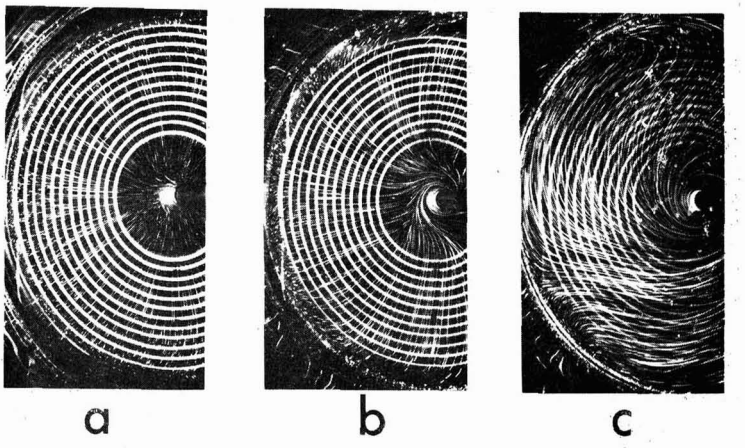


Fig. 5. Flow patterns in horizontal planes (*a*) above the rings, (*b*) middle, (*c*) surface

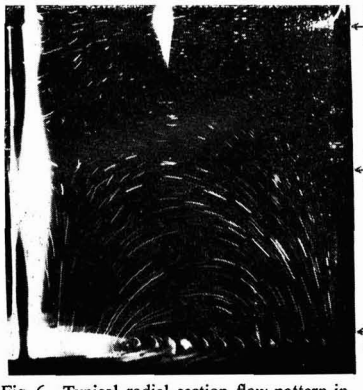

Fig. 6. Typical radial section flow pattern in No. 2 pan

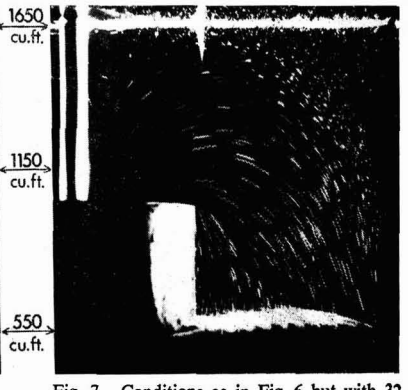


Fig. 7. Conditions as in Fig. 6 but with 32 inch-high central cylinder

The greater hydrodynamic resistance of the calandria tends to equalize the distribution of the upward flow (Fig. 8).

The flow pattern in a conventional forced circulation pan leaves a stagnant region in the upper levels of the massecuite. An expedient designed to reduce the volume of this stagnant region was tested in the No. 2 pan. This was an extension cylinder mounted above the innermost ribbon of the element (Fig. 7). The stagnant region is indeed much reduced, but at the cost of a considerable decrease of the total flow. In practice the extension cylinder would have to rise with the massecuite level so that its upper rim remained about 3 ft below the surface.

**Table IV. Flow rates (c.f.m.) at charge and strike levels**

| *Impeller* | *Massecuite level* | *Rotational speed (r.p.m.)* 42 | 69 | 92 | *Viscosity (poise)* |
|---|---|---|---|---|---|
| Axial-flow | Full strike | 1,950 | 3,200 | 4,800 | 65 |
| | 2 ft above rings | 4,500 | 10,000 | 13,000 | 1·35 |
| Simple mixed-flow | Full strike | 1,350 | 2 0 | 4 | 65 |
| | 2 ft above rings | 4,0 | 7, | | 1·35 |
| Mixed-flow | Full strike | | | | 65 |
| | 2 ft above rings | | | | 1·35 |

(4) *Flow rate at charge and strike levels*

In the early phase of the pan cycle, when the permissible rate of evaporation is limited by the small area of crystal surface that is available for the accommodation of excess solute, the viscous forces due to thermal convection alone, may be insufficient to shear apart clusters of seed crystals—a situation which leads to a conglomerated product. It is important to determine the rate of forced circulation at this stage.

With the massecuite at the level of the initial charge, measurement and integration of the flow velocities are appreciably affected by turbulence. The total flow rates at charge level derived from observations on a model, recorded in Table IV, have an estimated coefficient of variation of 10%. Integrated flow rates at charge and strike levels in the No. 2 pan are compared in the table for each of the three impellers.

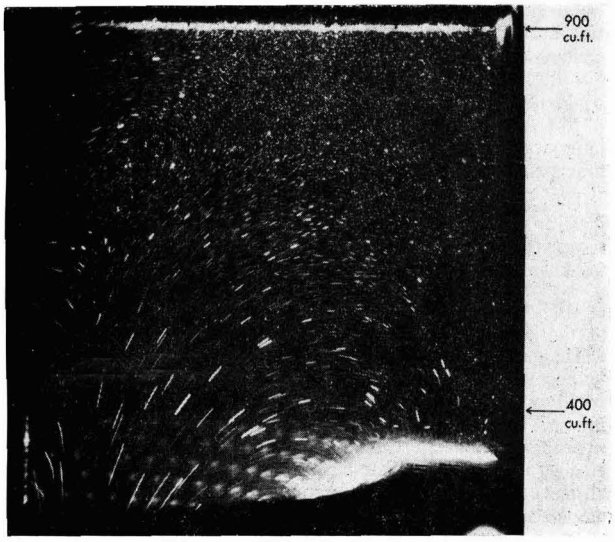


Fig. 8. Typical radial section flow pattern in G pan

Because of the difference of viscosity, the average flow rate at charge level is nearly three times that at strike level.

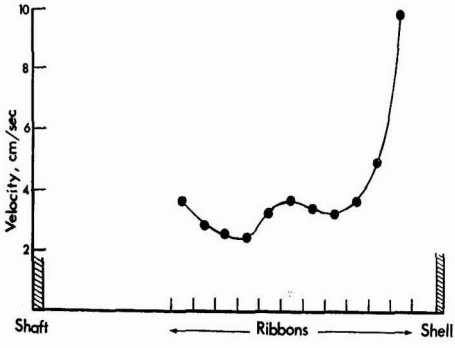


Fig. 9. Radial distributions of velocities in the model of No. 2 pan

(5) *Linear velocity past the heating surfaces*

A flow velocity of 1 ft/sec past the heating surfaces is considered to be desirable. At low velocities the increase of temperature during transit and the corresponding fall in supersaturation may be excessive.

**Table V. Massecuite velocities.**

| Pan | Circulation (c.f.m.) | Strike volume (cu.ft.) | Mean velocity (ft/sec) In downtake | Past heating surfaces |
|---|---|---|---|---|
| No. 2 (ribbon) | 4,800 | 1,650 | 4·1 | 0·8 |
| *B* (ribbon) | 4,550 | 1,400 | 3·8 | 1·3 |
| *G* (calandria) | 7780 | 1,090 | ·9 | 0·35 |

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with half of its depth projecting below the lower rim of the downtake.

(6) *Effect of the position of the impeller*

At high solution concentrations there is a risk that unwanted crystal nuclei will be generated in the turbulent regions in the neighbourhood of the tips of the impeller blades. For this reason it is desirable that the impeller speed be limited.

Tests with the axial-flow impeller in a number of vertical positions with respect to the heating element showed that, at a given rotational speed, circulation is greatest when the impeller blades protrude below the lower rim of the downtake by a distance equal to $\frac{1}{3}$ to $\frac{2}{3}$ of the depth of a blade (Fig. 10). This observation applies to all three pans and the shapes of the curves of circulation against position are sufficiently similar to allow us to take the results of observations on the B pan as representative.

If the impeller is too close to the bottom of the pan its axial thrust is ineffective. If it is totally surrounded by the wall of the downtake its centrifugal action is nullified and there is too much viscous drag between the tips of the blades and the wall of the downtake. RICHARDSON and WILLIAMS[5] found that the regularity index of sugar crystals[6] obtained with an axial flow impeller, rotating at a fixed speed in the full-scale G pan, reached a maximum value when the impeller occupied the intermediate position.

The simple mixed-flow impeller, complete with shroud, was tested in the two ribbon pans (No. 2 and B) in the two limiting positions—the shroud alternately flush with the upper and lower rims of the downtake – at three rotational speeds. (Projection of the shroud

[5] Private communication, 1965.
[6] ILL: *I.S.J.*, 1965, **67**, 201.

out of the downtake would increase the resistance of the flow circuit). The same configurations without the shroud were also investigated (Fig. 11). The shroud could not be fitted into the downtake of the G (calandria) pan because the latter was partly obstructed by structural members.

The mixed-flow impeller was designed to work in one position only with respect to the downtake and it was tested in this one position.

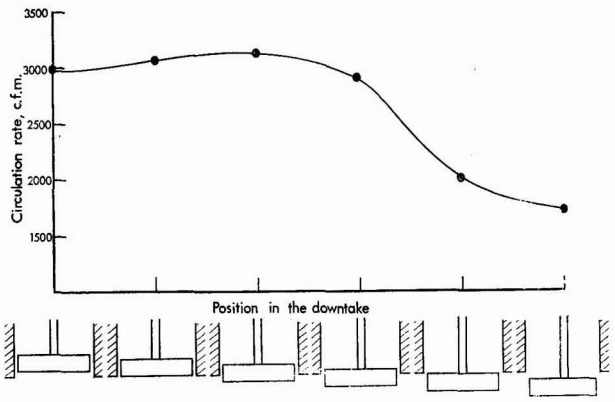



Fig. 10. Effect of the position of the axial-flow impeller in the downtake of the *B* pan

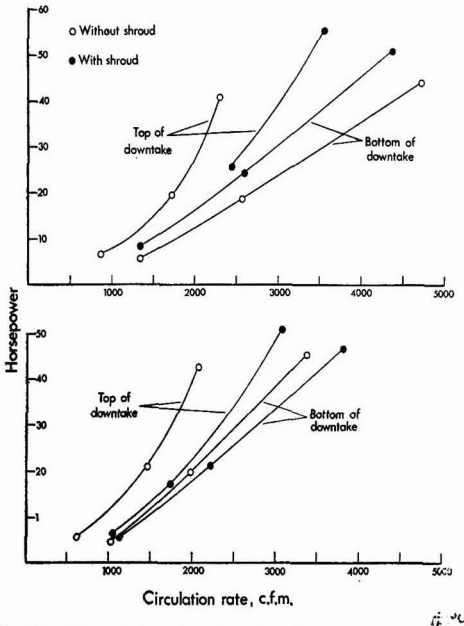
(7) *Optimization of the axial-flow impeller*

The modified axial-flow impeller was tested, with all six blades, at constant speed in three positions—just inside, intermediately positioned and just outside the downtake. Circulation was greatest in the intermediate position in all pans. An approach to an optimum design of the modified axial-flow impeller was achieved by testing it in all pans with 2, 3, 4 and 6 blades (Fig. 12), and by progressively trimming the blade tips of the marginally superior four-blade version while running in the No. 2 pan (Fig. 13). The best compromise between excessive backward slip and excessive viscous drag is achieved at a ratio of impeller diameter to downtake diameter of 0·94.

Further optimization was attempted by testing the four blade impeller in the No. 2 pan with three values —1·05, 1·50 and 1·95—of the pitch to diameter ratio. It is evident from Fig. 14 that the original ratio of 1·50 is satisfactory.

(8) *Comparative performance of the impellers*

A comparative test of the four impellers, each in its best (or only) position produced the results shown



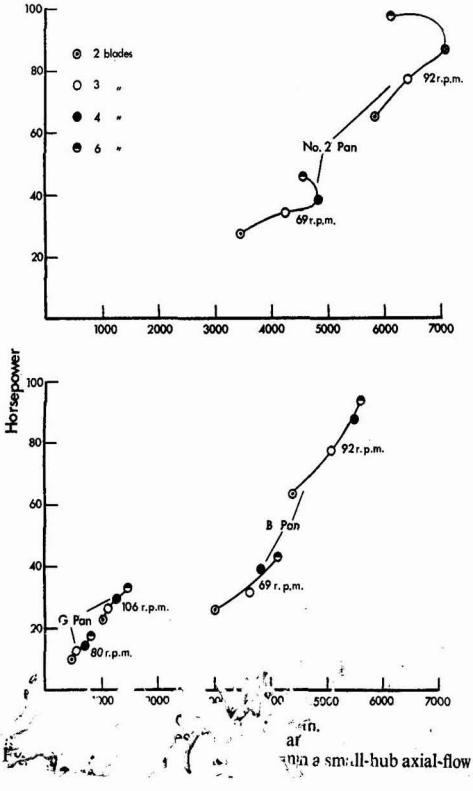




Fig. 11. Effect of shroud and position in the downtake on the simple mixed-flow impeller (above) No. 2 pan, (below) *B* pan

...ar ...n a small-hub axial-flow

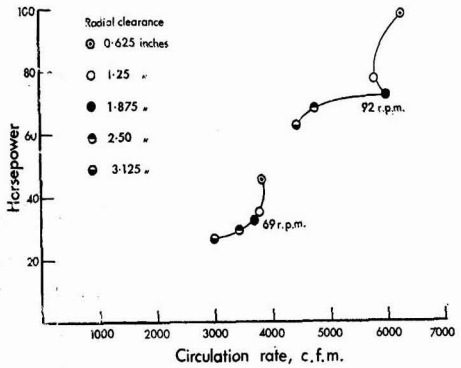



Fig. 13. Effect of overall diameter of a small-hub 4-bladed axial-flow impeller in the 58½-in dia. downtake of the No. 2 pan

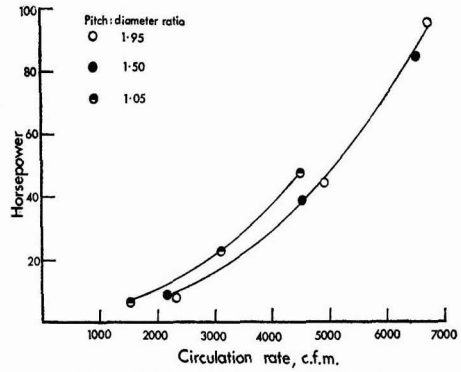



Fig. 14. Effect of blade pitch for a small-hub, 4-bladed axial-flow impeller in No. 2 pan

in Fig. 15. Differences between types are small in the G (calandria) pan, but in the low-resistance ribbon pans the modified axial-flow type is the most economical. The order or merit is the inverse of the order of area of the moving impeller surface. It indicates that the area of blade at which the thrust/drag relationship is most favourable is that of the modified axial-flow impeller, where the area projected on to a horizontal plane is that of 4 × 60° sectors. The hub contributes to the viscous drag and reduces the area available for flow; it should be no larger than is necessary for adequate mechanical strength.

(9) *Optimization of the mixed-flow impeller*

The benefits of reducing rotating area which does not contribute useful thrust, and of finding an optimum value for the active area, were confirmed when improved performance was obtained from the mixed-flow impeller by (*a*) removing entirely the conical base of the hub and (*b*) trimming a 30° sector from the leading edge of each blade. In Fig. 16 the results of these modifications are compared with the performance of the axial-flow impeller. A "cleaned-up" mixed-flow impeller [illegible] downtake, was the [illegible] shown to be the [illegible] position its performance [illegible] indistinguishable f[illegible]

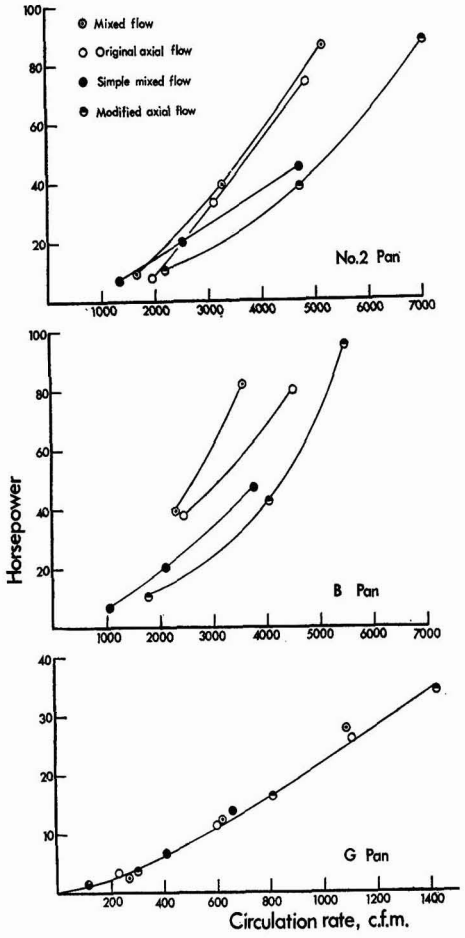
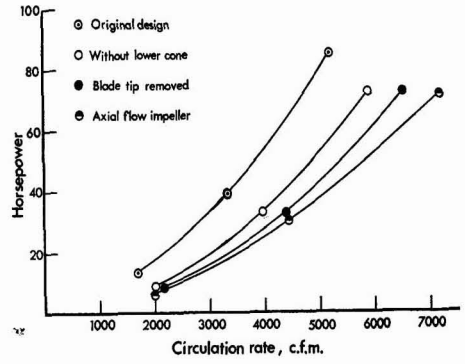



Fig. 15. Comparison of four impellers, each in its best position




16. Effect of progressive trimming of the mixed-flow impeller in No. 2 pan

*(To be continued)*

# Measures adopted in Mauritius to improve raw sugar filtrability

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(Mauritius Sugar Industry Research Institute, Réduit, Mauritius)

*Paper presented to the 13th Congr. I.S.S.C.T., 1968*

## PART II

### Boiling House Work

*Remelting Processes*

Until only a few years ago the boiling process followed by all the factories in Mauritius consisted in using the *C*-sugar, in most cases single-cured, for preparing a magma which was used as footing for the *A*- and *B*-strikes. Sugars of poor filtrability were consequently produced, particularly in those factories where low magma purities prevailed.

In 1966, however, 21 of the 23 factories adopted remelting of all their *C*-sugar whilst double-curing of the final massecuite was practised in 9 factories. In addition, a few factories resorted to remelting of *B*-sugars, either in part or totally, whilst one factory used the *B*-sugar as footing for the *A*-strike, remelting only the excess. From the results obtained and from the information gathered by the author during a visit to Natal in 1966, it would appear that the total gain in filtrability that may be expected from the remelting of all the *C*- and *B*-sugars and the bagging of only *A*-sugars is of the order of 12–15 points. This is not very large especially in view of the fact that *B*-sugar remelting calls for additional equipment and steam consumption. Hence, whereas *C*-sugar should under no circumstances be used as footing for shipment strikes and should be remelted, preferably after double curing, remelting of *B*-sugar should be governed by the conditions prevailing in each individual case, and by the success or failure of other measures adopted with the object of improving filtrability.

*Production of less B-massecuite*

One of these measures should be the adoption of a boiling process in which as little *B*-sugar as possible is produced since it is well known that *B*-sugars have much lower filtrability than *A*-sugars. Thus the results of an extensive survey carried out by Douwes Dekker[18] in 1961 show that average *A*-sugar filtrability in Natal that year amounted to 49·4, whilst figures for *B*- and *C*-sugars were 25·5 and 12·5 respectively; similar conditions prevail in Mauritius where the filtrability of the *B*-sugar is generally about one-half that of the *A*-sugar. It is not generally realized, however, that it is often an easy matter to vary massecuite proportions, even without changing their purities, and thus improve average shipment sugar filtrability by reducing the amount of *B*-sugar produced. The diagrams in Figs. 5 and 6 will illustrate the point. Fig. 5 represents the boiling process which was followed by one of the local factories in 1966 and it will be observed that for every 100 solids by weight in syrup, about 67·0 are used to build the *A*-massecuite, whilst 25·8 and 7·2 are fed to the *B*- and *C*-massecuite respectively. Solids in massecuite and massecuite percentages by weight are indicated in Table II.

**Table II. Massecuites solids and percentages of unmodified process**

| *Massecuite* | *Solids in massecuite % solids in syrup* | *% Massecuite by weight* |
|---|---|---|
| *A* | 84·0 | 49·0 |
| *B* | 54·9 | 32·0 |
| *C* | 32·6 | 19·0 |
| *Total* | 171·5 | 100·0 |

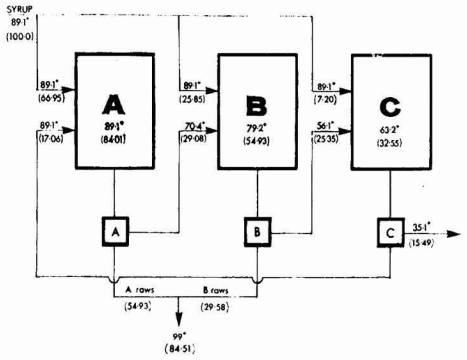



Fig. 5. Boiling process followed in 1966

Now, without changing massecuite and molasses purities, the above process was modified in 1967 so as to produce less *B*-massecuite. This was achieved by using more *A*-molasses on the final massecuite

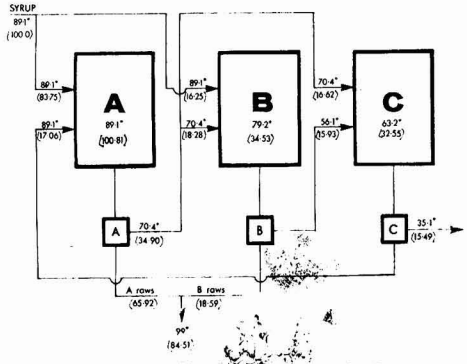
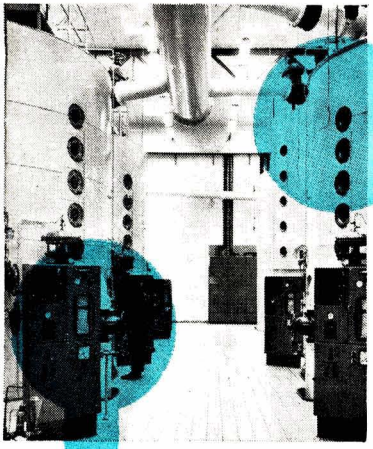
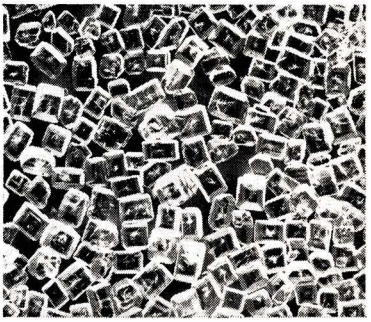



Fig. 6. Modified boiling process, 1967

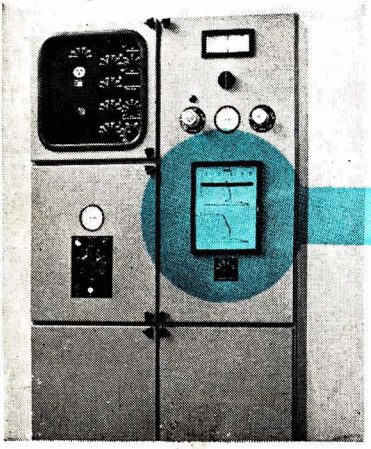
[18] *Proc. Int. Soc. Sugar Cane Technol.* 11th Congr., 1962, 1959–878.

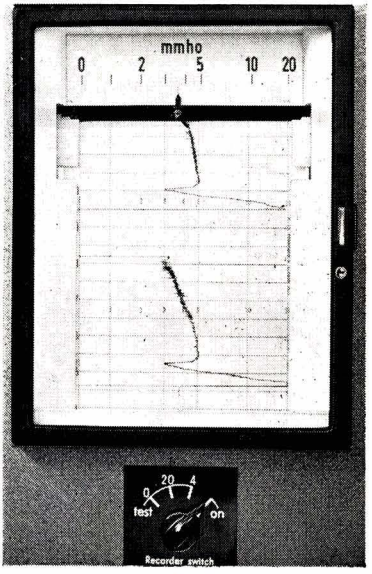
# DDS COMPLETE PAN BOILING AUTOMATICS





A low content of conglomerates and a uniform grain size constitute an essential prerequisite for producing the best possible sugar from a given juice. In an existing vacuum pan the best results are achieved by keeping the supersaturation in the mother liquor at an optimum during all stages of the strike. By automizing both graining and final boiling the DDS-Pan-Boiling Automatics meet these demands to their full extent, at the same time considerably reducing the labour costs.






The function of the DDS-Pan-Boiling Automatics is based on a measurement of the conductivity combined with efficient vacuum regulation. The equipment is used for juices with purity up to 97 and works without any use of water. The DDS-Pan-Boiling Automatics have been developed during the last ten years and are of a sturdy and simple construction. They operate successfully in Italy, The Netherlands, South Africa, and Denmark.

whilst feeding as much of the syrup as possible to the *A*-strike, the difference being sent to the *B*-strike only. This is shown in Fig. 6 from which it will be observed that for every 100 solids in syrup, 83·8% are used to build the 1st massecuite and 16·2 in the 2nd massecuite. Solids and percentage figures of the modified process are shown in Table III.

**Table III. Massecuites solids and percentages of modified process**

| *Massecuite* | *Solids in massecuite* % *solids in syrup* | % *Massecuite by weight* |
|---|---|---|
| *A* | 100·8 | 60·0 |
| *B* | 34·5 | 20·6 |
| *C* | 32·5 | 19·4 |
| *Total* | 167·8 | 100·0 |

On comparing Tables II and III it will be observed that the small modifications brought to the boiling process have decreased the amount of *B*-massecuite produced by 11·4% whilst increasing that of *A*-massecuite by an approximately equivalent amount.

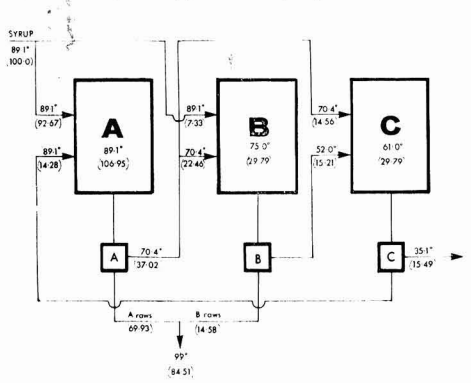



Fig. 7. Boiling process after second modification, 1967

It is true that the impact of some 11% more *A*-massecuite on average raw sugar filtrability cannot be very large. Yet it is a step taken in the right direction, not only from the filtrability angle but also from the processing angle generally. And it is possible to improve further on the boiling process described diagrammatically in Fig. 6 by following that shown in Fig. 7 which was adopted a few weeks after the 1967 crop had started. It will be observed that in this case *B*- and *C*-massecuite purities have been slightly reduced but that the *A*-strike and final molasses purities lie unchanged. As a result of these modifications the proportion of *B*-massecuite has decreased by approximately 3% more, as shown in Table IV.

**Table IV. Massecuite solids and percentages after second modification**

| *Massecuite* | *Solids in massecuite* % *solids in syrup* | % *Massecuite by weight* |
|---|---|---|
| *A* | 106·9 | 62 |
| *B* | 32·8 | 19 |
| *C* | 29·8 | 17·0 |
| *Total* | 169·5 | |

*Influence of grain size*

It was claimed, in the light of certain industrial results obtained in 1966, that filtrability increases when grain size is reduced, but, as already pointed out by the author of the article concerned, no reliable data were available to prove this point[8]. It is a fact that the filtrability of a raw sugar is governed mostly by the purity of the mother liquor from which it is crystallized. Hence, if the crystals from any given strike are classified by sieving into various sizes, the filtrability indices of the different fractions should be about the same since all the crystals above a certain size take approximately the same time to reach their final size. This is shown in Table V in which filtrability results for three *A* sugars are given.

**Table V. Influence of grain size on filtrability of crystals from the same strike**

| *Sample* | *Fraction, mm.* | | *Filtrability,* % |
|---|---|---|---|
| Mon Désert-Alma | >1·20 | | 44 |
| | >0·75 | <1·20 | 47 |
| | >0·49 | <0·75 | 48 |
| St. Felix | >1·20 | | 46 |
| | >0·75 | <1·20 | 47 |
| | >0·49 | <0·75 | 48 |
| Britannia | >0·75 | <1·20 | 51 |
| | >0·49 | <0·75 | 52 |
| | >0·39 | <0·49 | 50 |

It is also interesting to analyse the results of what DOUWES DEKKER[5] calls a "peeling test". In this test, as carried out in our laboratories, each sugar crystal is considered to be made up of five concentric layers of equal weight. These layers are peeled off one by one and the filtrability after each peel measured. This is achieved in the following manner. A sample of raw sugar is dried and sieved, all the crystals smaller than 1·20 mm being discarded. After affination and drying the sugar is thoroughly mixed with a saturated solution of sucrose to which has been added the exact amount of water required to dissolve one fifth by weight of the sample of affined sugar taken. It is assumed that during this affination process the outer layer dissolves first, leaving the four inner layers. The magma is centrifugalled and dried. Part of the sugar obtained is kept for analysis, the remainder being treated in a similar manner to peel off the fourth layer, and so on. Table VI gives the results of three of these peeling tests. *C*-sugar was not used as footing for any of the samples analysed.

The figures tabulated confirm those obtained by DOUWES DEKKER[5] and show that filtrability decreases from the core towards the periphery of the crystal whilst the amounts of total phosphate and starch increase. This results from the decreasing purity of the mother liquor during the growth of the crystals. However, it would appear that in industrial practice when coarse grain is boiled the occlusion of impurities is greater than when small crystals are produced. This has been shown in the laboratory by ONNA *et al.*[19] who found that the amount of non-sucrose constitu-

[19] ONNA, TU and AKATSUKA: *Rpts. 18th Meeting Hawaiian Sugar Tech.*, 1959, 111–112.

**Table VI. Results of "peeling tests"**

| *Factory* | *Sample* | *Filtrability, %* | *Total phosphate, p.p.m.* | *Starch, p.p.m.* |
|---|---|---|---|---|
| Beau Champ | Affined | 44 | 41 | 133 |
| *A*-sugar | After 1st peel | 47 | 36 | 133 |
| > 1·20 mm | After 2nd peel | 51 | 29 | 108 |
| | After 3rd peel | 59 | 20 | 66 |
| | After 4th peel | 61 | 16 | 53 |
| Ferney | Raw | 19 | 74 | 126 |
| *B*-sugar | Affined | 41 | 22 | 84 |
| > 1·20 mm | After 2nd peel | 46 | 17 | 64 |
| | After 3rd peel | 49 | 15 | 49 |
| | After 4th peel | 50 | 15 | 40 |
| Ferney | Raw | 21 | 75 | 126 |
| *B*-sugar | Affined | 44 | 22 | 78 |
| from same | After 1st peel | 49 | 17 | 57 |
| strike but | After 2nd peel | 51 | 15 | 48 |
| > 0·75 and < 1·20 | | | | |

ents included in raw sugar is directly related to crystal size. More recently MORITSUGU and PAYNE[20] have shown that "in general the amount of salts included within the sucrose crystal increased with the size of the screened crystal". It should therefore be the aim of the raw sugar manufacturer to produce 0·6–0·7 mm regular crystals rather than coarse ones.

*Influence of rate of crystallization*

As already report by DUPONT DE R. DE SAINT ANTOINE[4], a number of tests were carried out in a factory during the 1966 crop to study the influence of mechanical *versus* natural circulation on crystal quality. Unfortunately rather wide variations were obtained in the results, both with *A*- and *B*-sugars, and it was therefore not possible to draw any definite conclusions. This is probably due to the fact that in industrial practice it is not possible to keep conditions sufficiently constant long enough to enable fair comparisons to be made. Yet it is claimed by several authors, VANHOOK[21] and WEBRE[22] amongst others, that the use of mechanical circulation results in the production of more regular and less coloured crystals containing fewer conglomerates. MORITSUGU and PAYNE[20] have also shown that "the amount of salt included in the crystal diminished as the rate of stirring increased". It is therefore important to ascertain that the pans used for the boiling of shipment strikes, particularly *B*-sugars when they are bagged, should have good circulation.

*Exhaust steam temperature*

A survey carried out during the 1966 crop has shown that whereas in many factories the exhaust steam temperature was normal, in several others it contained a fairly considerable amount of superheat. It was therefore postulated that in those latter factories viscous products might be produced which would adversely affect filtrability and measures were taken to desuperheat the steam. It has not been possible to assess the result, but an interesting aspect of the question that came to light when the project was studied is that, apparently, the percentage increase in viscosity between syrup or *A*-runnings and final molasses may vary considerably from one factory to the next. But these results are only preliminary and need confirmation. A new series of experiments were therefore drawn for the 1967 crop.

*Screening of sugar after centrifugalling*

A practice generally followed in Mauritius is to screen all the sugar discharged from the centrifugals so as to separate the dark and low polarization lumps that would otherwise find their way to the storage bin. The screening is usually achieved by fitting a stationary screen towards the end of the grasshopper conveyor. From the screen the lumps fall into a small remelter from which the liquid is pumped to the syrup storage tanks.

It is not expected that the adoption of this practice will lead to spectacular gains in filtrability but, once again, it is a right step in the proper direction especially in that it improves the keeping qualities of the raws by eliminaging a major source of contamination of the sugar by osmophilic yeasts.

QUALITY CONTROL

The marked improvement in the refining properties of Mauritius raws in 1966 would doubtless have not been achieved if strict quality control had not been exercised on all the raws produced. All the factory laboratories are equipped with C.S.R. test filters and the filtrability indices measured daily, in addition to other routine analyses such as polarization and moisture. Further, on their arrival at the docks, the sugars from each factory are sampled separately and analysed daily for pol and moisture in the central laboratory of the Mauritius Sugar Syndicate, whilst weekly composite samples are analysed for filtrability. In addition, the sugars that are loaded on every cargo are composited and full analyses carried out. These analyses include polarization, moisture, ash, reducing sugars, colour, specific grain size, filtrability and starch content. Finally the sugars produced yearly by each factory are composited separately and full analyses carried out on these samples too.

CONCLUSION

The review presented here shows that by paying careful attention to process work it is not such a difficult proposition, as many seemed to think, to improve considerably the refining properties of the raws produced in any factory. A most important aspect of the question is that, in most cases, the improvement may be achieved at low cost, without major capital expenditure.

The experience gained in 1966 has been put to profit by the industry and the results obtained after two months crushing in 1967 indicated that average raw sugar filtrability for the island would be much better still than it was in 1966. This is evidenced by the results obtained in Rose Belle factory which

[20] *Proc. 12th Cong* [illegible] HOUSE, CROI[illegible] 32 9NA. GR[illegible] Ed. P. HONIG.
[21] *Zeitsch. Zuckerin*[illegible]
[22] "P[illegible]

in 1966 registered the second lowest average filtrability and which in 1967 was producing the best sugar in the island.

SUMMARY

The quality of Mauritius raws, which at one time enjoyed an excellent reputation amongst refiners, had lately greatly deteriorated. The main measures adopted by the industry to improve the filtrability of these raws are reviewed. These measures include, amongst others, the adoption of the enzymatic process of starch removal, the replacement of cold or hot liming by boiling juice liming, the remelting of *C*-sugar instead of using it as footing for the shipment strikes, the production of less *B*-massecuite and of smaller crystals, the screening of the raws after centrifugalling and the adoption of strict quality control on all the raws produced.

As a result of these measures, average filtrability of Mauritius raws improved considerably in 1966 as compared with the previous crop.

# Effect of burning and storage on cane deterioration

## Part III. On sugar-invertase relationships

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*Introduction*

THERE is a large body of literature concerning the sucrose hydrolysing enzymes of yeast, but until recently these enzyme systems of sugar cane have received scant attention. Much of the understanding of these enzymes of sugar cane has, in fact, come about principally in the past five years.

HATCH and his co-workers have shown[1–4] that hydrolysis of sucrose by invertase was both a prerequisite and the rate-limiting process of storage of sucrose by both immature and mature storage tissue. They have also shown that changes in the total sugar content of mature tissue were related to the neutral invertase activity of the tissue, and the amount of acid invertase present in immature tissue was linearly related to the rate of elongation of immature internodes. RIZK and NORMAND[5,6] and ALEXANDER[7] have shown that both invertases are present in mature and in immature tissues.

Recent attempts have been made to establish a quantitative relationship between sugar content and invertase activity of growing sugar cane. ALEXANDER[8] has demonstrated an inverse relationship between invertase activity and sucrose content of meristems. He has also stated that "high" invertase activity is characteristic of "high" tonnage and "low" sugar varieties. RIZK and NORMAND[5,6] have also found a close relationship between acid invertase, or A/N ratio, and sugar components, i.e. as enzyme activity increased, reducing sugar increased but sucrose and total sugar decreased. The present report attempts to assess the effects of burning and storage on these relationships of growing plants.

[illegible] 19·9
[illegible] 9·8
Th[illegible] 29·8 [illegible] repo[illegible]
hav[illegible] 1·6·5

part does not involve new experiments, but represents an attempt to correlate the findings of the preceeding parts.

*Results and Discussion*

The data in Tables I and II show some quantitative relationships between sugar components (sucrose, total sugar, reducing sugar) and activity of the invertases in both burned and unburned cane at various storage periods. Burning had considerable effect, but when either burned or unburned cane is considered separately, these relationships remained constant among different portions of the stalk (Table I) as well as among different varieties (Table II). Variations among stalk portions and among different varieties for all variables were more pronounced in unburned than in burned cane.

The sugar-invertase relationships of unburned cane were similar to those reported earlier for comparable standing cane[6]. Acid invertase activity (or A/N ratio) was lowest in fully mature tissue (low reducing sugar, high in total sugar and sucrose) and highest in immature tissue (high reducing sugars, low total sugars).

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[1] HATCH *et al.*: *Plant Physiol.*, 1963, **38**, 338–343.
[2] HATCH and GLASZIOU: *ibid.*, 344–348.
[3] SACHER *et al.*: *ibid.*, 348–354.
[4] HAWKER and HATCH: *Physiologia Plantarum*, 1965, **18**, 444–453.
[5] RIZK and NORMAND: *Proc. 63rd Meeting Assoc. Sou. Agric. Workers*, 1966, 301.
[6] *idem*: *Sugar J.*, 1968, **31**, (3), 11–12, 12–13.
[7] ALEXANDER: *J. Agric.* (Univ. Puerto Rico), 1965, **49**, (3), 287–307.
[8] *ibid.*, 1967, **51**, (1), 29–38.
[9] RIZK and NORMAND: *I.S.J.*, 1969, **71**, 7–8, 35–37.

**Table I. Comparisons between the sugar contents and invertase activities for cane treatments × parts of the cane stalk interaction**

| *Cane treatments* | *Parts of the cane stalk* | *Sucrose % (pol)* | *Purity* | *Reducing* sugar* | *Total* sugar* | *Acid† invertase* | *Neutral† invertase* | *A/N ratio* |
|---|---|---|---|---|---|---|---|---|
| Burned | Bottom | 15·49 | 79·81 | 81·01 | 360·59 | 27·00 | 19·25 | 1·15 |
| | Middle | 14·17 | 75·64 | 89·61 | 351·57 | 25·93 | 18·86 | 1·14 |
| | Top | 10·86 | 66·20 | 97·21 | 324·98 | 21·06 | 18·63 | 0·96 |
| Unburned | Bottom | 15·10 | 84·64 | 85·96 | 357·70 | 42·60 | 25·93 | 1·64 |
| | Middle | 14·39 | 82·14 | 92·07 | 351·24 | 46·03 | 25·56 | 1·84 |
| | Top | 10·34 | 68·94 | 104·17 | 310·21 | 49·96 | 25·56 | 2·01 |
| L.S.D. at 5% | | 0·43 | 1·75 | 1·43 | 3·18 | 2·48 | N.S. | 0·08 |

*Expressed in mg per ml juice.

† Expressed in μg glucose produced by hydrolysis in 4 hours by 0·1 ml dialysed juice.

While burning did affect the absolute concentrations of the sugar components, the trend of the relative concentrations, with regard to either the stalk portions or varieties, did not change.

Invertase activities were reduced by burning (the acid more than the neutral) and the trend of relative activities was the reverse of that of unburned cane (Tables I and II). This reversed relationship indicated that the effect of burning on acid invertase activity was greater in the top part than in the middle and bottom parts. The activity of neutral invertase in burned or unburned cane was not subject to variation among parts of the cane stalk. As a result the A/N ratio was closely correlated with acid invertase activity, increasing from the bottom to the top in unburned cane and increasing in the opposite direction (from the top to the bottom) in burned cane.

Burning affected invertase activity most in the lower-sucrose tissue. This was true when the tissue was the partially mature portion of a stalk compared with the more mature internodes (Table I) as well as when it was a low sucrose-yielding variety compared with a higher yielding one (Table II).

It is of interest that an effect of burning would appear to be a reversal of the A/N ratio relationship to reducing sugar concentration. In unburned cane the relation is, as would be expected, a direct one in which greater acid invertase activity results in more reducing sugar. In burned cane, however, there is an inverse relationship between the two factors. BALCH *et al.*[10] have observed that deterioration characteristics of burned cane are usually opposite those of unburned cane, a fact which the present results may explain.

Many investigators[11–14] have reported that deterioration characteristics differ with variety. The data presented in Table II could be used to support an explanation based upon varietal differences in A/N ratio. The variety CP 42-10 when not burned had higher acid invertase activity than the other two varieties, but was strongly affected by burning and its acid invertase activity fell below the other two varieties. This effect could be related to the fact that CP 42-10 actually showed a rise in total sugar contents as a result of burning, while the other two varieties did not.

The available sucrose in sugar cane at grinding represents a balance between sucrose synthesized by the growing plant, sucrose and invert sugars utilized by the growing plant, and sucrose broken down in the harvested plant (especially when the latter is burned and stored). While invertases are probably not involved in synthesis, they are closely associated with sucrose-depleting activities. It seems likely, then, that future evaluation of new varieties, assessment of maturity, prediction of loss due to unavoidable storage, and perhaps other decisions may be based upon the A/N ratio or some other standard of evaluation of invertase activity.

[10] *U.S. Dept. Agric. Tech. Bull.*, 1950, (1021), 1–23.
[11] CROSS and BELILE: *I.S.J.*, 1915, **17**, 218–225.
[12] HALDANE: *ibid.*, 1933, **35**, 140–143.
[13] HALL: *ibid.*, 1914, **16**, 235.
[14] LAURITZEN *et al.*: *Proc. 6th Congr. I.S.S.C.T.*, 1938, 808–818.

**Table II. Comparisons between the sugar contents and invertase activities for cane treatments × varieties interaction**

| *Cane treatments* | *Parts of the cane stalk* | *Sucrose % (pol)* | *Purity* | *Reducing* sugar* | *Total* sugar* | *Acid† invertase* | *Neutral† invertase* | *A/N ratio* |
|---|---|---|---|---|---|---|---|---|
| Burned | CP 42-10 | 10·51 | 70·00 | 96·38 | 319·40 | 21·56 | 18·56 | 0·95 |
| | CP 36-105 | 14·13 | 73·25 | 90·88 | 357·72 | 24·80 | 18·96 | 1·07 |
| | CP 48-103 | 15·89 | 78·47 | 80·57 | 360·02 | 27·63 | 19·20 | 1·23 |
| Unburned | CP 42-10 | 10·57 | 75·32 | 92·24 | 301·46 | 52·83 | 26·33 | 2·00 |
| | CP 36-105 | 13·36 | 75·24 | 105·72 | 356·54 | 40·30 | 23·63 | 1·74 |
| | CP 48-103 | 15·90 | 85·16 | 84·20 | 361·56 | 35·40 | 27·10 | 1·74 |
| L.S.D. at 5% | | 0·43 | 1·75 | 1·43 | 3·18 | 2·48 | 1·51 | 0·08 |

* Expressed in mg per ml juice.

† Expressed in μg glucose produced by hydrolysis in 4 hours by 0·1 ml dialysed juice.

# Sugar cane agriculture

**selection criteria for the future.** D. I. T. WALKER. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 21–24.—It is pointed out that sugar cane breeders have to look ahead at least 10 years—the time it takes for a new variety to become accepted from the first time it is raised as a seedling. On the assumption that a variety may have a run for at least 10 years, requirements 20 years ahead should perhaps be anticipated. Sugar cane characters are discussed from the point of view of their economic importance, their genetic determination and their relationship with other characters. Certain qualitative features must be present first and foremost. Four types of trials designed to find the relevant facts applicable in the later stage of variety testing (in Barbados) are outlined.

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**Recent developments in sugar cane selection in Guyana.** V. M. YOUNG-KONG. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 25–28.—At the Guyana Sugar Experiment Station, over the period 1954–64 the annual number of seedlings tested increased from approximately 9000 to 60,000. Sugar cane soils and soil problems in Guyana are discussed and the need emphasized for selecting the best variety for each different ecological area. The problem of heavy flowering and consequent pithy tissue is discussed.

* * *

**Recent studies with pre-emergence herbicides for sugar cane in Trinidad.** W. N. L. DAVIES. *Proc.* 1966 *Meeting B.W.I. Sugar Cane Tech.*, 38–44.—Herbicide trials carried out in Trinidad during the last two years are described. Several substituted uracils all gave good weed control, "Sinbar" and EH 767 being the more promising but phytotoxic to plant cane at rates of 1 lb (active ingredient) per acre and above. Of four substituted urea derivatives, "Afalon" and "Norea" were the most effective. Three benzenesulphonylcarbamates were evaluated and gave satisfactory weed control for about 2 months. "Tordon 22 K" controlled weed growth satisfactorily but was phytotoxic to plant cane at rates in excess of 2 lb/acre.

* * *

**Trials on irrigation methods and anhydrous ammonia applications.** J. F. BATES. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 45–51.—Furrow irrigation is to be preferred to the traditional flood irrigation in some areas of Guyana. Water quality makes overhead irrigation undesirable at some periods. Application of ammonium sulphate in furrow irrigation water was unsatisfactory owing to rapid absorption of the fumes [illegible]

**Florida sugar cane breeding programme.** N. I. JAMES and E. R. RICE. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 34–37.—This paper gives an up-to-date record of the practices employed at the US Sugar Cane Field Station and supplements the report by RICE and DUNCKELMAN in 1964 on the US seedling programme.

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**Mechanization of sugar cane culture in heavy clay soils in Martinique.** R. VOIVODITCH. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 52–55.—Traditional methods of cane cultivation in Martinique on the poorly drained heavy clay soils of the valleys are unsuited to mechanization because of the cambered bed system adopted. Altering these to Louisiana-type banks proved successful and allowed of mechanical harvesting.

* * *

**Estimating yield from relationship between sugar cane performance and critical months rainfall for the period 1957-1965.** R. A. WILKINS and K. H. ATESHIAN. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 65–75.—This paper presents a refined technique for estimating sugar cane performance using rainfall during critical months with age and ratoon % factor as additional parameters. Data from the period 1957 to 1965 is used to develop three steps in estimating performance. The three steps presented can be used to estimate sugar cane performance on a crop basis with each successive step having a higher degree of accuracy than the one before it.

* * *

**Diamond Estate—East Bank, Demerara. Rainfall 1887-1963, its annual distribution and possible effects on future cane mechanization.** R. F. HARBORD. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 76–82.—The possible influence of weather conditions or number of rainy days in relation to infield mechanization on this estate is discussed. It is assumed that present drawbacks to complete mechanization such as sociological and drainage problems, field lay-out, etc., may eventually be overcome, when weather will become the critical factor. The paper illustrates the varied weather conditions that can occur in Guyana and the "acceptable risk" involved.

* * *

**Sugar cane yield in Guyana for the period 1931-1965 and a forecast of future trends.** K. H. ATESHIAN and R. A. WILKINS. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 83–90.—The concept is put forward that yield may be connected with sunspot numbers, for rainfall itself seems to be affected by them.

**The use of vegetative tissues of sugar cane for determining the moisture status of the plant.** Y. SINGH. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 91–98.—The writer considers moisture levels associated with various growth rates should be capable of useful utilization in the determination of irrigation requirements. The use of the exposed spindle is advocated for evaluating moisture status because of the ease with which it may be collected and the negligible damage to the stalk tissues that result from its removal. Both field and drum grown plants were used in the experiments.

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**Some aspects of land reclamation using sugar cane on a reworked Scotland sand, Barbados.** E. R. ST. J. CUMBERBATCH. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 115–118.—Under conditions affected by erosion and by oil and salt in the soil, significant yield increases were obtained by mulching with bagasse and filter mud, and with sour grass.

* * *

**The incidence of pithiness in sugar cane and its effect on yield and quality.** H. EVANS. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 1966, 119–132.—The different types of pithiness that may develop in sugar cane are described and discussed at some length along with the likely causes for their development. The results of a questionnaire sent to sugar cane specialists in various cane growing countries on the subject are included. The extensive development of a pithy condition in mature canes of several varieties of sugar cane in Nigeria is referred to. Pithiness is often to be associated with arrowing and dry conditions but in Nigeria islands of pithy tissue occurred in the middle of the rainy season in July. This "island pithiness" was quite distinct from the well known breakdown of tissue in the centre of the sugar cane stalks sometimes leading to "cavitation" or "piping". Central core pithiness, or "piping", and "island pithiness" are discussed, as are varietal incidence of pithiness in commercial canes and loss of sugar due to the development of pithiness.

* * *

**Evaporation, transpiration, soil, moisture deficit and cane growth in Barbados.** J. C. HUDSON. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 137–144.—Regular growth measurements were made on first ratoon canes at seven sites comprising a wide range of soils and rainfall regions in Barbados. At selected times the total soil moisture was measured by a "monolith technique". Results are presented in a 3-dimensional relationship between growth rate, moisture deficit and age of crop. Marked differences in growth rate were found depending on the soil type and whether the period had a relatively low or high evaporation rate. The 700-lb monoliths were planted to cane and a "profile moisture release" curve determined. This shows promise as a rapid technique to assess soil with regard to available moisture.

**Sugar cane root systems in Barbados.** J. [illegible] HU[illegible] *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 145–152. A technique is described for examining root systems in some detail and of making a permanent mounting for future reference. This involves removing large blocks of soil and subsequently washing out the roots or root fragments, to be later dried and mounted. About 30 root systems were initially "filed" in this way and observations made on the effects of soils, weeds, and age of crop upon the distribution and vigour of roots. Results are being related to the pattern of moisture removal from the various soils.

* * *

**The gibberellins of sugar cane.** B. H. MOST and A. J. VLITOS. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 164–171.—This paper is concerned with the naturally occurring growth substances regulating development in sugar cane and offers evidence for the occurrence of gibberellin $A_1$ and gibberellin $A_2$ in the apical meristem (growing point) and young leaves of sugar cane. Qualitative and quantitative differences were observed in the gibberellin content of cane harvested at different ages and growing under widely varying environmental conditions in the field.

* * *

**The structure and development of the egg of *Aeneolamia varia saccharina*.** D. W. FEWKES. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 176–182.—Results of detailed study of the egg of this sugar cane froghopper in Trinidad are given. Laboratory observations showed that eggs took from 41 to 145 days to hatch. This variability enables the insect to ride over adverse or dry periods and therefore assists in the survival of the species.

* * *

**Studies on the aetiology of froghopper blight of sugar cane.** E. A. C. HAGLEY. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 183–191.—Preliminary results of investigations in Trinidad are reported in this paper which is divided into two parts: (1) symptom expression and development on sugar cane and other plants, and (2) probable rôle of enzymes and amino acids in the salivary secretion of the adult froghopper.

* * *

**Recent work on chemical control of the sugar cane froghopper in Trinidad.** D. W. FEWKES and D. A. BUXO. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 192–223.—Detailed accounts are given of trials with numerous insecticides under two main headings: (1) field trials with an ovicide for froghopper control and (2) evaluation of insecticides for froghopper nymph control. "Strobane" and "Toxaphene" (both at 15 and 20 lb/acre) gave excellent control of both second and third broods when applied as dusts. "Bidrin" and "Dursban" (organophosphates) gave satisfactory control of nymphs as did "Thiodan". "Mesurol" (a carbamate) again gave excellent initial and residual control of nymphs.

**Developments in rodent control in Guyana.** J. F. BATES. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 224–232.—Developments that took place in Guyana during 1961–1966 are discussed and techniques used on estates in 1966 are described. Characteristics of the cane field rat, *Holochilus brasiliensis*, indigenous in Guyana, are discussed. The acquired widespread resistance of this species to the coagulant poison "Warfarin" is referred to. Trials with some of the newer rat poisons are reported.

* * *

**Some observations on the biology of "jumping borer" on sugar cane in Trinidad.** D. W. FEWKES. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 233–235.—The "jumping borer" or "lesser cornstalk borer" (*Elasmopalpus lignosellus*) was first known to cause serious damage to sugar cane in Trinidad in 1957. Results of some laboratory studies and notes on the biology of the insect are given. The incidence of "jumping borer" in Trinidad between 1957 and 1966 is given.

* * *

**Maturity testing of sugar cane growing on organic soil of Florida.** F. LE GRAND and F. G. MARTIN. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 238–245.—This paper presents the results of a study on maturity testing for ripeness of sugar cane as influenced by temperature and rainfall and age of cane. It is pointed out that since facilities available to an average individual grower are limited, maturity testing should be carried out with juice extraction equipment that may be constructed locally with simple instrumentation. A small 3-roller mill with fixed top roller was used for juice extraction. An equally satisfactory sample 2-roller mill, locally constructed, is described and illustrated. A graphical interpretation of the results obtained is given.

* * *

**An improved method for the evaluation of sugar cane quality suitable for both research institutions and individual sugar estates.** H. EVANS. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 246–248.—A description is given of a modified "Atlas" tea cutter, which is similar to a chaff cutter, adapted to cut cane into $\frac{1}{16}$-inch slices for juice extraction and of a simple press for use in connexion with it. The equipment has proved very satisfactory in use in Guyana.

* * *

**Preliminary experiments in Jamaica with a method of determining loss of sugar resulting from rat damage to sugar cane.** J. R. METCALFE and G. THOMAS. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 276–278. The method here described involves two exercises: the direct estimation of loss based on comparison of damaged and undamaged canes, and the correlation of actual loss with visible injuries which can be easily counted. Rat damage in 10 fields amounted to 14% of the potential yield. The percentage of canes attacked was directly correlated with loss of sugar and was therefore a valid index of loss. In extensive surveys of rat damage the optimum number of samples was shown to be 10 per 10-acre field.

* * *

**Further work on "Gramoxone" as a desiccant.** F. A. GUMBS. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 249–265.—The results of extensive trials are given. The use of "Gramoxone" resulted in heavy loss in sucrose. It was concluded that the use of "Gramoxone" as a desiccant prior to harvest is entirely ruled out on economic grounds.

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**The ripening of sugar cane.** F. COLMET DAAGE *et al.* *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 266–271. The problem of the ripening of sugar cane in Martinique and Guadeloupe, where frequent and abundant downpours of rain often occur during harvesting, is discussed, especially in relation to nitrogen and the use of nitrogen fertilizers.

* * *

**Some observations on the incidence and prevention of flowering of sugar cane in Guyana.** H. EVANS and J. F. BATES. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 279–290.—Literature on this subject in other countries is reviewed and an account given of some observations made in Guyana and Nigeria. The object of the study here reported was to determine when the reception of the flowering stimulus occurred with a view to timing the application of chemical floral inhibitors. It was concluded that the period of floral induction in Guyana is much more prolonged than in areas of higher latitude, and complete control of arrowing by means of chemicals does not seem possible except by continuous periodical applications over the induction period, which would be commercially unpractical.

* * *

**Toxic sulphate soils in Guyana and their improvement for sugar cane cultivation.** H. EVANS. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 291–300.—The prevalence of toxic sulphate (aluminium and iron sulphate) in the acid peat soils of Guyana ("pegasse") is discussed. Cane planted in such soils is stunted or dies off completely. In less severe cases some growth results. Cultural methods are described to avoid the formation of large areas of toxic dam beds surrounding the fields in the process of digging high-level navigation and irrigation trenches and low-level drainage trenches. Methods of reclamation of existing barren dam beds are discussed.

* * *

**Recent investigations on biological control of sugar cane pests in the West Indies.** F. J. SIMMONDS and F. D. BENNETT. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 301–303.—The position in regard to the possibilities of biological control of some major sugar cane pests in the West Indies is reviewed, particularly in regard to cane borers and froghoppers. An account is given of recent introductions of potential parasites from other countries and of the experimental work carried out or in progress with them.

**Infestation status of sugar cane plantations in Guadeloupe by *Diatraea saccharalis*—Importance of *Lixophaga* and *Metagonistylum* parasitism.** Y. LEMAIRE. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 1966, 304–308. Reference is made to the successful control in Guadeloupe of the borer *Diatraea saccharalis* by the release of the fly parasite *Lixophaga* during the past 12 years. Rearing techniques for *Lixophaga* were perfected locally and average releases are about 80,000 per year. The biological control programme is explained. The results of a survey to assess the value of the parasitism by *Lixophaga* and *Metagonistylum* during the 1966 season is given.

* * *

**Preliminary studies with *Jaynesleskia jaynesi* Aldrich, a potentially important parasite of *Diatraea* spp.** F. D. BENNETT. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 309–310.—Unsuccessful attempts to introduce this little known South American insect, known to be a parasite of certain sugar cane borers (*Diatraea saccharalis* and other species), to Trinidad are described. The discovery that gravid (pregnant) females can be collected readily around certain flowering weeds near the borders of cane fields in Colombia is referred to and trial of the parasite in Caribbean cane growing countries is recommended.

* * *

**Alternative laboratory hosts for Tachinid parasites of *Diatraea*.** F. D. BENNETT and F. J. SIMMONDS. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 311–313. Results are given of experiments in Trinidad to determine whether certain readily available insects (*Lepidoptera*) would serve as suitable hosts for the laboratory production of three parasites of the cane borer. It was found the parasites could develop successfully on the wax moth, a pod borer of the pigeon pea and one (*Trachylepidia fructicassiella*) that attacks pods of certain species of *Cassia* (ornamental trees). The last mentioned was used on a large scale for laboratory production of *Lixophaga*.

* * *

**Notes on experimental work for control of *Eodiatraea centrella*.** J. F. BATES. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 1966, 314–316.—The economic importance of this borer (the yellow headed moth borer) in Guyana is pointed out for, unlike *Diatraea saccharalis* (black headed borer), it is not controlled by the Amazon fly (*Metagonistylum minense*). Observations are recorded relating to (a) studies of diapause in *E. centrella* pupae (b) use of parasite nematodes (c) sex attractant studies and (d) effect of light on mating and oviposition. None of these showed promise of any immediate practical means of control.

* * *

**The incidence of sugar cane moth borer damage in Trinidad in relation to aerial application of insecticides for froghopper control.** D. W. FEWKES, D. A. BUXO and T. R. BARNES. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 317–325.—Reference is made to extensive drift dusting of insecticide (DDT and "Sevin") in Trinidad and British Honduras for control of froghopper being held responsible for increased borer attack and yellow aphid infestation through causing the death of parasites or natural enemies of these pests. An account is given of a survey in sprayed and unsprayed fields for froghopper control in Trinidad, to determine the effect on moth borers. It was concluded the spraying caused mortalities with the large and the small moth borers and with their parasites.

* * *

**Experiences with the use of miniplots in sugar cane experiments.** M. E. A. SHAW. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 326–327.—Experience in the use of a 4-feet continuous length of row (miniplot) in estimating the yields of normal-sized experiment plots is given. The establishment and uniformity of the stand achieved and the selection of a miniplot are described. Statistical tests of the reliability of the technique and an equation to define the relationship between miniplot and the whole plot yield are given. Some applications of the technique are suggested.

* * *

**Lodged cane burning, a costly operation.** ANON. *Australian Sugar J.*, 1968, **59**, 615.—The burning of cane trash on cane lodged by flood waters proved very difficult. Desiccation trials were carried out both by aerial and boom applications of "Gramoxone" (4 oz a.i. per acre) and sodium chlorate (12 lb per acre). Adequate coverage of cane and weed leaves was the limiting factor, an application of at least 200 gallons per acre of spray volume being necessary, which was not an economical proposition.

* * *

**An appraisal of varietal resistance to sugar cane smut.** J. DA CRUZ FILHO. *Brasil Açuc.*, 1968, **71**, 217–218. This disease (*Ustilago scitaminea*) was first recorded in Minas Gerais in August 1964 in the commercial variety CB 45-3 which constituted about 80% of the cane under cultivation. Inspection showed other areas to be infected. Results are given of trials with 26 varieties to test their resistance to the disease. Most were susceptible.

* * *

**First congress on cost reduction in sugar cane.** E. CERRIZUELA *et al. Publ. Misc. Estac. Exp. Agric. Tucumán*, 1967, **23**, 49 pp.; through *Hort. Abs.*, 1968, **38**, 574.—Production costs in Argentina are compared with those in Puerto Rico, Louisiana, Florida and Hawaii. A plan is proposed for reducing the number of man-hours per ton of cane produced in Argentina by more than half.

* * *

**Ideal breeding and selection of sugar cane.** C. EKAMBARAM. *Madras Agric. J.*, 1967, **54**, 524–530; through *Plant Breeding Abs.*, 1968, **38**, [illegible]. Results are presented of a study of field attributes in 200 selections from 6 parental crosses. The characters included length and thickness of cane, number of nodes, individual cane weight, filter quality.

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# Sugar beet agriculture

...ion on field emergence of ...sed seed. R. SCHILDBACH. *Zucker*, ... 53–70, 92–96.—Investigations and observations on field emergence extending over 3 seasons (1965-67) in 3 localities are reported. Seedling emergence varied from 37 to 65%, various factors being concerned such as soil temperature, moisture or rainfall, sowing date and soil type. Greenhouse tests under controlled conditions were also carried out. Low temperatures after sowing may retard or impair emergence. Physical properties of the soil were correlated with soil moisture. With very early sowing closer spacing was necessary to secure sufficiently uniform field emergence. Further experimentation is considered desirable.

* * *

**Inhibition of water uptake in sugar beet roots by ammonia.** D. M. STUART and J. L. HADDOCK. *Plant Physiology*, 1968, **43**, (3), 345–350.—Ammonium sulphate, ammonium carbonate or ammonia gas inhibited water uptake in sugar beet roots whenever the pH was sufficiently high to cause the production of ammonia. When ammonia was removed by aeration, inhibition of the water uptake by roots was rapidly reversed. ATP (adenosine triphosphate) at 0·2 mM appeared either wholly or partially to prevent the ammonia-induced inhibition of water uptake by roots. ATP may be involved in maintaining the structure of water pathway through the roots. In roots lacking epidermis, ammonia did not inhibit water uptake by the roots. This may indicate that the site of the inhibition lies within the root epidermis.

* * *

**Comparison between sugar beet and sugar cane.** L. DECOUX. *Agricultura* (Louvain), 1966, **14**, (1), 1–47; through *Biol. Abs.*, 1968, **49**, (4), 1868.—Sugar cane and sugar beet normally are adapted to fixed ecological conditions and do not enter into competition. Sugar beet grows about 6 months and sugar cane 12–24 months, according to country of production. The writer considers that, on balance, the yield of cane may be more affected by adverse conditions (parasitic or climatic) than that of sugar beet.

* * *

**The magnesium manuring of sugar beet on light sandy soils of East Anglia.** M. F. HARROD and T. H. CALDWELL. *Tech. Bull. Min. Agric. Fish. Fd.*, 1967, **14**, 127–142.—Results with Mg dressings on deep ...y sands and sandy loams are given. Responses to Mg w... ...pared at mo...rate and high levels of N-K manuring. At 3 ...ites ...yield... ...f su... responded ... to Mg ... ...v slight beneficial ...ted. ...il Mg ...plication ...ssed.

TO INDU... RY

**The effect of ploughing depth and subsoiling on sugar beet yield.** O. J. FURRER. *Schweiz Landw. Forsch.*, 1967, **6**, 201–212; through *Soils and Fertilizers*, 1968, **31**, (1), 95.—Ploughing depths of 18 cm and 28 cm and ploughing 18 cm plus 8 cm subsoiling were compared in trials in 8 different sites. Subsoiling increased yield by 1·6%. Deep ploughing but not subsoiling reduced the number of misshapen beet. Soil moisture was unaffected.

* * *

**The effect of sowing date and fertilizer rate on sugar beet.** J. C. HOLMES and S. N. ADAMS. *Expl. Husb.*, 1966, (14), 65–74; through *Soils and Fertilizers*, 1968, **31**, (1), 95.—There is evidence to show that sugar beet in Scotland shows the largest fertilizer response with early sowing and late harvesting and that the rate of applying compound fertilizer need not be changed for differences in sowing or harvesting date.

* * *

**State trials and approval of sugar beets in 1967.** N. S. YAKIMENKO. *Sakhar. Svekla*, 1967, (9), 32–33; through *Plant Breeding Abs.*, 1968, **38**, 369.—The 1966 trials involved 102 cultivars and hybrids of which 87 were bred in the Soviet Union. For 1967, 29 cultivars and 13 hybrids were approved. Mention is made of some varieties removed from the approved list.

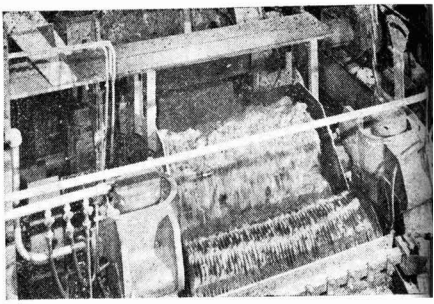
* * *

**Experiences with the beet fly (*Pegomya betae* Curt.) in Czechoslovakia.** V. SKUHRAVÝ. *Zucker*, 1968, **21**, 122–127.—In Europe beet fly as a sugar beet pest occurs in certain temperature zones. Data are given of its prevalence in Czechoslovakia over a number of years with maps to indicate its distribution. The possibilities of forecasting damage by the pest and of chemical control are discussed.

* * *

**Divergent selection in tetraploid pollinators for high and low germinating triploid hybrid seed.** R. E. STAFFORD and R. E. FINKNER. *J. Amer. Soc. Sugar Beet Tech.*, 1967, **14**, 363–367.—Many factors may influence the germination of sugar beet seed, important among them being chemical inhibitors in the seed which influence speed of germination. The writer considers that so far no attempt has been made to study triploid germination. Tetraploids producing high-germinating triploid progeny consistently would be a desirable feature in the triploid breeding programme. The object of this study was to determine if tetraploid male lines could be selected which would produce high and low germinating triploid hybrids. Negative results were obtained with the material studied. Limitations of the experiments are discussed. More critical data are needed.

# Cane sugar manufacture



**Defeco-melt crystallization process for manufacture of plantation white sugar without sulphur.** S. C. GUPTA, N. A. RAMAIAH and R. K. JAIN. *Paper presented to the 13th Congr. ISSCT*, 1968.—The defeco-melt crystallization (DMC) process[1] is described and results obtained using it are discussed.

* * *

**The reduction and control of calcium salts in cane sugar fabrication.** J. CASEY. *Paper presented to the 13th Congr. ISSCT*, 1968.—The reduction of calcium in clear juice by use of mill disinfectants and synthetic coagulants in clarification are discussed with reference to results in a number of cane sugar factories.

* * *

**A study of the rôle of starch in the growth of sugar cane and the manufacture of cane sugar.** W. CHEN. *Paper presented to the 13th Congr. ISSCT*, 1968.—The increase in the starch content of cane such as N:Co 310 during its growth and the rôle of starch in the processing of cane juice are discussed. The relationships between starch and turbidity and filtrability have been studied. Raw sugar from carbonatation factories had a low starch content.

* * *

**An absolute criterion of mill work ?** A. L. WEBRE and R. A. FIEDLER. *Paper presented to the 13th Congr. ISSCT*, 1968.—None of the existing criteria of cane mill performance is considered completely reliable, alone or combined with others. However, it is shown how the theoretical minimum milling loss can be determined from the cane pol:water ratio for a given imbibition:fibre ratio, and the ratio between theoretical minimum milling loss and the true milling loss then used as an absolute criterion of cane mill or diffuser performance.

* * *

**Cane diffusion—the displacement process in principle and practice.** J. H. PAYNE. *Paper presented to the 13th Congr. ISSCT*, 1968.—Unit operations are described and operational data for the 1966 season are discussed in the case of the Silver ring diffuser at Pioneer sugar factory in Hawaii.

* * *

**Preliminary physico-chemical studies on sugar cane diffusers.** W. S. GRAHAM, R. M. MORRIS and D. M. OOSTHUIZEN. *Paper presented to the 13th Congr. ISSCT*, 1968.—The main process variables investigated in the case of a De Smet cane diffuser were pH and operating temperature. pH had little effect on extraction of the commonly determined impurities in cane but was effective as a control for enzymatic destruction of sucrose. At a temperature below 70°C little starch was extracted, while above 70°C the level of starch extraction was the same as in milling. Diffusion extracted less wax than did milling.

* * *

**Cane preparation in relation to milling and diffusion.** D. H. FOSTER and D. S. SHANN. *Paper presented to the 13th Congr. ISSCT*, 1968.—Experimental work in Queensland on maceration and diffusion is reviewed. The effects of screening and shredding the coarse particles of bagasse which contain most of the sugar lost in final bagasse are discussed. In large-scale screening tests at high crushing rates it was found that a 1-mm reduction in the average particle thickness results in an increase in overall pol extraction of 1%. A regression equation has been developed from tests with first mill bagasse to simulate diffusion. This defines the effects of preparation, temperature and time of treatment of cane on pol extraction. The significance of "pol in open cells" or "displaceability index" is discussed and other measures of preparation are considered. The importance of preparation is discussed.

* * *

**Preliminary investigations on extraction of sugar cane at varying pH values, temperatures and retention times.** E. BJERAGER and H. BRÜNICHE-OLSEN. *Paper presented to the 13th Congr. ISSCT*, 1968.—Laboratory investigations have shown that the extraction of impurities having adverse effect on subsequent processing increases with rise in pH, at temperatures above 70°C and with prolonged juice retention in the diffuser. Thus, for optimum results, the pH should be that of freshly-cut cane, the temperature should not exceed 70°C and the retention time should be less than one hour.

* * *

**A theoretical approach to cane diffusion.** P. FREUND. *Paper presented to the 13th Congr. ISSCT*, 1968. The SILIN formula for beet diffusion[2] has been modified for cane diffusion. The modified version takes the form: $\alpha = KN^2 \frac{H}{V_p} vS$, where $\alpha$ is the product of four factors expressing the transfer surface of the particles, temperature, leaching time and a constant for a given diffuser; $K$ characterizes a stage of a given diffuser, i.e. "stage efficiency" and $KN$ characterizes

[1] *I.S.J.*, 1966, **68**, 340.

[2] SILIN: "Technology of beet sugar production and refining". (Israel Program for Scientific Translations, Jerusalem.) 1964, pp. 143–145.

the whole diffuser; $H$ is the height of the bagasse layer, $V_p$ is the percolation rate, $v$ is a temperature factor, and $S$ is the particle surface area. Good agreement has been found between values given by the formula and experimental results obtained by various authors. It has been found that increase in temperature, height of bagasse layer, cane fibre content, imbibition, and amount of primary juice separated will lead to a higher extraction.

* * *

**Review of recent diffuser developments.** H. S. WU. *Paper presented to the 13th Congr. ISSCT*, 1968. Seven commercial designs of cane diffuser are listed, and operation of diffusers with and without cane mills and with clarification of press water illustrated by flow diagrams. The equipment used for cane preparation and dewatering of wet bagasse from the various diffuser designs are listed, and a brief survey given of the types of diffuser and advantages which should accrue from their use. Addresses of manufacturers are given and drawings presented of the BMA, Fairymead and Segura designs, while in an appendix are operational results for three Silver ring units, a De Smet diffuser and the DDS cane diffuser in Tanzania.

* * *

**The Philippine sugar industry.** E. R. DE LUZURIAGA. *Sugarland*, 1967, **4,** (9, 10, 11), 25–30.—A brief survey is presented of the history and development of the Philippine sugar industry with details of the principal sugar organizations and the four refineries.

* * *

**Deterioration of gur during storage—certain correlation studies on moisture, reducing sugars, polarization and total sugars.** P. SUBRAMANIYAM and S. VAIDYANATHAN. *Madras Agric. J.*, 1966, **53,** 199–206; through *S.I.A.*, 1968, **30,** Abs. 68–6.—Loose heaps of gur were stored from May to February in an ordinary godown (warehouse) (November R.H. 84·0%) and in an improved godown having damp-proof flooring, damp-proof doors and ventilators (Nov. R.H. 73·9%). In the former case, moisture increased from 5·7 to 14·3% and reducing sugars from 12·4 to 21·0%; pol decreased from 75·7 to 61·0 and total sugars from 86·6 to 82·1%. In the improved godown, moisture increased only from 5·3 to 6·7% and there was no significant change in the other variables.

* * *

**Heat and power for the sugar industry.** A. C. VALENTINE. *Steam Heating Engineer*, 1967, **36,** (7), 12–17; (8), 34–37; (9), 14–19, 25.—The processes used in making white sugar from beet and raw sugar from cane are briefly described with the aid of flow diagrams, and the use of back-pressure steam turbo-alternators to provide low-pressure steam as well as electrical power is discussed, the steam and power requirements of the sugar factory governing the type of generator and its operating conditions. It is suggested that cane sugar factories with high power loads may find condensing turbines economical.

**Clarification factor—a reappraisal of its rôle in clarification studies.** K. N. PAUL. *Indian Sugar*, 1967, **17,** 679–680.—Use of the clarification factor as a guide to clarification efficiency is not recommended for various reasons which are stated. Instead, use of the non-sucrose components of the juice, determined qualitatively and quantitatively before and after clarification, is advocated.

* * *

**The loss of sugar in sugar cane after harvest. I.** A. P. GUPTA, I. S. JUNEJA and M. NARAIN. *Indian Sugar*, 1967, **17,** 685–693.—Tabulated analyses for different cane varieties harvested during various months show the adverse effect of cane storage on sugar losses. Up to 24 hours after harvesting the losses are negligible, but increase with time and mostly depend on the atmospheric temperature and humidity. Varietal differences have also been observed.

* * *

**Drive for sugar cane milling units.** H. J. SCHROEDER. *Zeitsch. Zuckerind.*, 1968, **93,** 171–175.—A survey is presented of the various types of electric motors used as drives for cane mills.

* * *

**The Mexican sugar industry.** S. REINHARD. *Zeitsch. Zuckerind.*, 1968, **93,** 176–181.—A survey is given of the Mexican sugar industry, including the names and capacities of the 69 sugar factories in operation and information on the production of "piloncillo" (a non-centrifugal sugar) using a primitive sugar cane mill. Cane agriculture, land reform, investment in the industry, and sugar prices are also discussed.

* * *

**Evaluating extraction performance on analyses only.** C. G. M. PERK. *S. African Sugar J.*, 1968, **52,** 243. For evaluating milling extraction, the use of lost undiluted juice % fibre in final bagasse is advocated, since it is unaffected by inaccuracies in calculating bagasse weight (shown by tests at Entumeni to be as much as 7% higher than true values) but is based on the Brix of first expressed juice, which is analysed in Southern African sugar factories. Tabulated data for 25 factories show that milling loss figures generally follow the trend indicated by values of lost undiluted juice % fibre but not always.

* * *

**High-pressure boiler feed water deaeration.** R. PIAT. *Rev. Agric. Sucr.* (*Mauritius*) 1967, **46,** 197–199.—At Mon Désert Alma sugar factory, boiler feed water is brought to boiling point before being transferred to the feed tank, in order to reduce the oxygen content. A marked reduction in the consumption of chemicals for oxygen scavenging has been achieved. Diagrams are given showing the feed tank and scrubber arrangements.

**Factory expansion and modernization at Pasudeco.** C. MENDIOLA and D. BALAGSO. *Sugar News*, 1968, **44,** 17–21.—Details are given of alterations to equipment and new machinery installed to expand the sugar factory of Pampanga Sugar Development Co. in the Philippines from a daily crushing rate of 5500 to 7000 t.c.d.

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**Performance of Edwards "Autocane" carrier drive at Bogo-Medellin.** H. K. MIJARES and R. J. BANDOLON. *Sugar News*, 1968, **44,** 25–26, 28.—A general description and principles of operation of the Edwards Engineering Corporation's "Autocane" carrier drive are given. Some difficulties encountered at Bogo-Medellin are noted.

* * *

**Notes on mill settings.** F. SERNA SILVA. *Bol. Azuc. Mex.*, 1967, (220), 30–38.—Recommendations made by mill manufacturers, and practices in various countries, for roller and turnplate adjustments, are summarized and a list presented of factors which affect calculated settings.

* * *

**Electronics applied to the sugar industry.** O. TEIXEIRA. *Brasil Açuc.*, 1968, **71,** 144–155.—Application of electronic devices in sugar factories is reviewed, with particular attention to measurement and control of pH of juices, etc.

* * *

**Treatment of juices when milling cane containing soil and trash.** R. PEDROSA P. *Bol. Ofic. A.T.A.C.*, 1967, **22,** (2/3), 38–50.—In order to prepare for the difficulties which will arise from soil and trash in the cane when harvesting and loading are completely mechanized, a series of steps are required. These include examination of juice screens to see the type of soil particle entering the factory; knowing the type of soil planted to cane, determination of the amounts and nature of soluble components in order to determine the appropriate treatment; study and application of flocculants for elimination of soluble impurities; determining the best type of clarifier to give high quality clear juice and easily-handled muds; use of the best system of continuous liming to give best results and maintain juice at the iso-electric point for good defecation; use of new mechanical separation methods for removing soil particles from raw juice; and complete disinfection of mills and other plant. Each step is discussed in some detail.

* * *

**Pass in the vapour valves of pans and syrup vessels.** O. A. ESPINOSA DE LA T. *Bol. Ofic. A.T.A.C.*, 1967, **22,** (2/3), 69–71.—There are many installations where a single condenser serves more than one pan or evaporator vessel. The valves in the vapour lines are among the largest in the factory, with consequent problems in maintenance and, especially, perfect sealing to avoid drops in vacuum. When it is necessary to close one valve and open one side to atmosphere, the leakage of air can cause difficulties in the other vessels served by the same condenser as a result of the loss of vacuum. To avoid this it has been found practical to install a 1-inch steam line within the vapour ducting and directed to the pan or evaporator side of the vapour valve; when the latter is closed, a flow of steam is directed through the steam line at the valve. It is drawn in through the leaks and expands under the reduced pressure, filling the leak aperture and excluding air. Since it is completely condensed, it causes no loss of vacuum.

* * *

**Evaporator cleaning.** A. G. KNIGHTS and D. A. MCDONALD. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 328–329.—In Guyana, raised cane crushing rates without increased evaporator capacity meant that tube cleaning had to be carried out within a weekly down time of 12 hours. This is achieved by use of electrically-driven scrapers alone, except in one factory where the scale is pretreated by boiling with 10–15% $Na_2CO_3$ solution. The evaporators are cooled either by filling with cold water or by an induced air draught, and then descaled; a new type of cable* which has shown much longer life is supplied with water as well as the tool-carrying cable, so that it serves as a coolant and lubricant and helps to wash away the detached scale.

* * *

**Entrainment.** H. L. GROGAN. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 329–330.—Entrainment was prevented in the vessels of a quadruple-effect evaporator by fitting a wooden maze in the vapour space, combined with blocking headbox drains through which liquor was passing upwards. Entrainment was stopped, but it was found that the maze slowed down cooling at the week-ends with consequent delay in mechanical cleaning.

* * *

**Exhaustion of final molasses in Barbados factories, 1952-1966.** D. H. WEST. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 338–351.—Exhaustion of final molasses in Barbados factories during the period was examined and shown to have been less efficient during the late 1950's although the reducing sugars:ash ratio had remained stable throughout. By 1961 recoverable sugar lost in molasses reached about 4% of total sugar production. Research on the subject since 1962 is summarized and recommendations for practical applications of the work are discussed, as is a means of calculating exhausted final molasses sucrose content under various conditions of temperature and total dry matter.

* * *

**The efficiency of the steam generating plant in the cane sugar factory.** H. S. BIRKETT. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 352–362.—Benefits which arise from high boiler efficiency are discussed, as are the factors determining the efficiency of steam generating plant and the calculation of this efficiency.

* Flexible Drives (Gilmans) Ltd., Myers Rd., Warwick, England

**Continuous versus batch centrifugals for centrifugalling low grade cane sugar massecuites.** L. S. BIRKETT. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 331–337. On the basis of comparisons at two factories, the estimated increase in molasses purity due to greater passage of fine crystals is 0·60 units while a further 0·25 increase results from minimum dilution by steam and water, giving a total of 0·85 units rise. When the low-grade products are highly viscous, more dilution through washing and crystal re-solution on reheating result in greater differences in purity of molasses from the two types of centrifugal. In calculating whether the increased loss is economically acceptable, it should be recognized that rather than needing no supervision, continuous machines need careful supervision to achieve optimum results and avoid substantial losses which might otherwise go undetected.

* * *

**Handling and storage of raw sugar in bulk in Barbados, 1961-1966.** R. R. TROTT. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 363–369.—A description is given of the quality control scheme needed to govern the mixing and storage or raws from the 15 different factories in Barbados entering the Bridgetown store. The characteristics of the sugar examined include keeping quality, pol, cleanliness, crystal size and uniformity, and temperature at entry. Summaries of results from 1961 to 1966 are included, and standards originally set are discussed, as well as changes in these standards during the period. Annual pol and weight losses are summarized and plans for improving the storing, handling and refining quality of Barbados raws are described.

* * *

**Sugar mill bearing lubrication.** L. G. WINTER and A. K. SOMERVILLE. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 370–374.—While bitumen compound lubricants are suitable for pressures of up to 1000 p.s.i., additives are necessary where larger and higher-speed mills involve higher pressures. The cost of annual dismantling for bearing overhaul is often neglected as part of lubrication costs, and this is increased by bearing failure during crushing. The effect on load carrying capacity of temperature increase is calculated, and the troubles which can arise through bitumen compound carbonization at higher temperature are described. Heat conduction from the bearing is discussed, as is the supply of lubricant under pressure to a groove from which it can run to the bearing proper.

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**Removal of boiler ash by fluming.** S. RAMLALL. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 374–376.—The furnace chambers of the Thompson-Eisner furnaces at Enmore sugar factory were redesigned to include a V-shaped section with a flume at the bottom of the V. Water introduced through fantail jets at the inlets creates fast-moving streams which carry fly-ash and unburnt bagasse particles past flo[illegible] seals at the ends of the flumes; the[illegible] seals prevent air entering the fi[illegible]ce. At inte[illegible] the flumes are inspected and rodded to clear blockages if they have been formed. The system has reduced downtime and furnace cleaning, brickwork fused ash deposits and fly-ash nuisance to the neighbourhood, while boiler efficiency is believed to have increased.

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**The "Rapi-Floc" system of filtration in Guyana.** L. S. BIRKETT. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 395–396.—To counter inadequate clarifier capacity to meet the crushing rate, the "Rapi-Floc" system was adopted at La Bonne Intention. This involves use of a flocculant to give a denser mud which on filtration gives a clear filtrate which can be sent to the evaporators direct instead of being returned to the clarifier. Experience with the process is described, and the extra costs involved are detailed.

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**The influence of surface active agents on low grade boiling.** D. H. WEST. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 399–403.—Surface-active agents have proved of great value when processing syrup and molasses from drought-affected cane. This has been the result of lowered surface tension, allowing faster evaporation, but reduction of viscosity has been rare. Without reduction in its viscosity better exhaustion of molasses is unlikely, and none was observed in 1964, although in 1963 satisfactory boiling could not have been carried out without these chemicals. It is recommended that a stock of the agents should be kept for use when crushing drought-affected or stale burnt cane, or when additional evaporation is required. Results of tests indicate that, when crushing fresh, well-matured cane, the benefit obtained would not be sufficient to offset the cost.

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**Magnetic separator as installed on Albion Estate 44 × 84-in mill tandem.** I. GORDON. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 403–404.—A description is given of a magnetic separator installed at Albion factory and certain design defects indicated. After 3765 hours of operation the roller surfaces are almost entirely free from tramp iron damage, while large quantities of assorted iron—cane knives, sling chains, punt jointings, bolts, nuts, iron bars, etc., have been separated.

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**Mechanized handling of bagasse.** A. G. KNIGHTS and D. C. PERREIRA. *Proc.* 1966 *Meeting B.W.I. Sugar Tech.*, 404–407.—An account is given of the construction at Wales factory of a new bagasse "loggie" or store from which bagasse is reclaimed for firing the furnaces out of crushing periods. It was hoped originally to operate without machines for reclaiming, but a tractor with a blade attachment proved necessary. A similar store at Uitvlugt is briefly described; this also uses a tractor.

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**Washing of cane at Hacienda Pomalca.** A. DE LA PIEDRA and F. VERA. *Anal. VII Conv. Asoc. Peruana Téc. Azuc.*, 1963, 215–217.—During an emergency

after heavy rain, water sprays under pressure were used to wash cane entering the Hacienda Pomalca sugar factory. It was found better to use water falling under gravity from sprays two metres above the cane, and this is the basis of the permanent installation built. The washing has successfully separated trash and soil from the cane, but the water requires clarification in a decanter from which muds must be returned to the fields.

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**Planned preventive maintenance in sugar factories.** D. M. ADAMS. *Proc. 1966 Meeting B.W.I. Sugar Tech.*, 408–417.—The establishment of a system of planned maintenance is described, and the necessary organization and financial aspects discussed.

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**Dry cleaning of cane at Hacienda Tumán.** G. RUÍZ F. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 218–222.—A detailed description is given of the Honolulu Iron Works Co. dry cane cleaner installed at Hacienda Tumán for separating soil and trash from cane arriving at the rate of 200 t.c.h., together with comparisons of data from the 1958/59 and 1962/63 seasons, before and after the installation.

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**Conditioning of a boiler to increase its capacity.** C. MORALES. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 223–227.—Details are presented of the steps taken to increase the capacity of three boilers at Hacienda Pomalca by 9660 lb to 28,800 lb/hr, by constructing an economizer, doubling the tubes, providing an air preheater, etc.

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**Comparative tests of the operation of the BMA continuous centrifugal.** S. CASTRO R. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 228–229.—*C*-massecuite, reheated with hot water at 70° or 90°F, depending on the viscosity, was sent to a BMA continuous centrifugal and Buckau-Wolf automatic batch machines. The BMA machine handled 1700–1900 kg/hr of massecuite and produced a higher purity molasses but the sugar crystals were of better quality than those of the batch machine.

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**Shelling of mill rolls at Hacienda Pomalca.** A. DE LA PIEDRA and F. VERA. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 230–232.—A description is given of the simple installation constructed for shelling of mill rollers which has made the process less costly than having the rollers re-shelled overseas.

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**Driving the mill by means of electric motors.** A. DE LA PIEDRA and F. VERA. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 233–236.—Advantages of the electric motor for cane mill drive are listed under two heatings: operational advantages and thermal advantages. It is also mentioned that the cost of electric drive is less than for steam engines and turbines.

**Electrical interconnexion of Haciendas Pomalca, Tumán and Pucalá.** T. GALARRETA L. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 237–242.—The possibility of interconnexion of the power lines of the three sugar factories has been studied and the advantages are listed. It is concluded that, technically, the process is desirable while, economically, the investment would be amortized in a short time by the saving in fuel needed for auxiliary diesel generators or the cost of a new turbo-generator which would otherwise be needed.

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**Casting of rollers.** B. DOCHEFF. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 243–250.—It is concluded from a study of the proposal that it would be advantageous to establish a foundry for casting of rollers, etc., for Peruvian sugar factories. It is proposed that a commission be set up to examine the proposal more completely and to carry it out.

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**Operation of the cane mill.** B. DOCHEFF. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 251–253. Equipment for recording mill roller float was installed at Pomalca and examination of the work of each mill permitted adjustments which raised throughput from 150 to 165 t.c.h.

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**Double liming.** G. ROELEVELT. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 283–284.—Liming in two stages, first in the cold and later at 100°C, has been found at Hacienda Tumán to give better clear juice quality and produce further advantages in the boiling house.

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**Experiments carried out with the bactericide "Busan 881".** C. A. MEOÑO O. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 288–291.—From experiments carried out at a sugar factory it was found indispensible to use a chemical bactericide in the milling train, and it is also convenient to clean additionally with steam at intervals to remove bagacillo, etc., from the chains, carriers, etc.

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**Purification of *B*-molasses by centrifugation.** F. PROSKOWETZ and J. C. P. CHEN. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 292–295.—See *I.S.J.*, 1964, **66**, 84.

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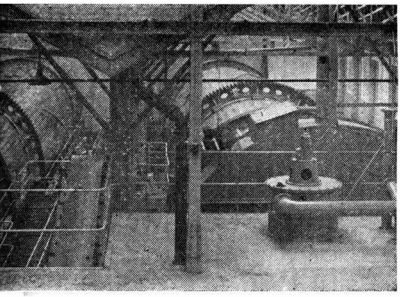
**Treatment of turbid juices from rotary filters as a means of increasing clarification capacity and of reducing the percentage of ash in export sugar.** C. A. MEOÑO O. *Anal. VII Conv. Asoc. Peruana Técn. Azuc.*, 1963, 302–308.—In view of results obtained at Hacienda Pucalá with the treatment of turbid juices with phosphoric acid and "Separan AP-30" coagulant, this method is recommended for use in factories where recirculation of solids to mixed juice is a problem, in order to increase clarifier capacity and alleviate the problems caused by the non-sugars in the final products.



# Beet sugar manufacture

**Fundamentals of automatic control.** J. PULACZEWSKI and S. MICHALOWICZ. *Gaz. Cukr.*, 1968, **76**, 37–40. The fundamentals of automatic control are explained and its application in the beet sugar factory discussed in the form of a number of questions.

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**Effects of condensate accumulated in the steam spaces of a vacuum pan on the boiling period.** H. BAYSAL. *Seker*, 1966, **16**, (61), 4–10.—A formula is derived for calculating the rate of accumulation of condensate in the event that the drain is blocked during boiling.

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**Influence of heating steam pressure in a vacuum pan during boiling.** H. BAYSAL. *Seker*, 1967, **16**, (62), 1–4. The relationship between heating steam pressure and boiling time in a vacuum pan is expressed by means of an equation, as is the relationship between the weight of water evaporated and the weight of condenser water required.

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**Electronic level control.** R. NIKSARLI. *Seker*, 1967, **16**, *(61)*, 15–16.—A circuit diagram and description are given of a level control designed and constructed by the Turkish Sugar Corporation Technological Research Institute at Etimesgut. Use of such home-produced instruments would have advantages for Turkish sugar factories.

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**Causes of foaming and floc formation in granulated sugars and means of avoiding them.** Y. SARAY. *Seker*, 1967, **16**, (63), 15–23.—Foaming of granulated sugar is caused by saponin, while pectin and protein are also necessary for floc formation. Foaming and floc can best be reduced by minimizing the saponin content by the use of active carbon in the refinery and by liming and carbonatation of juice to the optimum pH.

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**Utilization of beet tails in Kastamonu sugar factory.** Y. AKYÜZ. *Seker*, 1967, **16**, (63), 24–27.—An account is given of trials at Kastamonu sugar factory during the 1964/65 campaign on the economics of treatment of beet tails and their evaluation.

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**Feed water and its importance.** A. YILMAZ. *Seker*, 1967, **16**, (63), 28–31.—The importance is emphasized of avoiding scale-forming salts of Ca and Mg in boiler feed water as well as corrosion-producing constituents such as $CO_2$, $O_2$, sugar and acids.

**Reasons for increased aeration of molasses and ways of reducing this.** Y. EREN. *Seker*, 1967, **16**, (65), 23–26.—During processing, molasses is apt to entrain air, especially during centrifugalling, and samples from Turkish sugar factories in 1965 contained up to 29·7% air. This aeration caused difficulties in pumping, and methods of reducing the air content are surveyed; they include storage for 10–40 days, preferably after dilution to below 80°Bx, subjection to vacuum evaporation after storage, and treatment with steam.

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**Optimum conditions of evaporation in single-pass evaporators.** N. YU. TOBILEVICH, O. N. SIRYI and V. T. GARYAZHA. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (1), 160–166.—Tests were carried out with a single-pass evaporator to show its advantages over multi-pass evaporators (mainly reduction of the time sugar solutions are exposed to high temperature effects) and to establish optimum evaporation conditions. As regards the effect on the juice, single-pass evaporators with sections are preferred to sectionless ones.

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**Corrosion resistance of some steels, alloys and platings in diffusion juice.** V. K. SUPRUNCHUK, V. N. SHCHEGOLEV, I. D. VDOVENKO and N. N. GRATSIANSKII. *Sakhar. Prom.*, 1968, **42**, (2), 9–13.—Results are given of tests on the corrosion resistance of various metals. The most suitable for equipment in contact with raw juice were certain chrome steels, a carbon steel-chrome steel bimetal, and chromium plating. Polyethylene had high chemical and mechanical durability, but difficulties in bonding it to carbon steel preclude its application as a protective coating.

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**Migration of non-sugars during green syrup purification by electrodialysis.** L. D. BOBROVNIK, G. P. VOLOSHANENKO and A. P. KOZYAVKIN. *Sakhar. Prom.*, 1968, **42**, (2), 13–15.—In demineralization tests, electrodialysis removed impurities from green syrup in the following descending order: inorganic non-sugars > organic non-nitrogenous non-sugars > nitrogenous non-sugars. Of the last, the glutamic complex was the component most removed.

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**Improvement of technological processes at Lokhitskii factory.** E. E. BELOKON'. *Sakhar. Prom.*, 1968, **42**, (2), 17–20.—Details are given of modifications to the boiling scheme, carbonatation, and juice and syrup filtration at this Soviet sugar factory.

**Method of stabilizing the specific load in tower diffusers.** V. Ya. Vailov, E. T. Koval', B. A. Eremenko and V. G. Yarmilko. *Sakhar. Prom.*, 1968, **42**, (2), 21–27. The adverse effects of a low specific load on diffuser performance are discussed. The most suitable means of increasing the load is considered to be increasing the speed of the scroll at a given constant shaft torque. The linear relationship between specific load and shaft torque is shown graphically and graphs are also given showing the change in shaft torque as a function of increase or decrease in shaft speed and diffuser throughput.

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**Effect of dirt and leaf contents on beet quality in storage.** E. V. Panferova. *Sakhar. Prom.*, 1968, **42**, (2), 46–49.—Tabulated data covering a 3-year period indicate the adverse effects of dirt and leaves on stored beet.

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**Determination of beet mass and sugar losses during beet transfer to the factory.** V. A. Maksyutov and Yu. I. Dushitskii. *Sakhar. Prom.*, 1968, **42** (2), 50–53.—A method is described for determining loss in beet weight between the yard and sugar factory and the sugar content in flume-wash water. Some results are tabulated.

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**Paying for beet on the basis of sugar content.** A. P. Pivovarov. *Sakhar. Svekla*, 1968, **13**, (3), 36–38. The advantages of beet payment on the basis of weight and sugar content are discussed with reference to the USSR and a sample scale of payment, drawn up for one sugar factory, is presented.

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**Suitability of applying 2nd carbonatation at boiling temperature. I. Laboratory tests. II. Factory-scale tests.** J. Dobrzycki. *Gaz. Cukr.*, 1968, **76**, 30–33, 53–57.—Laboratory and factory tests showed that the temperature of juice at 2nd carbonatation should be raised to boiling in order to prevent over-saturation with excessive amounts of $CO_2$. The pH of 1 litre of over-saturated juice rose from 7·8 to 8·5–9·0 after 2 min according to the amount of heat applied to the juice (2·4–12·5 kcal/min). Hence, it is shown that at least 3000 kcal/100 kg juice is required to prevent over-saturation. However, if the juice is heated to 103–104°C before 2nd carbonatation, only 400 kcal/100 kg is needed to adjust the pH after gassing to optimum alkalinity; this would prevent over-saturation and minimize evaporation.

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**Counter-current regeneration of ion exchangers and adsorbents.** H. Hitzel. *Zucker*, 1968, **21**, 206–211. Details are given of the "Ionit" counter-current filter for ion exchanger and adsorbent regeneration which has proved reliable in factory-scale tests as well as indicating the advantages of counter-current regeneration. Results are given of thin juice defiming and decolorizing tests.

**Beet syrup purification by electrodialysis.** I. F. Zelikman and D. M. Leibovich. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (1), 80–82.—In electrodialysis tests on 60°Bx syrup containing known concentrations of electrolyte, deionization increased as the current density fell from 10 to 1·5 mA/sq.cm. The pH fell from 8 to 6·7–6·9. Increase in syrup purity was greater the higher was the initial purity, and hence the lower was the electrolyte concentration. At 85·7 initial purity, 84% deionization (maximum attained in the tests) increased the purity to 91·5, but the pH fell from 7·6 to 3·4 and the purity increase in terms of power consumption was considered inadequate.

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**Test on Polish WA41-1500 centrifugals.** A. Yu. Volokhov. *Sakhar. Prom.*, 1968, **42**, (3), 7–10. Details are given of the fully-automatic WA41-1500 centrifugal which has a maximum speed of 1500 r.p.m., a basket 1230 mm in diameter with a massecuite capacity of 450 kg, and is capable of 20 cycles/hr under normal conditions. In comparative tests with 93–94°Bx massecuite the machine gave approximately the same results as a Fives Lille-Cail high-speed centrifugal.

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**One of the reasons for beet syrup of inadequate concentration.** I. F. Zelikman and V. A. Kolesnikov. *Sakhar. Prom.*, 1968, **42**, (3), 10–11.—A detailed explanation is given of reasons for inadequate evaporation of thick juice in sugar factories in Krasnodar Territory (average Brix of concentrated juice over four campaigns was 52°).

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**Selection of types of evaporator and evaporator station arrangement.** N. Yu. Tobilevich, O. N. Siryi and V. T. Garyazha. *Sakhar. Prom.*, 1968, **42**, (3), 12–16. The choice discussed is between single- and multi-pass evaporators. Two schemes are described involving a mixture of single- and multi-pass evaporator bodies and two schemes which incorporate only multi-pass effects.

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**Design of ion exchanger reaction vessels.** V. S. Pavlenko and I. N. Kaganov. *Sakhar. Prom.*, 1968, **42**, (3), 16–19.—Details are given of modifications to an ion exchange filter for water purification at Tul'skii sugar refinery. The redesigned column has been used for syrup ion exchange treatment.

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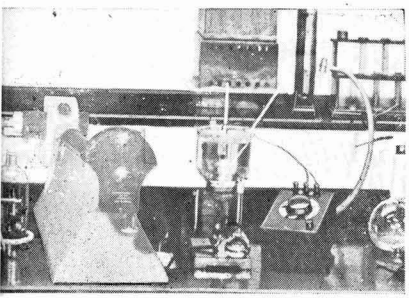
**Test on an experimental commercial-scale unit for white sugar cooling in a fluidized bed.** A. I. Chernyavskii, V. D. Karmazin and N. F. Novikevich. *Sakhar. Prom.*, 1968, **42**, (3), 20–22.—A fluidized bed cooler is described in which white sugar was cooled from 44–52·5°C to 20–37°C at a throughput of 8·5–17 tons/



# Laboratory methods & Chemical reports

**Aspects of the colloid chemistry of cane juice clarification.** P. HIDI. *Paper presented to the 13th Congr. ISSCT*, 1968.—Cane juice clarification is discussed in terms of the interaction between colloidal suspensions of opposite charges. It is shown that clarification efficiency depends on the degree of neutralization of the original negatively charged particles by the positively charged colloidal calcium phosphate formed during liming, incomplete neutralization resulting in turbid juice while an excess of positive particles will cause settling difficulties. The possible application of these principles in clarification of mill juice is considered.

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**Kinetic studies on caramelization of reducing sugars.** N. A. RAMAIAH and M. B. KUMAR. *Paper presented to the 13th Congr. ISSCT*, 1968.—Studies on the kinetics of alkaline degradation of reducing sugar, leading to caramel formation, are reported and a possible mechanism is suggested.

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**Distribution of non-sucrose in sucrose crystals.** H. J. DELAVIER and H. HIRSCHMÜLLER. *Paper presented to the 13th Congr. ISSCT*, 1968.—The ash content of sugars (white and refined) of various origins was determined conductimetrically after each sugar sample had been screened to separate it into crystal size fractions. Contrary to earlier findings, the smaller crystals did not always contain more ash than the larger crystals, although in 5 out of 9 cases examined, the ash content of the smallest fraction was greater than that of the largest fraction. This occurred where the sugar was of very high purity. When crystals were partially dissolved the ash content of the solution was greater than that in the original crystals and in the undissolved crystal residues. This was ascribed to differences in mother liquor purity surrounding the growing crystals.

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**Studies on the colour problem of plantation white sugars.** N. A. RAMAIAH and B. I. NEMADE. *Paper presented to the 13th Congr. ISSCT*, 1968.—Coloration of white sugar during storage was found to be due to caramelization of reducing sugars present between the crystal layers. This was catalysed by the ash components (chiefly carbonate) in carbonatation sugar, so that carbonatation sugar underwent greater colour development than did sulphitation sugar. The destruction of carbonates by syrup sulphitation at pH 5·0 and modification of the carbonatation process are two suggested ways of overcoming the problem.

**A study on the filtrability of raw sugar in (the) refining process.** C. A. LEE. *Paper presented to the 13th Congr. ISSCT*, 1968.—In factory and laboratory studies, no relationship was found between the filtrability of raw sugar and that of carbonatation slurry prepared from it. Affination increased the filtrability of a carbonatation slurry by 30%. The filtrability was affected by a number of factors and was not improved by repeated carbonatation and filtration. No differences were found in the filtrabilities of carbonatation slurries from raw sugars produced by different boiling processes. The filtrability of carbonatation slurry from the same raw sugar could vary considerably under normal factory conditions.

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**Statistical formula for predicting the filtrability of raw sugar crystal.** H. C. TSENG. *Paper presented to the 13th Congr. ISSCT*, 1968.—While clarified juice turbidity was found normally to be inversely related to raw sugar filtrability, this was not so when the juice was highly refractory and/or when clarification was difficult. A regression formula is presented for predicting the filtrability of raw sugar ($Y_c$) in terms of syrup turbidity ($X$): $Y_c = 108{\cdot}2 - 0{\cdot}273X$.

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**Filtrability of Hawaiian commercial sugars.** C. C. TU. *Paper presented to the 13th Congr. ISSCT*, 1968. Studies on 20 commercial sugars showed that the insoluble particles in the crystals were essentially the filtration-impeding substances, sugars of high filtrability containing less than 100 p.p.m. of insoluble particles separated by centrifuging at 44,300 *g* of a 10% solution of the crystals. Quantities and sizes of the insoluble and soluble particles in the samples were compared and evaluated on the basis of light-scattering data.

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**Spectral properties of commercial sugars.** C. C. TU. *Paper presented to the 13th Congr. ISSCT*, 1968. While the spectral properties of 13 commercial sugars were found to be similar in the visible region, differences occurred in the u.v. region; these differences were ascribed to the nature of some of the colouring substance in the crystal. High attenuancy of sugar solutions before centrifuging was attributed to the presence of water-insoluble particles. The decrease in attenuation is best measured using an ultra-violet rather than a visible wavelength.

**Applications of infra-red spectroscopy to sugar research: analysis of water-insoluble matter from sugar crystals.** C. C. TU. *Paper presented to the 13th Congr ISSCT*, 1968.—Most of the infra-red spectra of the water-insoluble matter from samples of washed raw sugar crystals from 26 different sources in Hawaii were found to be similar to one another, many being almost identical. Striking differences did occur, however, in the 8–10μ region of the 2·5–16μ spectrum.

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**The occurrence of oligosaccharides in cane products.** C. C. TU. *Paper presented to the 13th Congr. ISSCT*, 1968.—Extracts from cane juice were spotted on chromatography paper and developed with 6:4:3 *n*-butanol:pyridine:water. Oligosaccharides containing ketoses were detected with anisidine hydrochloride and those containing aldoses with aniline hydrogen phthalate. The composition of an oligosaccharide was determined by partial acid hydrolysis followed by paper chromatography as above. Oligosaccharides were also isolated from raw sugar crystal. Both these and the oligosaccharides from cane juice were probably produced by enzymatic or bacterial reactions in cane stored for 24 hours or more before processing.

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**Formation of needle-shaped sugar crystals.** M. KAMODA, F. ONDA, H. ITO, T. SHIRASAKI, T. MIKI and T. ANDO. *Paper presented to the 13th Congr. ISSCT*, 1968.—Studies of the possible causes of needle-shaped crystals in low-grade refinery massecuite[1] showed that close relationships existed between crystal axis ratio (*b:c*) and gum content and between *b:c* and oligosaccharide content, gum tending to cause quadratic-type crystals while oligosaccharides tended to cause needle-shaped crystals. Gum was also the secondary factor in the formation of needle-shaped crystals.

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**Occlusion of filtration-impeding substances in (the) sugar crystal.** T. ANDO, M. KAMODA, F. ONDA, H. ITO, T. SHIRASAKI and T. MIKI. *Paper presented to the 13th Congr. ISSCT*, 1968.—Raw sugar solutions containing various quantities of gum, starch, silica and phosphate were boiled in a laboratory vacuum pan. The amounts of the impurities occluded within the crystals increased with their concentrations in the mother liquor, more gum being occluded than any of the other substances. Phosphate tended to inhibit starch occlusion and to increase the amount of silica occluded but did not affect gum occlusion.

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**Non-static character of formation of a new phase in supersaturated sucrose solutions.** A. V. ZUBCHENKO, S. E. KHARIN and YU. N. LEVIN. *Izv. Vuzov, Pishch. Tekhnol.*, 1968, (1), 136–139.—Curves showing the rate of formation of crystals with time were calculated from sucrose crystallization kinetics. They are approximately S-shaped, but with an elongated section between the two curved ends. They pass through a maximum, of which the height and position on the *x*-axis depends on the initial supersaturation. It is shown mathematically that nucleation initially takes place under non-static conditions for a time (known as the "relaxation period") which is governed by the initial supersaturation and which increases with rise in supersaturation.

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**Sucrose solubility in water as a function of pH.** E. S. LYGIN. *Sakhar. Prom.*, 1968, **42,** (2), 16–17.—The solubility of sucrose as a weak acid ($S_o'$) at a given pH is calculated as $S_i[1 + \text{antilog}(\text{pH} - \text{pK}_a)]$, where $S_i$ is the characteristic solubility of a weak acid in 0·01N HCl and is approximately the same as $S_o'$ in pure aqueous solution, and $\text{pK}_a$ is the ionization constant. Experimentally-determined sucrose solubilities at various pH values agreed with calculated values, and the equation is considered suitable for approximate calculations.

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**Sucrose solubility in water at high temperatures.** A. SMELÍK, J. VAŠÁTKO and J. MATEJOVÁ. *Listy Cukr.*, 1968, **84,** 52–55.—An apparatus for determining sucrose solubility in water is described, in which water was saturated with sucrose during 60–180 min at constant temperature. Measured values were used to derive a quadratic equation for solubility: $S = 68{\cdot}415 + 0{\cdot}09559t + 0{\cdot}0004905t^2$, where $S$ = sucrose percentage and $t$ = temperature (°C). The equation is valid for temperatures in the range 89·2–145·3°C. The upper temperature is the limit of sucrose molecule association for the formation of pre-crystallization nuclei.

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**Quantitative determination of amides and amino acids in sugar factory juices. I. Aspartic acid.** R. OSVALD and M. FRAŇKOVÁ. *Listy Cukr.*, 1968, **84,** 56–62. Aspartic acid in raw and thick juices was determined by two-dimensional paper chromatography on Whatman No. 1 paper. The spots were developed with 3:1 phenol:water and 4:1:5 *n*-butanol:acetic acid: water, and ninhydrin (0·1% solution in acetone) was used for detection. Chromatograms and tabulated data are presented.

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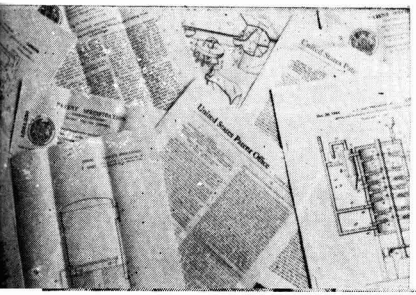
**Traces of copper compounds in white sugar.** M. GAWRYCH. *Gaz. Cukr.*, 1968, **76,** 57–59.—Tests showed that for determining copper in white sugar it was better to add hydrogen peroxide than conc. $H_2SO_4$ + conc. $HNO_3$ to the sample. The copper content of the resultant solution was then determined colorimetrically after sodium diethyldithiocarbamide had been added to form a yellow complex with copper. The copper content of Polish white sugar samples was well below the permissible level.

[1] SHIRASAKI and KAMODA: I.S.J., 1967, **69,** 88.



# Patents

## UNITED KINGDOM

**Beet harvesters.** (1) K. C. SHOTBOLT and R. A. SHOTBOLT, of Ramsey, Hunts., England. **1,114,624.** 11th August 1965; 22nd May 1968. (2) ALMABAL G.M.B.H., of Basle, Switzerland. **1,114,734.** 16th December 1965; 22nd May 1968.

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**Cane harvester.** MASSEY-FERGUSON (AUSTRALIA) LTD., of Sunshine, Victoria, Australia. **1,115,281.** 28th June 1966; 29th May 1968.

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**Refining esters of polyhydric alcohols.** NORTH AMERICAN SUGAR INDUSTRIES INC., of New York, N.Y., USA. **1,116,630.** 12th July 1965; 12th June 1968. A crude transesterification mixture contains an ester of a $C_4$–$C_{16}$ polyhydric alcohol, e.g. sucrose, with a $C_4$–$C_{32}$ acid (salicylic, naphthenic, succinic, glutaric, adipic, azelaic, sebacic, maleic, fumaric or itaconic acid), ⩾20% of a reaction solvent on ester weight and up to 50% on ester weight of a fluxing agent which may be a $C_2$–$C_6$ aliphatic diol or a $C_3$–$C_6$ aliphatic triol or one of their esters with a $C_2$–$C_4$ fatty acid, a malate or other ester of a $C_4$–$C_6$ aliphatic dicarboxylic acid with a lower primary or secondary alcohol such that the molecule contains 5–10 C atoms, methyl or ethyl aconitate, tartrate or citrate, a lactate of a $C_3$–$C_6$ monohydric primary or secondary aliphatic alcohol or a $C_2$–$C_6$ diol having only one hydroxyl esterified, or an acetoacetate or levulinate of a $C_1$–$C_5$ monohydric alcohol or $C_2$–$C_6$ diol having only one hydroxyl esterified. The mixture is dispersed in 0·8–20 (1·5–5) weights of a wash solvent [water, methanol, ethanol, *n*-propanol, *sec*-butanol, acetone, methyl ethyl ketone, diethyl ketone, a di-$C_1$–$C_3$ alkyl ether, a $C_1$–$C_3$ alkyl ester of a $C_1$–$C_3$ fatty acid, methyl *iso*-propyl ketone, an aliphatic hydrocarbon of boiling point between —45°C and 115°C, neutral (2–25%) solutions of a Na, K, Ca or Mg salt of HCl, HBr, $H_2SO_4$, $HNO_3$, $H_3PO_4$, $H_4P_2O_7$ (NaCl, $Na_2SO_4$), or a mixture thereof] such that it is miscible with the fluxing agent but will allow the ester to separate. The washed mass is separated into a solvent-rich phase and an ester-rich phase.

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**Production of invert sugar solutions from molasses.** C. F. BOEHRINGER & SOEHNE G.M.B.H., of Mannheim-Waldhof, Germany. **1,116,888.** 14th March 1967; 12th June 1968.—Cane or beet molasses is first subjected to acid hydrolysis by bringing to pH 1–4 with HCl and maintaining at 60–105°C for 20–120 minutes, with passage of $SO_2$ before, during or after the hydrolysis. The molasses is neutralized with NaOH or KOH solution or a weakly basic anion exchanger. Alternatively, $H_2SO_4$ may be used for hydrolysis and neutralization omitted. The solution is applied to a cation exchanger and salts washed out (at 50–100°C, 60–90°C, >100°C) until the metal ions have been displaced by hydrogen ions, after which the invert sugar is eluted.

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**Beet harvester automatic steering device.** A. M. JONGENEEL, of Rio Vista, Calif., USA. **1,117,902.** 11th April 1967; 26th June 1968.

* * *

**Sugar extraction.** THE LUMMUS CO., of New York, N.Y., USA. **1,117,980.** 22nd December 1966; 26th June 1968.—Beet and cane cell protoplasm is destroyed by a dose of at least 0·1 megarad (0·5–5·0 megarads) of high energy radiation from an electron generator ($^{60}Co$), after which sugar extraction is facilitated.

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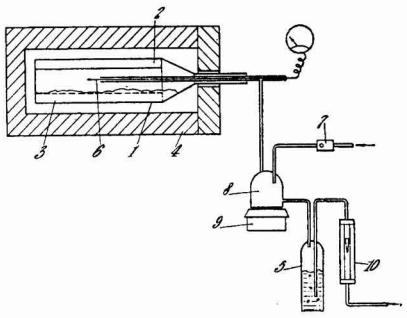
**Carbon adsorbent for sugar refining.** TATE & LYLE LTD., of London E.C.3, England. **1,118,651.** 13th January 1967; 3rd July 1968.

The adsorbent is a granular carrier (activated alumina, silica gel, sintered fullers' earth, bauxite, activated magnesia or a ceramic material) of which the surface is coated with (4–11% by weight of) carbon, deposited by cracking a vaporized hydro-




Copies of Specifications of United Kingdom Patents can be obtained on application to The Patent Office, Sale Branch, Block C, Station Square H[illegible], St. [illegible]ary Cray, Orpington, Kent (price 4s [illegible] each). United States patent specifications are obtainable from: The C[illegible]sioner of Patents, Washington, D.C. 20231, U.S.A. (price 50 cents each).

carbon (a normal paraffin having a chain length of at least 4) in the presence of the granules (and in the presence of a small proportion of oxygen).

The cracking is carried out in the horizontal cylindrical canister 1 with longitudinal baffles 2 which is loaded, e.g. with 22–44 mesh activated alumina 3 and rotated slowly. It is heated in a furnace 4 while passing a stream of nitrogen, pre-moistened by bubbling through water at room temperature in receptacle 5. When the thermocouple 6 shows that the temperature has reached 750°C, hexane is delivered through a metering pump 7 into a retort 8 heated by hotplate 9 through which the nitrogen stream also passes. The hexane in the stream is cracked thereby, some 30% of its carbon content being deposited on the alumina.

* * *

**L-Glutamic acid production.** AJINOMOTO CO. INC., of Tokyo, Japan. **1,118,827.** 25th June 1965; 3rd July 1968.—A micro-organism capable of producing L-glutamic acid is cultured on a medium containing molasses, raw juice, beet sugar, cane sugar, etc. and also containing a monopalmitate or stearate of propylene oxide (or a 2–10 polymer) and one or more of polyoxyethylene glycol, sorbitan, glucose, sucrose and glycerol.

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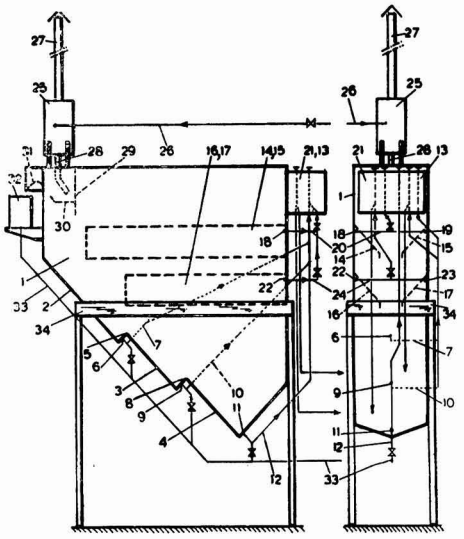
**Clarifier**[1]. KONINKLIJKE MACHINEFABRIEK GEBR. STORK & CO. N.V., of Hengelo, Holland. **1,124,064.** 23rd August 1965; 21st August 1968.

The clarifier comprises a rectangular tank 1 mounted on frame 34 and having a stepped sloping floor with three surfaces 2,3,4 interrupted by surfaces



5,8 forming troughs from which lead sediment outlets 6,9 discharging into pipes 7,10. A third outlet 11 from the bottom of the tank discharges into pipe 12 which leads into tank 13. Within the tank and supported with a downward slope towards the centre are plates 14,15 and 16,17 which conduct settling solids to the centre of the tank. Clarified juice is withdrawn through outlets 18, 19, 22, 23 just under the join of the plates with the tank walls. A pipe 24 connects these juice outlets and leads to tank 21. Muddy juice is supplied through pipe 26 to the feed box 25 and so through pipe 28 into the tank, a vertical and horizontal baffle 29,30 being provided as well as a vent pipe 27 above the feed box, and an overflow 31 delivering excess muddy juice to tank 32 supplying pipe 33.

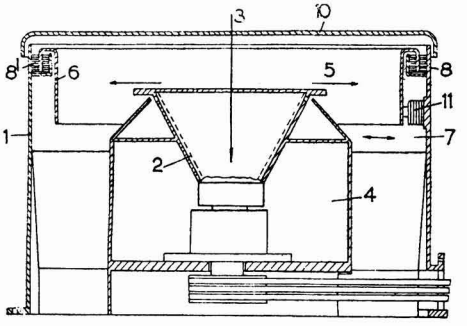
* * *

**Animal fodder.** MORELAND MOLASSES CO., of Maidstone, Natal, South Africa. **1,122,937.** 22nd June 1967; 7th August 1968.—Molasses is heated, mixed with cellulosic material and cooled to 40° in a screw conveyor against a flow of sterile air, to give a meal which is inoculated with a selected non-pathogenic micro-organism (*Achromobacter* or *Athrobacter* bacteria or *Penicillium* or *Aspergillus* fungi) to degrade at least part of the gums present and reduce any tendency to compact and form lumps. The micro-organism is cultured from a meal which has been allowed to undergo natural microbial attack.

* * *

**Continuous centrifugal.** HEIN, LEHMANN & CO. A.G., of 4000 Düsseldorf 2, Germany. **1,124,713.** 2nd February 1967; 21st August 1968.

Sugar separated from massecuite 3 by passage over the frustro-conical screen 2 into the housing 1 can collect on the inside of the latter and reduce—sometimes completely—the passage available for further crystals. To prevent such blockages a discharge



device in the form of an annular shell 6 is mounted resiliantly within the housing, using rubber ring or steel spring mountings 8 and vibrated by one or more vibrators 11 for vertical and horizontal generation of vibrations of variable amplitude.

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**Cane harvesters.** MASSEY-FERGUSON (AUSTRALIA) LTD., of Sunshine, Victoria, Australia. **1,125,605-8.** 27th September 1965; 28th August 1968.

See also I.S.J. 1968, 7

**Beet harvester.** C. J. STEKETEE, of Driewegen, Holland. **1,126,454.** 20th January 1967; 5th September 1968.

* * *

**Sugar cane processing.** R. B. MILLER, of Edmonton, Alberta, Canada. **1,126,491-3.** 19th July 1965; 5th September 1968.—Sugar cane stalks are separately handled in a line in which they are individually washed and leaves removed and subsequently processed for cuticle wax removal, split longitudinally and the pith separated from the fibrous rind. The juice content of the pith may then be expressed, while the intact rind may be processed for manufacture of boarding, etc.

* * *

**Production of glutamic acid by fermentation.** MERCK & CO. INC., of Rahway, N.J., USA. **1,126,579.** 15th December 1965; 5th September 1968.—A biotin-requiring micro-organism (*Micrococcus glutamicus*) is established as a growing culture in a growth-stage vessel to which is supplied a continuous stream of nutrient medium containing 10–100 g/litre of a carbohydrate (as e.g. dextrose, invert or blackstrap molasses) 0·9–10 g/litre of nitrogen, 0·001–5 g/litre of inorganic salts and 1·4–100 γ/litre of biotin, with aeration and agitation at pH 4·5–8·5 and 15–37°C, and continuously withdrawing from the vessel at the same rate of addition whereby with a residence time in the broth of 1–25 hours and a constant concentration of growth factors an equilibrium state is achieved with the growth rate of the micro-organism remaining substantially constant (to maintain a constant concentration of 0·3–3·0% w/w). The withdrawn broth is continuously added to a transition vessel stage where fresh nutrient medium and a growth inhibiting factor [an antibiotic (penicillin, cephalosporin, oxamycin)] are added, to give concentrations of 0–700 g/litre of carbohydrate, 0·9–8 g/litre of nitrogen, 0·001–5 g/litre of inorganic salts, 1·6–100 γ/litre of biotin and 0–1 × $10^6$ γ/ml of growth inhibiting factor, and the broth kept at pH 4·5–8·5 and 20–37°C with continuous aeration and agitation and continuous withdrawal from the vessel whereby, with a residence time of 1–16 hours, a second equilibrium is established with a substantially constant growth rate for the micro-organism at a lower level than the growth rate in the first vessel and an L-glutamic acid content of 5–100 g/litre. The withdrawn broth passes to a production stage vessel where it is continuously agitated and aerated at pH 6·0–8·5 and 20–42°C and fresh nutrient medium and growth inhibiting factor added, to give concentrations of 100–700 g/litre of carbohydrate, 2–20 g/litre of nitrogen, 0·001–5 g/litre of inorganic salts, 1·6–100 γ/litre of biotin and 0–1 × $10^6$ γ/ml of growth inhibiting factor, and broth continuously withdrawn whereby, with a residence time of 3–50 hours, a third equilibrium is established in which the rate of L-glutamic acid production in the production stage vessel remains substantially constant to give a concentration of 10–100 g/litre of glutamic acid in the broth from which, after withdrawal, it is recovered. The transition vessel stage may be omitted and the [illegible] used in only two instead of three stages.

**Beet harvesters.** E. J. E. HEYENS, of Hulst, Holland. **1,126,893.** 23rd November 1966; 11th September 1968.

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***Planting cane trash stripper.*** A. T. DEWAR and W. S. DEWAR, of Brisbane, Queensland, Australia. **1,126,910.** 14th June 1966; 11th September 1968.

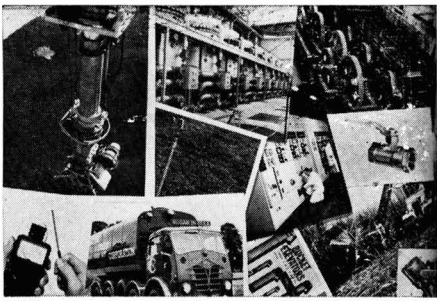
* * *

**Cane planter.** C. C. ETWELL, of Walkerston, Queensland, Australia. **1,127,890.** 11th September 1967; 18th September 1968.

* * *

**Decolorization of sugar solution.** ROHM AND HAAS CO., of Philadelphia, Pa., USA. **1,129,125.** 11th February 1966; 2nd October 1968.—The sugar solution is contacted with particles of substantially non-ionogenic macroreticular cross-linked synthetic resin having a porosity of at least 10%, a specific surface area of at least 10 sq.m./g and which is not swollen by the solution [containing 2–100% (8–25%) of units of a polyethylenically unsaturated (polyvinyl) monomer (divinyl benzene, trivinyl benzene, an alkyl divinyl benzene having 1–4 $C_1$ or $C_2$ alkyl groups on the benzene nucleus, an alkyl trivinyl benzene having 1–3 $C_1$ or $C_2$ alkyl groups, or a mixture of these; vinyl toluene, divinyl xylene, divinyl ethyl benzene, 1,4-divinyl 2,3,5,6-tetramethyl benzene, 1,3,5-trivinyl 2,4,6-trimethyl benzene, 1,4-divinyl 2,3,6-triethyl benzene, 1,2,4-trivinyl 3,5-diethyl benzene, 1,3,5-trivinyl 2-methyl benzene, divinyl pyridine, divinyl naphthalenes, diallyl phthalate, ethylene glycol diacrylate or dimethacrylate, divinyl sulphone, polyvinyl or polyallyl ethers of glycol, glycerol, pentaerythritol or mono-or dithioglycol or resorcinol, divinyl ketone, divinyl sulphide, allyl acrylate, diallyl maleate, diallyl fumarate, diallyl succinate, diallyl carbonate, diallyl malonate, diallyl oxalate, diallyl adipate, diallyl sebactate, divinyl sebacate, diallyl tartrate, diallyl silicate, triallyl tricarballylate, triallyl aconitate, triallyl citrate, triallyl phosphate, N,N′ methylene diacrylamide or dimethacrylamide, N,N′ ethylene diacrylamide, trivinyl naphthalenes or polyvinyl anthracenes)] and the remainder units of at least one monomer containing a single polymerizable ethylenically unsaturated group (methyl, ethyl, propyl, *iso*-propyl, butyl, *t*-butyl, ethyl hexyl, *cyclo*-hexyl, *iso*-bornyl, benzyl, phenyl, alkylphenyl, ethoxymethyl, ethoxyethyl, propoxymethyl, propoxyethyl, propoxypropyl, ethoxyphenyl, ethoxybenzyl or ethoxy*cyclo*-hexyl acrylate or the corresponding esters of methacrylic acid, ethylene, propylene, *iso*-butylene, di-*iso*-butylene, styrene, vinyl toluene, vinyl chloride, vinyl acetate, vinylidene chloride, acrylonitrile, isoprene, butadiene or chloroprene). Impurities forming colour are removed from the solution and may be desorbed, e.g. by elution with acetone (95% removed by 1 bed volume), ethanol (86%) or NaOH solution (76% with a single bed volume of 0·07% NaOH, 84% with 0·10% NaOH. 95% with 0·2% NaOH and 72% with 1% NaOH).

# 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.**

**Corrosion inhibitor.** Hodag Chemical Corp., 7247 Central Park, Skokie, Ill., 60076 USA.

"Protectol", newly introduced by Hodag, is an ash-free, oil-soluble corrosion inhibitor designed for use as a protective coating for sugar factory equipment during shut-down periods. It need not be removed when the machinery is put back into service, and can be easily painted over if desired. Humidity cabinet tests showed that it gave rust-free protection to sand-blasted steel for nearly 5 months, while an identical untreated panel rusted in less than 5 hr. "Protectol" is also effective for protection of internal diesel engine parts, and is also recommended as an additive to the diesel fuel. It can also be added to light oil or distillate, in a concentration of 1%, and flushed through pipelines and tubes to give protection during off-season shutdowns.

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## PUBLICATIONS RECEIVED

**PIONEER CANE SUGAR DIFFUSER.** Dorr-Oliver Inc., Stamford, Conn., U.S.A.

Details of the history and development of cane diffusion at Pioneer cane sugar factory, in Hawaii, are given in a well-prepared publication illustrated with photographs of the Silver ring diffuser. First developed at Pioneer, this diffuser is now made under licence by Dorr-Oliver Inc.

* * *

**CORROSION INHIBITOR.** Amchem Products Inc., Ambler, Pa., U.S.A.

A technical service data sheet gives details of "Rodine No. 213" and "Rodine No. 214" corrosion inhibitors which will prevent attack of HCl on iron and steel during cleaning. "Rodine No. 214" contains a blue dye for ease of detection in an acid bath.

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**CHEMICALS FOR AGRICULTURE.** E. I. du Pont de Nemours & Co. Inc., Industrial and Biochemicals Dept., Wilmington, Del., 19898 U.S.A.

Information is available giving details and applications of DuPont chemicals for weed and grass control, including "Hyvar X" and "Hyvar X-WS" bromacil and "Karmex" diuron weed killers.

* * *

**"DOWPON" CALENDAR.** Dow Chemical Co. (U.K.) Ltd., 105 Wigmore St., London W.1, England.

A 12-month calendar is now available from Dow Chemical Co. for help in applying "Dowpon" systemic grass killer. Among the crops covered in the 4-page brochure which includes the calendar is sugar beet. The "Dowpon" 3-point plan for crop treatment is also described.

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**BMA INFORMATION.** Braunschweigische Maschinenbau-anstalt, Langer Kamp 5, 33 Braunschweig, Germany.

Issue No. 7 of "BMA Information" gives details of two 44 × 88 in cane mills supplied to South America (these are two of the largest cane mills in the world, it is claimed); the Braunschweig carbonatation schemes of 1957, 1960 and 1965; Cocharcas sugar factory, the fourth sugar factory to be supplied by BMA to Chile; BMA-Zsigmond high-speed evaporators; the K 850 continuous centrifugal; the BMA-Brukner settling basin; BMA beet transfer equipment; a rotary filter cleaning device; and a starch and glucose factory erected by BMA in Morocco.

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**BEET SUGAR FACTORIES.** Maschinenfabrik Buckau R. Wolf A.G., 4048 Grevenbroich, P.O. Box 69, Germany.

A well-prepared, 89-page book gives details of equipment manufactured by Buckau-Wolf for the beet sugar factory, including beet handling equipment, diffusers, juice purification plant, evaporators, vacuum pans, centrifugals, sugar dryers, beet pulp dryers, cube and loaf sugar equipment, and steam and power plant.

* * *

**CATENARY IDLER.** Rex Chainbelt Inc., P.O. Box 2022, Milwaukee, Wisconsin, 53201 U.S.A.

Bulletin 6651 contains details of the new Rex catenary idler which has been created especially for the movement of hot, sticky, wet or abrasive materials. Double contact seals reduce maintenance and assure longer service, while non-regreasable bearings help prolong belt life by preventing belt contamination from grease. The idlers are available in 18, 24, 30 and 36-in belt widths. The bulletin features the latest dimensional and engineering data on the idler and gives a load chart for aid in selecting the proper idler for a given application.

* * *

**Compressor sets for Italy.**—Siemens A.G. have received an order from "Eridania" Zuccherifici Nazionali S.p.A. (Genova) for seven ELMO $CO_2$ compressor sets with motors having outputs ranging from 315 to 350 kW. This brings to 20 the total number of single-impeller compressors ordered from Siemens since December 1966. They are used in carbonatation stations.

* * *

**Broadbent centrifugals for Mexico.**—Thomas Broadbent & Sons Ltd., of Huddersfield, Yorks., England, have recently supplied five fully-automatic batch centrifugals to Cooperativa de Ejidatarios y Obreros del Ingenio del Mante S.C.L. in Mexico. Only 29 weeks elapsed between receipt of the order and production of sugar to the customer's satisfaction after the centrifugals had been installed in the sugar factory.

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**De Smet diffusers for Italy.**—Extraction De Smet S.A., of Edegem-Antwerp, Belgium, have received an order for two beet diffusers, each of 5000 tons/day capacity (with a peak production possible of 5500 tons/day) to be installed in the new sugar factory at Argelato (Bologna), which is owned by Società Italiana per l'Industria degli Zuccheri

# International Sugar Agreement, 1968

## Price and prevailing price

THE 1968 International Sugar Agreement entered into force on 1st January 1969. As in past Agreements, the price stabilization mechanism of the new Agreement is based on a system of export quotas, which are to be adjusted in response to sugar price movements in the free market.

The definition of the price to be used for the purposes of the new Agreement is:

(*a*) the arithmetical average of the spot price under the New York Coffee and Sugar Exchange Sugar Contract No. 8 and the London Sugar Market daily price after conversion of both these prices to US cents per pound avoirdupois free on board and stowed Caribbean port, in bulk,

or (*b*) if the difference between the two prices referred to in sub-paragraph (*a*) above is more than six points, the lower of the two prices plus three points.

The formula follows the criteria introduced under the International Sugar Agreement of 1958 in January 1961, except in respect of the conversion of the daily prices of the two markets. Whereas the criteria adopted in January 1961 required a conversion of the prices to an f.a.s. Cuban port, bagged basis, the new formula provides for these prices to be converted to an f.o.b. and stowed, Caribbean port, bulk basis.

Action in respect of quota adjustments will be based on movements of the "prevailing price" for the calculation of which the derived International Sugar Agreement price will be used. Information on both these prices will be available in the Secretariat of the International Sugar Organization, 28 Haymarket, London, S.W.1 by 11 a.m. of the day following the quotations of the two Sugar Exchanges.

The "prevailing price" is the average price (as defined in the Agreement) over a period of seventeen consecutive market days. In order to be above or below any stated figure in Article 48 of the Agreement (which governs establishment and adjustment of quota levels), not only must that average be above or below the stated figure, but the price on the first day and on not less than twelve days of the period must also be above or below that stated figure.

The change in the conversion basis will bring the price formula of the Agreement closer to trade practice. From now on, the Spot Price under the New York Coffee and Sugar Exchange Sugar Contract No. 8 will need only to be reduced, for the purposes of that formula, by the element of "bag allowance" as determined by the Exchange (this stands at present at 0·055 cents per pound avoirdupois). The L.D.P., which is already quoted in respect of sugar in bulk, will only need to be reduced by the elements of "cost, insurance, and freight from the Caribbean to the United Kingdom" and the result expressed in US cents per pound avoirdupois.

## Brevities

**Sugar machinery exhibition in USSR.**—More than 100 machinery manufacturing firms from 14 countries participated in the "Sakharoindustriya-69" exhibition held in Moscow from the 20th to 31st January this year. Among the equipment exhibited were beet slicers, pulp pressing and briquetting equipment, gas and air pumps, filters, automatic film evaporators, high-speed centrifugals, laboratory equipment, automatic devices, etc.

* * *

**Sugar Industry Technologists' Inc. 1969 Meeting.**—The 28th Annual Meeting of this international association of sugar refinery technologists will be held during the 27th–29th April at the Hilton Hotel in New York. Requests for information and reservations should be made to the Executive Secretary, Mr. CURTIS L. TAGGART, P.O. Box 47, Medford, Mass., 02155 USA.

* * *

**Philippines sugar situation**[1].—The first official estimate of sugar production in the Philippines from the 1968/69 crop amounted to 1,820,000 short tons, tel quel, but as a result of typhoons striking the cane areas in early December, a loss of 146,000 tons is forecast. Sugar from the crop utilized to meet the 1968 US quota amounts to 170,000 tons and local consumption to 700,000 tons, leaving 804,000 tons available for export to the US against the 1969 quota. Since, on the present quotas totalling 10·6 million tons, the Philippines' share is 1,126,020 tons, it would appear unlikely that the full quota for 1969 will be delivered although it has become the practice to start crops as early as possible in order to deliver new crop sugar to the US before the ... the calendar year.

**Malaysia sugar factory**[2].—A 30 million Malaysian dollar, 25,000-acre sugar cane plantation and sugar factory is to be set up in Perak State, and the factory will be provided with 12 million dollars' worth of Japanese equipment. The enterprise, to be known as Gula (sugar) Perak, has Perak State government participation with the state development board and two local companies.

* * *

**Fermentation chemicals in Ireland**[3].—Chas. Pfizer & Co. is to construct a production centre in Ireland. The first phase, costing about $12 million, will include a factory, to be in operation in 1971, for production of citric and gluconic acids, etc., using Irish raw materials including beet molasses, an agreement for the supply of which has been made with the Irish Sugar Company.

* * *

**Brazil sugar factory**[4].—Indústria e Comércio de Minérios (ICOMI) is to set up its own sugar plantation on 202 hectares in Amapá; it is also to set up, in conjunction with the Inojosa group, a sugar factory, Central Açucareira do Amapá, at Porto Platon, near Macapá. The factory will have an annual production capacity of 250,000 bags of crystal sugar (15,000 metric tons) and is to begin production in 1970; the total investment will be about 16 million new cruzeiros (about $4,200,000).

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[1] C. Czarnikow Ltd., *Sugar Review*, 1968, (897), 234.
[2] *Reuters Sugar Report*, 7th October 1968.
[3] *Chem. Market Newspaper*, 16th September 1968; through *Sucr. Belge*, 1968, **87**, 896.
[4] *Bank of London & S. America Review*, 1968, **2**, 699.

# Brevities

**USSR sugar production, 1968**[1].—Production of granulated sugar in the USSR totalled 10·1 million metric tons, or 800,000 tons more than in 1967.

* * *

**Portugal sugar factory**[2].—A beet sugar factory is to be constructed near Figueiras da Foz, by a Spanish-Portuguese company, AGRINCO. The factory will have a production capacity of 30,000 tons of sugar per year and will require sowing of 6000 hectares to sugar beet.

* * *

**EEC export rebate reductions**[3].—The Commission of the European Economic Community has lowered the export rebate for refined beet and cane sugar to $141 from $147·90 per metric ton, with effect from 12th December. No rebate was fixed for raw beet and cane sugar, as the Community had none to export.

* * *

**St. Kitts (Basse Terre) Sugar Factory Ltd. 1967/68 report.** Crop started on 15th February and ended 31st August 1968, with the production of 34,832 tons of sugar equivalent to 35,390 tons 96°pol. This was less than the 39,195 tons 96°pol sugar made in 1967 although the cane crushed was almost the same (321,464 tons in 1968 *vs.* 327,752 tons). This was due to the lower sugar content (12·53% *vs.* 13·29%) but although fibre in cane was also higher (16·75 *vs.* 15·66%), the pol loss in bagasse was lower (2·83% *vs.* 2·94%). The crop was smaller than had been hoped, owing to the continuance of the drought of the past six years, and unfavourable weather also indicates that the 1969 crop will also not be good.

* * *

**New cooperative sugar factories for India.**—A new co-operative sugar factory is to be set up at Dhauaha in Champaran District, Bihar, at a cost of Rs. 19 million[4]. Three further mills are also to be built at Hardnaganj (Aligarh), Kaimganj and Rasra, in Uttar Pradesh[5].

* * *

**Japan sugar refineries rationalization**[6].—Two Japanese refiners, the Dai-Nippon Seito K.K. and Ensuiko Seito K.K., have reached an agreement for cooperation in production and selling. Their production will be concentrated on the most modernized sugar refineries (Sakai and Moji refineries of Dai-Nippon, and Yokohama refinery of Ensuiko). The operations of two refineries (Yokohama refinery of Dai-Nippon and Osaka refinery of Ensuiko) will be suspended. A single brand will be used for their products. The Dai-Nippon Company was formed in 1950 and owns three refineries at Yokohama (daily producing capacity 600 metric tons), Sakai (500 tons) and Moji (400 tons). The Ensuiko Company, also formed in 1950, owns two refineries, one at Osaka (350 tons) and the other at Yokohama (800 tons).

* * *

**Caroni Ltd., 1967/68 report.**—In 1968 213,380 tons of sugar were produced compared with 177,451 tons the year before; the cane:sugar ratio improved and a modest profit was realized. The local price of sugar was increased and sales to the USA were higher. Performance was improved at Ste. Madeleine factory following its rebuilding and cane cultivation is back in cycle. All factories worked smoothly throughout the crop. In the field the extension of mechanical harvesting absorbed the rise in individual wages with no appreciable increase in reaping costs. 400,000 tons of cane were loaded mechanically, an increase of 33% over 1967, while five Cary combine harvesters reaped 100,000 tons of cane, compared with 25,000 tons in 1967. This programme strictly adhered to the order made by the Industrial Court on mechanization. The application of insecticides to control the froghopper pest by aircraft was extended throughout the estate and was applied effectively to 400 acres of smallholders' cane. This service is being extended to 1300 acres in 1969. The use of aircraft was also developed to control cane fires of unknown origin and has now become a regular feature of the operations.

## Switzerland sugar imports, 1968[7]

| | 1968 | 1967 |
|---|---|---|
| | (*metric tons, white sugar*) | |
| Belgium-Luxembourg | 18,036 | 1 |
| Brazil | 641 | — |
| Cuba | 16,084 | 9,283 |
| Czechoslovakia | 32,358 | 33,132 |
| Denmark | 36,943 | 14,686 |
| Finland | 464 | 54,321 |
| France | 71,801 | 30,543 |
| Germany, West | 18,672 | 4,789 |
| Hungary | 1,875 | 6,350 |
| Italy | 12,241 | — |
| Peru | 1,346 | 1,821 |
| Poland | — | 1,027 |
| UK | 47,943 | 58,307 |
| Other countries | 5 | 20 |
| Total | 258,409 | 227,303 |
| Total, raw value | 287,121 | 252,559 |

* * *

**Italian 1968 beet campaign**[8].—Beet production in 1968 amounted to 10,950,000 tons as against 13,200,000 tons in 1967. The beet area was reduced at 320,000 ha *vs.* 349,000 ha, while the sugar yield was also lower at 4·8 tons/ha as against 5·2 tons/ha. Four factories did not work during the campaign, and the 75 that operated sliced an average of 3100 tons/day during an average campaign of 56 days. In the 1967 campaign the 79 factories sliced an average of 2800 tons/day during a campaign which averaged 67 days.

* * *

**New USSR sugar factory**[9].—According to a report in the Soviet press, a new sugar factory with a daily capacity of 3000 tons of beets has been put into operation in Gheorghiu-Dej in the Lipinsk district. Machinery and equipment for the factory were supplied by Poland.

* * *

**Austrian 1968 beet sugar crop**[10].—The 1968 campaign in Austria came to an end in the middle of December with a production of 275,000 tons of white sugar from 1,930,000 tons of beet. This was slightly higher than the previous campaign when 270,000 tons of sugar were produced from more than 2,000,000 tons of beet.

* * *

**Philippines sugar expansion**[11].—The Philippines Sugar Quota Administration has embarked on a crash sugar production programme in an effort to prevent further renouncing of additional allocations from the United States, which meant forfeiting foreign exchange earnings for the Philippines owing to failure to fill the allocations because of the non-availability of sugar for that purpose during the past three years. The establishment of eight new sugar mills having a total daily capacity of 29,500 metric tons, at a cost of US $111,400,000, has been approved by the Philippine National Bank. Of these eight new mills, Aidsisa, in Silay City, has already commenced milling operations in 1967/68, while the others are due to start in 1969. In addition, application for six other mill projects are pending approval; their total projected capacity is 25,000 tons daily and cost $88 million. The combined output of the 26 existing mills and the eight new sugar factories is expected to rise from 1,821,000 short tons to 2,451,500 tons when the new mills reach full production in 1971–72.

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[1] *Public Ledger*, 4th January 1969.
[2] F. O. Licht, *Journal Européen des Sucres*, 8th November 1968.
[3] *Public Ledger*, 14th December 1968.
[4] *Indian Sugar*, 1968, **18**, 427.
[5] *ibid.*, 503.
[6] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (4), 6.
[7] Calculated from data given in F. O. Licht, *International Sugar Rpt.*, 1968, **100**, (5), vii; (28), ix; 1969, **101**, (4), iv.
[8] *Zeitsch. Zuckerind.*, 1969, **94**, 48.
[9] F. O. Licht, *International Sugar Rpt.*, 1969, **101**, (2), 4.
[10] *Zeitsch. Zuckerind.* 1969, **94**, 48.
[11] *Sugar News*, 1968, **44**, 569–570.

# Let's talk


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Centrifugals – Fully and semi-automatic and associated equipment are now being manufactured by Manloves and will incorporate the latest Watson Laidlaw designs with our technical expertise and engineering skill.

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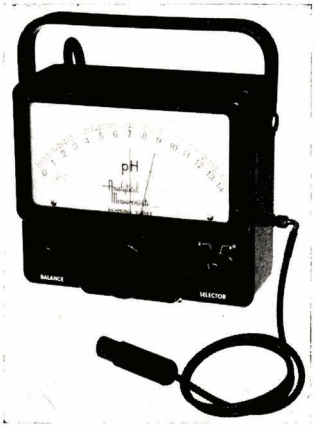
# INSTRUMENTS FOR JUICE EXAMINATION




## pH

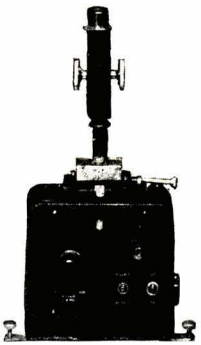
The illustrated model 700 has a scale length of 7 in from 0 to 14 pH with a readability of 0·02. This instruments is supplied with the exclusive polythene shielded pH probe unit. The amplifier is a printed circuit high output electronically modulated unit with a single operating control giving an accuracy and overall stability of better than 0.05 of a pH Unit. Operating the instrument is so simple that untrained personnel can make pH determinations with no danger of damaging sensitive components. The instrument is plugged into the mains supply, standardized with the buffer solution and is then ready to operate. An adjustable index pointer is provided so that frequent buffer checks are eliminated.

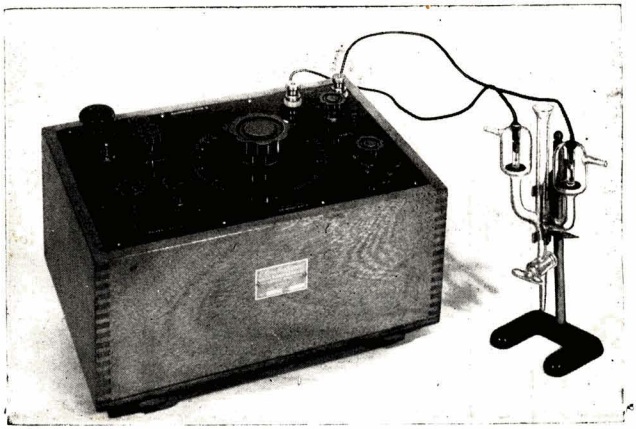
Other models available.

## Colloids

Colloids in juices retard boiling, increase viscosity, hamper efficient work in the centrifugals, and generally reduce the capacity of the factory. They should be removed during the clarification stage to prevent these difficulties in the sugar house.

The **COLLIMETER** is the fir instrument to permit comparison of the colloid-removing efficiency alternative clarification procedures. This is done on the basis of the q tity of a standard dyestuff required to bring a sample in a cataphoresis cell to the iso-electric point as observed through the microscope.





## Ash

The Type H **SALOMETER** for electronic determination of the ash content of sugar products retains the well-known characteristics of previous models, such as knife-edge accuracy, simple magic-eye tuning, and also is provided with temperature compensation (2% per°C), a main dial calibrated in micromhos for simplified calculation, a new power factor system to extend its range, and a special quick-action electrode system



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