International Sugar Journal

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SOMMAIRES : ZUSAMMENFASSUNGEN • SUMARIOS

Un procédé pour computer et déterminer la teneur en matières sèches de sirops et boissons préparés de sucre inverti "moyen". 2-ème partie. G. J. MAROV. *p.* 163–169

On donne des tables qui montrent le poids total et le poids des matières sèches des sucres dans un volume donné de solution de sucre inverti "moyen" en fonction de la valeur Brix. Les tables comprennent les valeurs Brix dans la gamme 0–80° et donnent le rapport entre le poids et le volume sous forme de lb/imperial gallon, lb/U.S. gallon et g/litre. A l'aide de cettes tables on peut calculer le Brix à réfractomètre, à aréomètre et le Brix "réel" d'une formulation donnée. Cette application est illustrée par des exemples.

* * *

Explosion de sucre en Hollande. *p.* 169–172

Un rapport sur une explosion de poussière qui est arrivée dans la sucrerie de la Friesch-Groningsche Coöperatieve Beetwortelsuikerfabriek en Raffinaderij G.A. à Groningen le 3 Mai 1965. L'explosion a été cause de beaucoup de dommage aux élévateurs et à l'imprimerie. On discute la cause possible de l'explosion et les mesures recommandées par le comité d'investigation pour l'empêchement d'une explosion à l'avenir.

* * *

Contrôle de la jacinthe d'eau (*Eichhornia crassipes*). *p.* 172

On discute le contrôle de la jacinthe d'eau, regardée comme une des plus mauvaises herbes du monde, qui bloque les cours d'eau à l'intérieur d'un pays aussi que les canals pour drainage et irrigation. On donne les détails d'une méthode employant l'herbicide 2,4-D qui s'a montré dans des essais au Queensland plein de promesses à l'égard au désherbage de la plante.

Eine Methode für Berechnung und Messung vom Feststoffgehalt in Sirupen und Getränken, die aus sogenanntem Mittelinvertzucker bestehen. Teil 2. G. J. MAROV. *S.* 163–169

Man stellt Tabellen dar, welche das Gesamtgewicht und des Gewicht des Fests offes in den Zuckern pro Volumeneinheit von Invertzucker-Lösungen in Abhängigkeit von der Brix-Konzentration zeigen. Sie beziehen sich auf den Brix-Bereich von 0–80° und geben das Verhältnis zwischen Gewicht und Volumen in der Form von lb/Imperial gallon, lb/U.S. gallon und g/Liter. Die Tabellen haben zum Zweck die Berechnung von der refraktometrischen, areometrischen und "wirklichen" Brix-Wert einer gegebenen Formulierung. Diese Anwendung wird mit Beispielen illustriert.

* * *

Staubexplosion in den Niederlanden. *S.* 169–172

Eine Zusammenfassung der Bericht über eine Staubexplosion in der Zuckerfabrik der Firma Friesch-Groningsche Coöperatieve Beetwortelsuikerfabriek en Raffinaderij G.A. in Groningen am 3. Mai 1965 wird gegeben. Die Explosion verursachte beträchtlichen Schaden an die Zuckerelevator und an die Druckerei. Man bespricht die mögliche Ursache wie auch die von der Untersuchungskommission vorgeschlagenen Massnahmen, um eine Explosion in Zukunft zu verhüten.

* * *

Kontrolle von Wasserhyacinthe (*Eichhornia crassipes*) *S.* 172

Man bespricht die Wasserhyacinthe, die als eine der schädlichsten Pflanzen in der Welt angesehen wird, weil sie Binnenwasserstrassen und Entwässerungs- und Bewässerungskanale versperrt. Man gibt Einzelheiten einer Methode mit 2,4-D-Unkrautvertilgungsmittel, das in Versuchen in Queensland sich als vielversprechend für Bekämpfung des Unkrauts erwies.

Un procedimiento para computar y determinar sólidos en siropes y bebidas formulado con azúcar medio-invertido. Parte II. G. J. MAROV. *Pág.* 163–169.

Se presentan en forma tabular el peso total y el peso de sólidos azúcares por galón de soluciones de azúcar medio-invertido como función de Brix. Las tablas cubiertan un alcance de 0° a 80° Brix y incluyen la relación peso:volumen en términos de libras inglesas por galón Imperial, libras inglesas por galón U.S., y gramos por litro. Estas tablas han sido compilado para predecir el Brix refractométrico, el Brix hidrométrico y el Brix "verdadero" de una dada formulación. Esta aplicación se ilustra con ejemplos.

* * *

Explosión azucarera en Holanda. *Pág.* 169–172

Se resume un informe sobre un explosión que occurró a la azucarera en Groningen de la Sociedad Friesch-Groningsche Coöperatieve Beetwortelsuikerfabriek en Raffinaderij G.A. de Holanda el 3 mayo de 1965. El explosión causó daño extensivo de los elevatores de azúcar y de la estación de impreso. Se discutieron el fuente posible de la explosión y medidas que han sido recomendado por la junta de investigación para prevenir una repetición.

* * *

Control del jacinto de agua (*Eichhornia crassipes*). *Pág.* 172

Se discute control del jacinto de agua, uno de las peores de las malas hierbas del mundo, que cerra vías fluviales interiores, y canales de drenaje y de regadio. Se presentan detalles de un método con el uso de herbicida 2,4-D que ha sido mostrado en experimentos en Queensland como la técnica con la más promesa para extirpar esta mala hierba.

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Notes & Comments

Britain and the E.E.C.

At the beginning of May the British Prime Minister announced that the U.K. Government had decided, following its preliminary discussions with member Governments of the European Economic Community, to apply for membership under the Treaty of Rome. The decision received the overwhelming assent of Parliament and a formal application was lodged on the 11th May.

Before the decision was announced, however, the hazards of membership had been publicized in Parliament and in the press, etc., and one particular interest which had been emphasized was that of sugar producers of the Commonwealth which have, under the Commonwealth Sugar Agreement, a guaranteed market at a guaranteed price which is vital in the case of certain producers such as Barbados, Fiji and Mauritius whose economies are almost completely dependent upon sugar.

Mr. WILSON and other members of the Government have stated that it was the Government's duty to seek suitable safeguards for these sugar producers, although anxiety still remained in spite of the fact that France had secured protection for certain of her ex-colonies through the device of labelling them Overseas Departments, to be treated as part of Metropolitan France.

In the event, however, President DE GAULLE appears to have repeated his previous action in closing the door on Britain's application and the minds of Commonwealth Sugar Agreement members can presumably be put at rest.

* * *

European sugar beet area, 1967.

At the end of March F. O. Licht K.G. published their first estimates of the areas to be sown to sugar beet this year for the 1967/68 campaign[1]. Revised estimates were published at the end of April[2] and appear elsewhere in this issue, together with the corresponding areas from 1966. Increases are expected in the E.E.C. countries, in Spain, Turkey, Ireland, Greece and the U.K., with decreases in Austria and Denmark. The net change in Western Europe is some 92,000 hectares, however, or less than 5%.

In Eastern Europe a small increase is expected, the 100,000 ha increase anticipated for the U.S.S.R. more than compensating for reductions in the other countries, particularly Czechoslovakia and Poland, where unfavourable weather conditions have obtained.

* * *

World raw sugar price.

In the second half of April the London daily price for raw sugar increased remarkably from about £17 to £24 per ton. This followed an unusual amount of activity in the London and New York markets but had been a result of a strongly optimistic tone in the markets which has persisted so that the higher price has been maintained with minor variations up to the time of writing.

A number of factors have contributed: flood followed by drought in Cuba has led to a belief that the official target of 6,500,000 tons of sugar will not be reached although some mills will continue crushing very late, one into July, and it is reported that she has been buying back current crop sugar. In C. Czarnikow Ltd.'s view, the European beet sugar crop will be some 300,000 tons over that of 1966/67 but nearly 3 million tons down on that of 1964/65; and since this estimate has come news of unseasonal snow in Italy which may have damaged the crop.

The quantity of sugar in second hands has been reduced drastically and the Brazil sugar crop became a most important factor. Last autumn sales of Brazilian sugar broke down the efforts of exporting countries to seek higher prices and a similar policy could equally depress prices now; however, pressure on Brazil has been much less than formerly and it was reported that she had refused several offers for her sugar around 3·05 cents per pound f.o.b.

In the middle of May it was announced that Brazil had sold 160,000 tons to Morocco at a price above 3 cents per pound, and rumours that Brazil contemplated re-entering the world sugar market were denied by the Export Director of the Instituto do Açúcar e do Alcool, Sr. FRANCISCO WATSON, who declared that, with the sale to Morocco, the 1966/67

[1] *International Sugar Rpt.*, 1967, **99**, (10), 1–5.
[2] *ibid.*, (12), 1–2.

crop had been entirely disposed of as Brazil was selling very large quantities to the U.S.A. against the 1967 quota.

* * *

U.K. sugar surcharge.

In consequence of the higher sugar prices during April and May, the Ministry of Agriculture, Fisheries and Food made Orders reducing the U.K. Sugar Board surcharge on three occasions between the middle of April and the middle of May. As a consequence the surcharge was reduced from 4d per lb (37s 4d per cwt) to 3¾d per lb (35s 0d per cwt) from the 20th April, to 3½d per lb (32s 8d per cwt) from the 26th April, and to 3¼d per lb (30s 4d per cwt) from the 11th May.

* * *

Soviet sugar industry[1].

It is reported that on 1st January 1966 the total beet slicing capacity in the U.S.S.R. was 535,400 metric tons/day; this was raised by 26,230 tons/day in 1966 and is to be further increased by 23,300 tons/day in 1967 through the construction of 7 new factories and expansion and reconstruction of others. During the current Five-Year-Plan (1966–70) 26 new sugar factories have been planned and many existing ones are to be reconstructed. However, despite the fact that 5 new beet factories started operations in 1966, there has been sharp criticism of the fact that in the last 2–4 years many factories have been working at below their rated capacity and the increase in beet slicing capacity has fallen well below the planned level. In the Russian Federation work started on 3 factories was not completed in time for the 1966/67 campaign. However, it is planned to increase the total beet processing capacity throughout the U.S.S.R. sufficiently to be able to cut the campaign length from 165 days in 1965 to 139 days in 1970. Improvement in the allocation of capital to the industry is called for. Amongst the schemes for expansion, reconstruction and re-equipping is a plan to increase the present sugar storage capacity in the Russian Federation and the Ukraine by 393,000 tons during 1967.

In 1966/67 8·25 million tons of white sugar were produced from approx. 70 million tons of beet, with 2 million tons of raw sugar which were sent to the refineries. In addition, in 1966, 1·5 million tons of white sugar were processed from cane raws.

* * *

Australian sugar crop 1966/67[2].

The record-breaking 1966 Australian sugar season came to an end with the cessation of operations at Gin Gin mill on the 18th January. It was one of the longest seasons in the Australian industry for many years, Broadwater Mill's season extending for 35 weeks.

Tentative figures supplied by mills give a Queensland sugar production of 2,202,270 tons 94 n.t. and a N.S.W. output of 140,223 tons. These yields of sugar were obtained from 15,514,698 tons of cane in Queensland and 1,171,441 tons in N.S.W. On the basis of these figures it can be calculated that in Queensland it took an average of 7·04 tons of cane to make one ton of sugar, and in N.S.W. the ratio was in the vicinity of 8·34.

Based on an acreage harvested in Queensland of 536,430, the yield of cane was approximately 28·8 tons per acre and the yield of sugar was almost 4·10 tons per acre.

* * *

U.K. Sugar Board 9th Annual Report

The Ninth Annual Report of the Sugar Board was published on the 21st March 1967 after presentation to Parliament by the Minister of Agriculture, Fisheries and Food. The Report deals with the activities of the Board for the year to 31st December 1966 and includes an audited statement of the Board's Accounts for that period.

During the year 1966 the world market price of raw sugar declined from £20 10s to £13 5s a ton; the domestic ex-refinery price was kept fairly steady by complementary increases in Surcharge.

The Board's Revenue Account also remained in close balance over the year. A cumulative deficit of about £300,000 at the end of 1965 was followed by a net surplus of about £600,000 in 1966, leaving a surplus of £300,000 to be carried forward into 1967.

The Board generally expect to be able to keep their Revenue Account roughly in balance without the average basic ex-refinery price of sugar departing very far in either direction from £70 a ton. In 1966 conditions were exceptionally favourable to them, as is explained in the Report, and the average ex-refinery price was just below £69 a ton. Retail prices for granulated sugar appeared, in general, to be no higher than they were ten years ago, just before the Board was set up. The Report contains a brief review of their ten years' operation under the Sugar Act of 1956, by which there were established.

The Board's deficit on the year's trading amounted to £56·9 million on 1·7 million tons of Commonwealth and Irish sugar. The Board also paid £31.2 million to the British Sugar Corporation, making a total outgoing of £88·1 million. Net receipts of Surcharge collected in the year amounted to £88·9 million, and, after meeting the expenses of the Board and H.M. Customs (who collect the Surcharge for them) and the cost of taxation, partly offset by dividends received on shares in the British Sugar Corporation, and by net interest receipts, there was a net surplus of nearly £600,000 on the year.

The increase in the rate of Surcharge over the year was needed, first, to balance the declining trend of world sugar prices at which the Board sell the sugar they buy at the (at present much higher) negotiated price determined under the Commonwealth Sugar Agreement, and, secondly, to meet the correspondingly increased cost of financing the British Sugar Corporation in their purchase of home-produced sugar beet at guaranteed prices under the Agriculture Acts.

[1] *Sakhar. Prom.*, 1967, **41**, (1), 1–2; (3), 1–6.
[2] *Australian Sugar J.*, 1967, **58**, 645.

A Procedure for Computing and Determining Solids in Syrups and Beverages Formulated with Medium Invert Sugar

By G. J. MAROV
(Chief Control Chemist, Product Development and Control, PepsiCo Inc., Long Island City, N.Y., U.S.A.)

Paper presented at the 9th Ann. Conf., Canadian Inst. Food Tech., 1966.

PART II

So far I have discussed procedures for measuring the true Brix of medium invert sugar solutions. I shall now indicate how the refractometer, the hydrometer, and the "true" Brix of a given formulation may be predicted by computation. This is done by means of a table that gives the total weight and the weight of sugar solids per gallon of medium invert sugar solutions as a function of Brix.

Table for medium invert sugar

Although accurate tables for the densities of aqueous sucrose solutions have been available since 1900[7], a table that gives the densities of pure invert sugar solutions was not published until 1963[8]. When these data became available, it occurred to us that since medium invert sugar is essentially an equal mixture of sucrose and invert sugar, it would be expected that its density, apparent specific gravity, total weight per gallon, and weight of solids per gallon, would be the average of the values for sucrose and invert sugar solutions of the same percent solids content. This is exactly how the data in the last three columns of Table III were computed. These columns give the apparent specific gravity, the pounds of solids per Imperial gallon, and the total solids per Imperial gallon of medium invert sugar for the range 0° to 80° Brix, at 1° Brix intervals. For the convenience of the user, the first two columns of the table give the refractometer and the hydrometer Brix. These values were obtained by subtracting the appropriate refractometer and hydrometer corrections from the corrected Brix. These corrections were obtained from Fig. 1.

Tables IV and V give similar data in pounds per U.S. gallon and in grams per litre, respectively.

As mentioned before, the data in Table III are applicable to medium invert sugar solutions in which invert sugar and sucrose are present in equal quantities. Although this sugar is commercially known as 50% invert type liquid sugar, its invert sugar solids generally vary from 45 to 55%. This variation, of course, would slightly alter the data in Table III. For example, for a 76% medium invert sugar that contains 55% invert sugar solids, it can be calculated that the solids per gallon are 10·511 lb and the refractometer correction is + 0·90° Brix. According to Table III these data are 10·514 and 0·82°, respectively.

While, apparently, it would seem desirable to have tables or nomographs that give data for these expected variations in invert sugar content, this would not be practical. This is because, in order to use the information, it would be necessary to determine the invert sugar and then to compute a particular formulation, as will be illustrated below (Tables VII and VIII), for every sugar delivery. This obviously would not be practical. Therefore, in practice, we must assume that medium invert sugar is a standard product that contains 50% invert sugar solids.

Applying the facts so far discussed, we are now ready to illustrate the practical use of the medium invert sugar table. Before proceeding, for the purpose of brevity and clarity, it should be mentioned that in this discussion it is assumed that all measurements are made at 20°C or are corrected to this temperature; also, unless otherwise specified, the term "gallon" means "Imperial gallon"; the expression "corrected Brix" means hydrometer or refractometer Brix corrected for the presence of invert sugar and is synonymous with "true Brix" or "percent true solids." The term "Brix", of course, means "percent sugar by weight" and, strictly speaking, applies to pure sucrose solutions only.

[7] PLATO, DOMKE & HARTING: *Z. Ver. deut. Zucker-Ind.*, 1900, **50**, 982, 1079.

[8] SNYDER & HATTENBURG : *Nat. Bureau Standards Monograph*, 1963, (64).

Table III.—Refractometer Brix, Hydrometer Brix, Corrected Brix, Apparent Specific Gravity, Pounds Solids per Imp. Gallon and Weight per Imp. Gallon of Medium Invert Sugar.

Refractometer Brix	*Hydrometer Brix*	*Corrected Brix*	*Apparent s.g.* (20°/20°)	*Pounds Solids per Imp. gallon*	*Total Wt. per Imp. gallon*
0·00	0·00	0·00	1·00000	0·000	9·994
0·99	1·00	1·00	1.00390	0·100	10·033
1·99	2·00	2·00	1·00780	0·201	10·072
2·98	3·00	3·00	1·01174	0·304	10·111
3·98	4·00	4·00	1·01570	0·406	10·151
4·97	5·00	5·00	1·01969	0·510	10·191

Table III (*continued*)

Refractometer Brix	*Hydrometer Brix*	*Corrected Brix*	*Apparent s.g.* (20°/20°)	*Pounds Solids per Imp. gallon*	*Total Wt. per Imp. gallon*
5·97	6·00	6·00	1·02369	0·614	10·231
6·96	7·00	7·00	1·02774	0·719	10·271
7·96	8·00	8·00	1·03181	0·825	10·312
8·95	9·00	9·00	1·03590	0·932	10·353
9·95	10·00	10·00	1·04003	1·039	10·394
10·94	11·00	11·00	1·04417	1·148	10·435
11·94	12·00	12·00	1·04836	1·257	10·477
12·93	13·00	13·00	1·05258	1·368	10·519
13·93	13·99	14·00	1·05680	1·479	10·561
14·92	14·99	15·00	1·06108	1·591	10·604
15·92	15·99	16·00	1·06538	1·703	10·647
16·91	16·99	17·00	1·06970	1·817	10·690
17·90	17·98	18·00	1·07406	1·932	10·734
18·90	18·98	19·00	1·07845	2·049	10·778
19·89	19·98	20·00	1·08287	2·164	10·822
20·89	20·97	21·00	1·08733	2·282	10·867
21·88	21·97	22·00	1·09181	2·401	10·912
22·87	22·97	23·00	1·09632	2·520	10·956
23·87	23·96	24·00	1·10087	2·640	11·002
24·86	24·96	25·00	1·10544	2·762	11·048
25·85	25·95	26·00	1·11005	2·884	11·094
26·85	26·95	27·00	1·11468	3·008	11·140
27·84	27·94	28·00	1·11936	3·132	11·187
28·83	28·94	29·00	1·12406	3·258	11·234
29·83	29·93	30·00	1·12881	3·384	11·281
30·82	30·92	31·00	1·13358	3·512	11·329
31·81	31·92	32·00	1·13838	3·641	11·377
32·80	32·91	33·00	1·14322	3·770	11·425
33·79	33·90	34·00	1·14809	3·901	11·474
34·78	34·90	35·00	1·15300	4·033	11·523
35·77	35·89	36·00	1·15793	4·166	11·572
36·76	36·88	37·00	1·16291	4·300	11·622
37·75	37·87	38·00	1·16791	4·435	11·672
38·74	38·87	39·00	1·17295	4·572	11·722
39·73	39·86	40·00	1·17803	4·709	11·773
40·72	40·85	41·00	1·18314	4·848	11·824
41·71	41·84	42·00	1·18829	4·988	11·876
42·70	42·83	43·00	1·19347	5·129	11·927
43·68	43·82	44·00	1·19868	5·271	11·979
44·67	44·81	45·00	1·20393	5·414	12·032
45·65	45·80	46·00	1·20921	5·559	12·085
46·64	46·79	47·00	1·21453	5·705	12·138
47·63	47·78	48·00	1·21989	5·852	12·191
48·61	48·77	49·00	1·22527	6·000	12·245
49·60	49·76	50·00	1·23070	6·150	12·299
50·58	50·75	51·00	1·23619	6·301	12·354
51·57	51·73	52·00	1·24167	6·453	12·409
52·55	52·72	53·00	1·24720	6·606	12·464
53·54	53·71	54·00	1·25276	6·761	12·520
54·52	54·70	55·00	1·25836	6·917	12·576
55·51	55·68	56·00	1·26401	7·074	12·632
56·50	56·67	57·00	1·26968	7·233	12·689
57·48	57·66	58·00	1·27539	7·393	12·746
58·46	58·64	59·00	1·28113	7·554	12·803
59·45	59·63	60·00	1·28692	7·717	12·861
60·43	60·62	61·00	1·29272	7·881	12·919
61·42	61·60	62·00	1·29856	8·046	12·978
62·40	62·59	63·00	1·30446	8·213	13·037
63·38	63·57	64·00	1·31039	8·381	13·096
64·37	64·56	65·00	1·31636	8·551	13·155
65·35	65·54	66·00	1·32235	8·722	13·215
66·33	66·52	67·00	1·32836	8·894	13·275
67·32	67·51	68·00	1·33443	9·068	13·335
68·30	68·49	69·00	1·34054	9·244	13·397
69·28	69·47	70·00	1·34667	9·421	13·458
70·27	70·45	71·00	1·35284	9·599	13·520
71·25	71·43	72·00	1·35904	9·779	13·582
72·23	72·42	73·00	1·36529	9·960	13·644
73·22	73·40	74·00	1·37156	10·143	13·707
74·20	74·38	75·00	1·37788	10·328	13·770
75·18	75·36	76·00	1·38421	10·514	13·834
76·16	76·34	77·00	1·39055	10·701	13·897
77·15	77·32	78·00	1·39702	10·890	13·962
78·13	78·30	79·00	1·40346	11·081	14·026
79·11	79·28	80·00	1·40995	11·273	14·091

Table IV.—Refractometer Brix, Hydrometer Brix, Corrected Brix, Apparent Specific Gravity, Pounds Solids per U.S. gallon, and Weight per U.S. gallon of Medium Invert Sugar.

Refractometer Brix	*Hydrometer Brix*	*Corrected Brix*	*Apparent s.g. (20°/20°)*	*Pounds Solids per U.S. gallon*	*Total Wt. per U.S. gallon*
0·00	0·00	0·00	1·00000	0·000	8·322
0·99	1·00	1·00	1·00390	0·084	8·354
1·99	2·00	2·00	1·00780	0·168	8·387
2·98	3·00	3·00	1·01174	0·253	8·419
3·98	4·00	4·00	1·01570	0·338	8·452
4·97	5·00	5·00	1·01969	0·424	8·485
5·97	6·00	6·00	1·02369	0·511	9·519
6·96	7·00	7·00	1·02774	0·599	8·552
7·96	8·00	8·00	1·03181	0·687	8·586
8·95	9·00	9·00	1·03590	0·776	8·620
9·95	10·00	10·00	1·04003	0·865	8·655
10·94	11·00	11·00	1·04417	0·956	8·689
11·94	12·00	12·00	1·04836	1·047	8·724
12·93	13·00	13·00	1·05258	1·139	8·759
13·93	13·99	14·00	1·05680	1·231	8·794
14·92	14·99	15·00	1·06108	1·324	8·830
15·92	15·99	16·00	1·06538	1·419	8·866
16·91	16·99	17·00	1·06970	1·513	8·902
17·90	17·98	18·00	1·07405	1·609	8·938
18·90	18·98	19·00	1·07845	1·705	8·974
19·89	19·98	20·00	1·08287	1·802	9·011
20·89	20·97	21·00	1·08733	1·900	9·048
21·88	21·97	22·00	1·09181	1·999	9·086
22·87	22·97	23·00	1·09632	2·098	9·123
23·87	23·96	24·00	1·10087	2·199	9·161
24·86	24·96	25·00	1·10544	2·300	9·199
25·85	25·95	26·00	1·11005	2·402	9·237
26·85	26·95	27·00	1·11468	2·505	9·276
27·84	27·94	28·00	1·11936	2·608	9·315
28·83	28·94	29·00	1·12406	2·713	9·354
29·83	29·93	30·00	1·12881	2·818	9·394
30·82	30·92	31·00	1·13358	2·924	9·433
31·81	31·92	32·00	1·13838	3·031	9·473
32·80	32·91	33·00	1·14322	3·139	9·513
33·79	33·90	34·00	1·14809	3·248	9·554
34·78	34·90	35·00	1·15300	3·358	9·595
35·77	35·89	36·00	1·15793	3·469	9·636
36·76	36·88	37·00	1·16291	3·581	9·677
37·75	37·87	38·00	1·16791	3·693	9·719
38·74	38·87	39·00	1·17295	3·807	9·761
39·73	39·86	40·00	1·17803	3·921	9·803
40·72	40·85	41·00	1·18314	4·037	9·846
41·71	41·84	42·00	1·18829	4·153	9·889
42·70	42·83	43·00	1·19347	4·271	9·932
43·68	43·82	44·00	1·19868	4·389	9·975
44·67	44·81	45·00	1·20393	4·508	10·019
45·65	45·80	46·00	1·20921	4·629	10·063
46·64	46·79	47·00	1·21453	4·750	10·107
47·63	47·78	48·00	1·21989	4·873	10·151
48·61	48·77	49·00	1·22527	4·996	10·196
49·60	49·76	50·00	1·23070	5·121	10·241
50·58	50·75	51·00	1·23619	5·246	10·287
51·57	51·73	52·00	1·24167	5·373	10·333
52·55	52·72	53·00	1·24720	5·501	10·379
53·54	53·71	54·00	1·25276	5·630	10·425
54·52	54·70	55·00	1·25836	5·759	10·472
55·51	55·68	56·00	1·26401	5·890	10·519
56·50	56·67	57·00	1·26968	6·023	10·566
57·48	57·66	58·00	1·27539	6·156	10·613
58·46	58·64	59·00	1·28113	6·290	10·661
59·45	59·63	60·00	1·28692	6·426	10·709
60·43	60·62	61·00	1·29272	6·563	10·759
61·42	61·60	62·00	1·29856	6·700	10·806
62·40	62·59	63·00	1·30446	6·839	10·855
63·38	63·57	64·00	1·31039	6·979	10·905
64·37	64·56	65·00	1·31636	7·120	10·954
65·35	65·54	66·00	1·32235	7·263	11·004
66·33	66·52	67·00	1·32836	7·406	11·054
67·32	67·51	68·00	1·33443	7·551	11·105
68·30	68·49	69·00	1·34054	7·697	11·155
69·28	69·47	70·00	1·34667	7·845	11·207
70·27	70·45	71·00	1·35284	7·993	11·258
71·25	71·43	72·00	1·35904	8·143	11·309

Table IV (*continued*)

Refractometer Brix	*Hydrometer Brix*	*Corrected Brix*	*Apparent s.g.* (20°/20°)	*Pounds Solids per U.S. gallon*	*Total Wt. per U.S. gallon*
72·23	72·42	73·00	1·36529	8·294	11·361
73·22	73·40	74·00	1·37156	8·446	11·414
74·20	74·38	75·00	1·37788	8·600	11·466
75·18	75·36	76·00	1·38421	8·754	11·519
76·16	76·34	77·00	1·39055	8·910	11·572
77·15	77·32	78·00	1·39702	9·068	11·625
78·13	78·30	79·00	1·40346	9·226	11·679
79·11	79·28	80·00	1·40995	9·386	11·733

Table V.—Refractometer Brix, Hydrometer Brix, Corrected Brix, Apparent Specific Gravity, Grams Solids per litre, and Weight per litre of Medium Invert Sugar

Refractometer Brix	*Hydrometer Brix*	*Corrected Brix*	*Apparent s.g.* (20°/20°)	*Solids per litre, grams*	*Total Wt. per litre, grams*
0·00	0·00	0·00	1·00000	0·00	997·2
0·99	1·00	1·00	1·00390	10·01	1001·1
1·99	2·00	2·00	1·00780	20·10	1005·0
2·98	3·00	3·00	1·01174	30·26	1008·9
3·98	4·00	4·00	1·01570	40·52	1012·8
4·97	5·00	5·00	1·01969	50·84	1016·8
5·97	6·00	6·00	1·02369	61·25	1020·8
6·96	7·00	7·00	1·02774	71·74	1024·8
7·96	8·00	8·00	1·03181	82·31	1028·9
8·95	9·00	9·00	1·03590	92·97	1033·0
9·95	10·00	10·00	1·04003	103·71	1037·1
10·94	11·00	11·00	1·04417	114·53	1041·2
11·94	12·00	12·00	1·04836	125·45	1045·4
12·93	13·00	13·00	1·05258	136·45	1049·6
13·93	13·99	14·00	1·05680	147·53	1053·8
14·92	14·99	15·00	1·06108	158·72	1058·1
15·92	15·99	16·00	1·06538	169·98	1062·4
16·91	16·99	17·00	1·06970	181·34	1066·7
17·90	17·98	18·00	1·07406	192·78	1071·0
18·90	18·98	19·00	1·07845	204·33	1075·4
19·89	19·98	20·00	1·08287	215·96	1079·3
20·89	20·97	21·00	1·08733	227·70	1084·3
21·88	21·97	22·00	1·09181	239·51	1088·7
22·87	22·97	23·00	1·09632	251·44	1093·3
23·87	23·96	24·00	1·10087	263·46	1097·8
24·86	24·96	25·00	1·10544	275·58	1102·3
25·85	25·95	26·00	1·11005	287·79	1106·9
26·85	26·95	27·00	1·11468	300·11	1111·5
27·84	27·94	28·00	1·11936	312·54	1116·2
28·83	28·94	29·00	1·12406	325·06	1120·9
29·83	29·93	30·00	1·12881	337·69	1125·6
30·82	30·92	31·00	1·13358	350·42	1130·4
31·81	31·92	32·00	1·13838	363·25	1135·5
32·80	32·91	33·00	1·14322	376·20	1140·0
33·79	33·90	34·00	1·14809	389·27	1144·9
34·78	34·90	35·00	1·15300	402·43	1149·8
35·77	35·89	36·00	1·15793	415·69	1154·7
36·76	36·88	37·00	1·16291	429·05	1159·6
37·75	37·87	38·00	1·16791	442·55	1164·6
38·74	38·87	39·00	1·17295	456·14	1169·6
39·73	39·86	40·00	1·17803	469·88	1174·7
40·72	40·85	41·00	1·18314	483·72	1179·8
41·71	41·84	42·00	1·18829	497·67	1184·9
42·70	42·83	43·00	1·19347	511·74	1190·1
43·68	43·82	44·00	1·19868	525·93	1195·3
44·67	44·81	45·00	1·20393	540·23	1200·5
45·65	45·80	46·00	1·20921	554·67	1205·8
46·64	46·79	47·00	1·21453	569·22	1211·1
47·63	47·78	48·00	1·21989	583·92	1216·5
48·61	48·77	49·00	1·22527	598·68	1221·8
49·60	49·76	50·00	1·23070	613·62	1227·2
50·58	50·75	51·00	1·23619	628·68	1232·7
51·57	51·73	52·00	1·24167	643·86	1238·2
52·55	52·72	53·00	1·24720	659·15	1243·7
53·54	53·71	54·00	1·25276	674·57	1249·2
54·52	54·70	55·00	1·25836	690·15	1254·8
55·51	55·68	56·00	1·26401	705·88	1260·5
56·60	56·67	57·00	1·26968	721·68	1266·1
57·48	57·66	58·00	1·27539	737·64	1271·8
58·46	58·64	59·00	1·28113	753·73	1277·5

Table V (*continued*)

Refractometer Brix	*Hydrometer Brix*	*Corrected Brix*	*Apparent s.g.* (20°/20°)	*Solids per litre, grams*	*Total Wt. per litre, grams*
59·45	59·63	60·00	1·28692	769·97	1283·3
60·43	60·62	61·00	1·29272	786·35	1289·1
61·42	61·60	62·00	1·29856	802·84	1294·9
62·40	62·59	63·00	1·30446	819·50	1300·8
63·38	63·57	64·00	1·31039	836·29	1306·7
64·37	64·56	65·00	1·31636	853·26	1312·7
65·35	65·54	66·00	1·32235	870·28	1318·6
66·33	66·52	67·00	1·32836	887·48	1324·6
67·32	67·51	68·00	1·33443	904·88	1330·7
68·30	68·49	69·00	1·34054	922·39	1336·8
69·28	69·47	70·00	1·34667	940·03	1342·9
70·27	70·45	71·00	1·35284	957·80	1349·0
71·25	71·43	72·00	1·35904	975·74	1355·2
72·23	72·42	73·00	1·36529	993·82	1361·4
73·22	73·40	74·00	1·37156	1012·09	1367·7
74·20	74·38	75·00	1·37788	1030·50	1374·0
75·18	75·36	76·00	1·38421	1049·03	1380·3
76·16	76·34	77·00	1·39055	1067·70	1386·6
77·15	77·32	78·00	1·39702	1086·60	1393·1
78·13	78·30	79·00	1·40346	1105·61	1399·5
79·11	79·28	80·00	1·40995	1124·78	1406·0

Let us assume that the formulation required is as indicated in Table VI. As shown in this table, we wish to prepare 125 gallons of a flavoured syrup that will contain 2 gallons of flavour concentrate, 3·5 lb of citric acid, 1·4 lb of sodium benzoate, and 1000 lb of medium invert sugar solids. The flavoured syrup is then to be mixed with five times its volume of carbonated water to yield 750 gallons of beverage.

Table VI.—Example of a typical flavoured syrup and beverage formulation

FORMULATION REQUIRED:

	Total weight	*Dry weight*
Flavour concentrate (2 gallons)	20·5 lb	1·2 lb*
Citric acid	3·5 lb	3·5 lb
Sodium benzoate	1·4 lb	1·4 lb
Medium invert sugar	(1308·9 lb)†	1000·0 lb

Total volume of simple syrup .... 123 gallons
Total volume of finished syrup .. 125 gallons
Total volume of beverage .... 750 gallons

* Estimated
† For 76·4° Brix medium invert sugar

INFORMATION NEEDED:

1. Hydrometer and/or refractometer Brix of simple syrup
2. Hydrometer and/or refractometer Brix of finished syrup
3. Hydrometer and/or refractometer Brix of beverage
4. Gallons of medium invert sugar required
5. Gallons of water required

In general, for any flavoured syrup and beverage formulation, the following information is needed:

(1) The hydrometer and/or the refractometer Brix of the syrup just before the flavour concentrate is added. This is the mixture that contains the liquid sugar, water, citric acid, and salts. It is generally known as the *simple syrup.*

(2) The hydrometer and/or the refractometer Brix of the syrup after the flavour concentrate is added. This is usually called the *finished syrup.*

(3) The hydrometer and/or the refractometer Brix of the *beverage* that is obtained by mixing the finished syrup in the correct ratio with carbonated water. In this particular example it is assumed that the proportion is 1 part of finished syrup to 5 parts of carbonatated water, i.e., the "throw" is 1 + 5.

(4) The volume of medium invert sugar required. This depends, of course, on the Brix of the medium invert sugar used in the particular formulation. In this instance, let us assume that the Brix is 76·4, corrected.

(5) The volume of water needed to prepare the simple syrup.

The step-by-step procedure is as follows and the computations are summarized in Tables VII and VIII.

Table VII.—Computation of hydrometer and refractometer Brix for simple syrup, finished syrup, and beverage

	Simple syrup	*Finished syrup*	*Beverage*
Solids, lb	1004·9	1006·1	1006·1
Volume, gallons	123	125	750
lb solids per gallon	8·170	8·049	1·342
% solids (corrected Brix)	62·74*	62·02*	12·76*
Hydrometer correction	0·41†	0·40†	0·00†
Hydrometer Brix	62·33	61·62	12·76
Refractometer correction	0·60‡	0·58‡	0·07‡
Refractometer Brix	62·14	61·44	12·69

Data from Table III: * by interpolation
† Column 3 — Column 2
‡ Column 3 — Column 1

Table VIII.—Computation of volumes of medium invert sugar and water

1. INVERT SUGAR

(a) $\dfrac{\text{lb medium invert solids}}{\text{corrected Brix} \times 0{\cdot}01} = \dfrac{1000}{0{\cdot}764} = 1308{\cdot}9 \text{ lb}$

(b) $\dfrac{1308{\cdot}9}{13{\cdot}859 \text{ lb per gal}} = 94{\cdot}44$ gallons of medium invert sugar

2. WATER

(a) $\dfrac{\text{lb solids in simple syrup}}{\text{corrected Brix} \times 0{\cdot}01} = \dfrac{1004{\cdot}9}{0{\cdot}6274} = 1601{\cdot}7$ lb (wt of simple syrup)

(b) $1308{\cdot}9 + 4{\cdot}9 = 1313{\cdot}8$ lb

(c) $1601{\cdot}7 - 1313{\cdot}8 = 287{\cdot}9$ lb

(d) $\dfrac{287{\cdot}9}{9{\cdot}994} = 28{\cdot}80$ gallons of water

(1) Determine the solids per gallon of simple syrup by dividing its total solids by the volume (in this instance 123 gallons):

1004·9 ÷ 123 = 8·170 lb per gallon

From Table III it is found by interpolation that 8·170 lb per gallon corresponds to 62·74% total solids. The table also indicates that in this Brix range the hydrometer and refractometer will give readings that are 0·41° and 0·60° Brix, respectively, lower than the true solids. Therefore:

62·74 — 0·41 = 62·33 (hydrometer Brix)
62·74 — 0·60 = 62·14 (refractometer Brix)

(2) Similarly, compute the solids per gallon of finished syrup by dividing the total solids by its total volume. It should be noted here that the flavour concentrate increases the volume by 2 gallons and the solids by 1·2 lb. This solids increase may be estimated from the specific gravity of the flavour concentrate or from an actual solids determination. In this particular instance, the 2 gallons of flavour concentrate weigh 20·5 lb and therefore the specific gravity is 1·025. Table III indicates that this specific gravity corresponds to approximately 0·6 lb solids per gallon and therefore 2 gallons of the flavour concentrate contribute approximately 1·2 lb of solids. This contribution is negligible and could be disregarded in this case. In other formulations, however, the flavour concentrate solids could be appreciable and should be included in the computation.

In this particular case the total solids are 1006·1 lb and the total volume is 125 gallons. By the procedure outlined above for the simple syrup, we obtain the following results:

lb solids per gallon	8·049
% solids	62·02
hydrometer Brix	61·62
refractometer Brix	61·44

(3) Compute the solids per gallon of beverage by dividing the total solids by the total volume of beverage (in this case 750 gallons). The results are:

lb solids per gallon	1·3415
% solids	12·76
hydrometer Brix	12·76
refractometer Brix	12·69

It should be noted that at this % solids range the hydrometer gives the correct reading, i.e. there is no hydrometer correction; the *refractometer* Brix, however, is 0·07° Brix lower. Again, this information is obtained from Table III.

(4) Determine the volume of medium invert sugar required as follows:

(a) Divide the medium invert sugar solids (in this case 1000 lb) by its % solids (in this case 76·4) and multiply by 100. This gives the weight of medium invert sugar in pounds.

(1000 ÷ 76·4) 100 = 1308·90 lb.

(b) Divide the above result by the total weight per gallon of 76·4° Brix medium invert; this figure is obtained from Table III by interpolation. Thus, the volume of medium invert sugar required is

1308·90 ÷ 13·859 = 94·44 gallons.

(5) Determine the water required as follows:

(a) Divide the total solids by the % solids in the simple syrup [see (1) above] and multiply by 100. This gives the total weight of the simple syrup:

(1004·9 ÷ 62·74) 100 = 1601·7 lb.

(b) To the weight of medium invert sugar [in this case 1308·9 lb, see (4a)] add the non-sugar solids and subtract from the total weight of the simple syrup. This gives the weight of water required. To convert to gallons, divide by 9·994.

1308·9 + 4·9 = 1313·8

1601·7 — 1313·8 = 287·9

287·9 ÷ 9·994 = 28·80 gallons

We now have all the information needed for this particular formulation and it is summarized in Table IX. Although the results are given to the second decimal place, in practice they would be rounded off to one decimal place because it is not possible to obtain better accuracy by means of the ordinary hydrometer or refractometer.

Table IX.—Summary of data computed for a simple syrup, finished syrup, and beverage formulation

	Simple syrup	*Finished syrup*	*Beverage*
Hydrometer Brix	62·33	61·62	12·76
Refractometer Brix	62·14	61·44	12·69
Corrected Brix	62·74	62·02	12·76
Gallons	123	125	750
Gallons of medium invert sugar (76·4° Brix)			94·44
Gallons of water			28·80

I should like to point out also that if we add 94·44 and 28·80, which are the volumes in gallons of medium invert sugar and water, respectively, the total is 123·24. The excess 0·24 gallons is, of course, the amount of shrinkage that takes place when liquid sugar and water are mixed.

As indicated before, the example was given for 76·4% medium invert sugar. In practice, for any particular formulation, it is convenient to prepare a table of volumes of sugar and water required for the range 76·0 to 78·0° Brix in increments of 0·2° Brix. For any given formulation, of course, the simple syrup, finished syrup, and beverage Brix will be the same regardless of the variation in the medium invert sugar solids. It is only the volumes of sugar and water that will vary.

Summary

In this paper is presented a medium invert sugar table; the method by which it was computed is shown and its use illustrated. In addition, the discrepancies that may be expected between the true solids content of medium invert sugar solutions and

the results obtained by the hydrometer and by the refractometer are discussed. Methods of correcting for these discrepancies are given.

The facts discussed make it clear that in the case of medium invert sugar, or in formulations with this sugar, the term "Brix" is ambiguous and may cause misunderstandings. For this reason, the use of terminology such as "refractometer Brix, uncorrected," "Brix, corrected," "% true solids," etc., is strongly recommended.

Sugar Explosion in Holland

AN explosion occurred at the Groningen sugar factory of Friesch-Groningsche Coöperatieve Beetwortelsuikerfabriek en Raffinaderij G.A. on the 3rd May 1965. The management of the Company set up a committee to investigate the cause of the explosion, to recommend steps to prevent a recurrence and to study the possibility of restricting the extent and destructive effects of such an unexpected explosion.

The report of the committee of investigation has now been issued and may be summarized as follows:

The dust explosion took place on 3rd May at approx. 1.30 p.m., i.e. about 30 minutes after the end of the lunch period. In order to find the causes of the explosion, the initial approach was to determine what particular conditions, different to those of normal working, obtained at 1.30 on the day of the explosion, and, in particular, if there were unusual quantities of dust, and how ignition took place.

During working conditions very little dust is generated by the equipment in the hopper room. All the points in question are connected by vacuum ducting to two central air filter units, an "Intensiv" filter in the screen section and a "Kiekens" filter in the by-products section. The small quantity of dust in the room outside the equipment is not suspended but lies on floors, ledges, etc., from which it is regularly removed by brooms or vacuum cleaners. The pulverizing mill unit, which was not in use on 3rd May 1965, was installed in a separate locked room.

There is no information available on dust concentrations occurring during normal operation of equipment and conveyors. Naturally they will depend to a great extent on the composition of the sugar being conveyed and on the loading of the equipment. The enquiry revealed that at about 1.05 p.m. elevator 152 was started up to convey sugar to the hoppers feeding the MIAG pulverizers. Shortly before the explosion it was observed that the motor of this elevator was consuming excessive power for normal working; it was concluded from this that the weigher located beneath the discharge of this elevator was not working. Under such circumstances the sugar is not thrown off the elevator but falls back onto it, thereby increasing the loading. This involves extra wear and tear of the sugar crystals and consequently forms dust.

From this it may be concluded that for some time between 1·05 p.m. and 1.30 p.m. there was formed in elevator 152 a quantity of dust which may certainly be regarded as greater than that found under normal circumstances. Shortly before 1.30 p.m. an employee went from the first to the fifth floor with instructions to get the weigher working again and, according to his evidence, there was no marked dust development in the section. Neither was there any mention in the evidence of other employees of the presence of dust in the rooms. The committee therefore considers it established that the dust involved in the initial explosion was formed in elevator 152 and that this formed an explosive mixture with air.

In this regard it may be pointed out that very extensive damage occurred at the location of the elevator on the 6th floor; the upper sides of the elevator were blown off, the outgoing pressure wave also removed the upper members of nearby elevators N 5 and 101, a hole was blown in the brick wall near elevator 152 and the wooden and glass structure of the printing section was blown away, while a hole several sq.m. in area was blown in the roof (See Figs. 1 and 2).

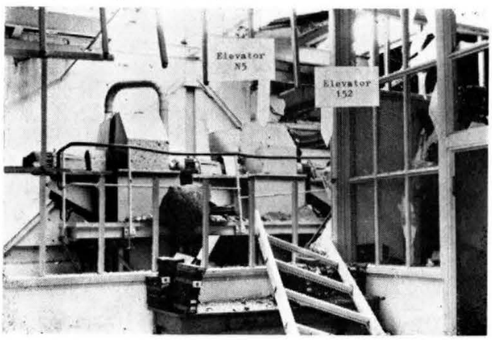

Fig. 1

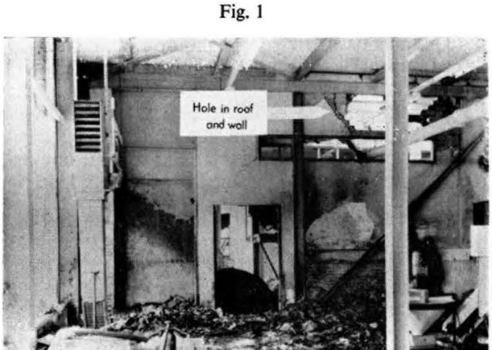

Fig. 2

An important fact is that the force of the explosion was greatest just next to the upper side of the elevator; this bears out the supposition that the blast wave travelled upwards through the elevator from the bottom. On the floor beneath, the shaft was split open in a great many places.

The next question which arises concerns the cause and location of the initiation or ignition of the explosion. An ignition can generally occur through an open flame, local overheating or through spark discharge of static electricity. Local overheating as a source of ignition can be ruled out. The elevator axle bearings and other rotating parts are located outside the housing of the equipment and during repairs not one bearing has shown signs of heat; all bearings have been checked for this.

At the time of the explosion the weather was thundery. No evidence of lightning strikes has been found, however, and this can also be ruled out as having a direct connexion with the occurrence of the explosion. The earthing of the steel framework of the equipment was in good condition and a survey carried out in December 1965 showed that there was no potential difference between the discharge of the silo elevator and the earth, there was only a small potential difference between the rollers supporting the conveyor belt in the tunnel and the same applied to the conveyor belt taking sugar to the bulk loading station.

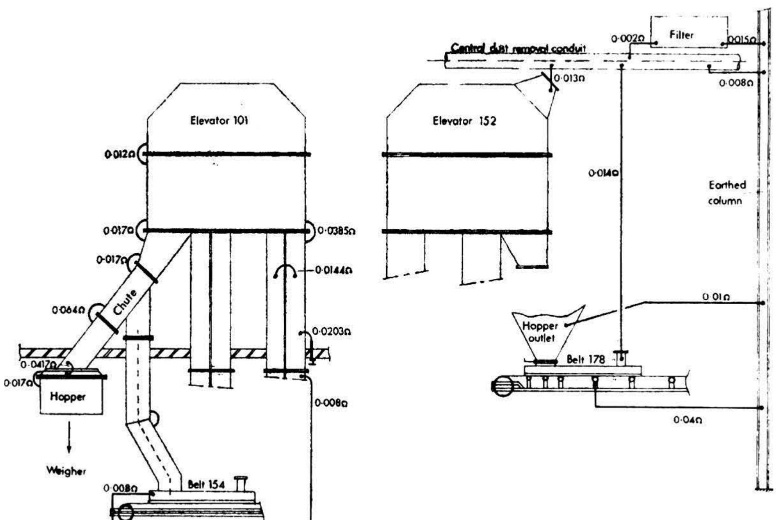

Fig. 3

At the head of the elevator 32, where there was somewhat more dust, the potential difference from earth was 200 volts while measurements near the "plastic" machine gave somewhat higher readings of 800–1000 volts. (This is the machine in which bags are made from a pre-printed polyethylene tube, filled with 1 kg of sugar and sealed.)

There was little accumulation of static electricity during normal operation, therefore, which is a result of good earthing. A number of measurements were also carried out on the earthing, the resistances all proving to be very low (Fig. 3).

During reconstruction after the explosion the equipment was erected as it had been originally so that measurement of contact resistances should give the same picture after as before the explosion. Prof. Dr. W. MAAS of the Centraal Proefstation van de Staatsmijnen in Limburg visited the site on the 8th May 1965 and further discussed aspects of static electricity in May 1966. He confirmed that electrostatic charging of dust occurs frequently; however a dust cloud with sufficient energy to ignite must be of very great volume, much greater than that of the elevators in the Friesch-Groningsche sugar factory.

An explosion such as that at the sugar silo in Sweden[1] can occur through static electricity; however the silo was of very great volume (25 m diameter and 30–40 m high). The charge limit is dependent on the rate at which the static charge is applied (rate of movement of the charging particle) and on the discharge rate (resistance of the particle). For conveyor belts moving at 15–3·2 m/sec antistatic material with a resistance of 10^8–10^9 ohms is sufficient to prevent accumulation of a high charge; faster V-belts are safe at e.g. 10^6 ohms. Normal lubricated bearings (metal to metal) are always able to conduct the charge away from the rotatory parts; with synthetic bushes, of e.g. nylon or "Akulon", high potentials are possible.

On the basis of his experience Prof. MAAS supported the view of the committee that the explosion was not caused by static electricity.

On the day of the explosion there were some stoppages on the first floor and these were put in order by about 10 a.m. However, against instructions, and without the knowledge of the technical supervisor, welding equipment was being used at the time of the explosion. Hence an open flame was being used in the direct vicinity of the dust suction lines at the point where elevators 101 and 152 meet (See Figs. 4 and 5). It may be assumed that the dust concentration in this case was higher than normal in the line from elevator 152. There are no signs on the ducting in question to indicate that the welding flame came

[1] *I.S.J.*, 1964, **66**, 361.

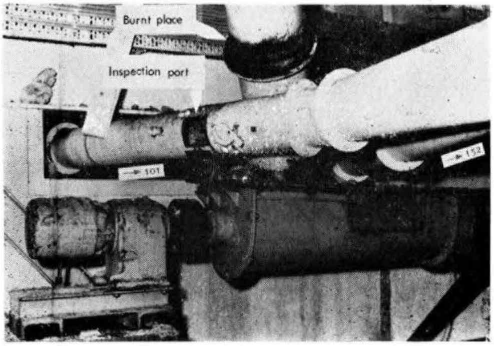

Fig. 4

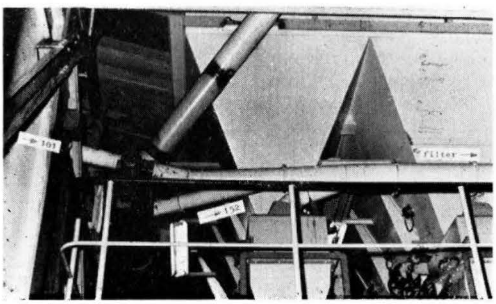

Fig. 5

into contact with it. There are a number of inspection ports in the ducts but it has not been possible to ascertain which of these were closed, i.e. well sealed. before the explosion. It is supposed, however, that ignition took place via an inspection port and that the explosion then travelled up and along elevator 152. This is consistent with the earlier conclusion that a blast wave may have travelled up the elevator from the bottom.

It is forbidden to smoke in the building except in the offices which are closed off on the ground floor and first floor. Apart from the welding flame mentioned above there appears to have been no other naked flame. Moreover there is no reason to suppose that this example was other than an uncommon infringement of the ban on naked lights.

Although the development of a static charge in a sugar dust cloud was probably not the cause of the explosion and the welding equipment is considered to have been the primary ignition source, the committee considers that the question of static electricity should be looked into more closely particularly in connexion with possible safety prevautions, about which a separate report will be produced. Concrete data are required, including the dust:air concentrations occurring in different places under varying conditions, and the distribution of grain size in this dust. No information is available on the electrical resistance of sugar, whether fresh or "dead" grain, crystal or fine dust, nor is there information on charges which can build up in various places and under different conditions. The committee considers it is desirable to collect such information and is to discuss the manner in which this can be done.

After the explosion it was necessary to rebuild the various stations in the shortest possible time, and in fact delivery from the silos recommenced in July. In order to achieve this minimum delay the layout was maintained almost unchanged; however, measures were taken to prevent any further explosion in the refinery by avoiding any extraordinary formation and accumulation of dust. For instance, during the reconstruction, the pulverizer station was removed from the main building and accommodated in a separate building with a light-construction wall on one side.

In addition to the existing ban on smoking, an absolute ban was placed on all work in the screening section which might entail use of a naked flame. Welding equipment and other tools which might cause a spark or fire must be kept outside the building and when their use is unavoidable, very stringent precautions must be taken and the work carried out under the strictest continuous supervision.

By providing "Silometer" level controls in the hoppers above the weighers in the sugar conveyor lines, the conveyors can be stopped without risk of blockages arising in the discharge from the elevators. In addition the idler axles on all elevators are provided with safeguards against slip so that the particular elevator and its supply line can be stopped.

Dust on rafters, structures, etc. is removed by use of vacuum cleaners with flame-proof motors or by a central dust removal system, and the use of brooms and brushes is limited to the cleaning of floors.

The possible occurrence of electrostatic loads and their energy values is under investigation but, in the meantime, steel-framed apparatus is to be regularly checked for earthing as a safeguard against lightning.

Of steps taken to limit the effect and extent of a possible explosion, some are concerned with personal safety and others with restriction of material damage. The central staircase proved to be a very satisfactory means of escape at the time of the explosion on 3rd May 1965; nevertheless it is proposed that the number of escapes should be increased. Three escape hatches with emergency locks have been introduced beneath the silos, increasing the number from 2 to 5. Regular inspection is necessary to ensure that these are unobstructed and to check the state of the doors and escape hatches.

The screening section has been divided into three groups, each of which is provided with ducting leading to a dust collection unit. The question of explosion hatches in the dust filter unit is under discussion with the manufacturers, and the committee is studying the provision of safeguards against explosion in the conveyor bridge between the screening section and the silo. As concerns sugar storage in the silo, the committee thinks that under normal conditions there is no acute danger of explosion, and with, reference to the work of KÜHNEN[2], no special measures have been recommended.

In the open areas of the silo, as in the screening room, there is a ban on smoking, naked flames and the use of inflammable materials, and measures are in force to keep the area free of dust. The central switch panel for the silo installation has been removed from the silo and is located over the staircase near the packaged sugar store, next to the entrance of the silo, where there is scarcely any risk of the presence of sugar dust.

The committee will consider further measures after the results of the investigation into dust concentration and static electricity in the equipment are known.

Water Hyacinth Control

THE water hyacinth (*Eichhornia crassipes*), native to the American tropics, is now regarded as one of the world's worst weeds with its proclivity for blocking inland waterways, drainage and irrigation canals. It now occurs in warm countries more or less all over the globe and in recent years has spread and attracted increased attention in such countries as the Congo (River Congo), Sudan (Nile), East Africa, Rhodesia, Natal, India, Malaya, Fiji, Western Australia and the warmer parts of New Zealand. Special symposia have been held in African countries in efforts to improve control or effect eradication in the more restricted areas.

Not infrequently the cane grower has cause to curse this handsome, blue flowered, aquatic plant when it has been allowed to take possession of an expanse of water in his area. Attention has recently been drawn to its activities in northern Queensland cane fields where poor drainage is a major problem. Adequate drainage has been provided in many instances but the rapid and close development of the weed in the drains impedes the flow of the water. An account[3] has been given (by L. G. W. TILLEY) of a series of herbicide trials carried out at Ingham to find a relatively cheap and effective method of control under these conditions.

The method which showed most promise was "two applications of 2,4-D amine, the applications being three to four weeks apart. The first application of 2·5 pounds of active ingredient of 2,4-D amine per acre is made at the outset of the wet season, when the plant is making its first vigorous growth, just prior to flowering. This gives a good top kill, but in about three to four weeks regrowth will appear; this is when the second application (at the same dosage rate) is made. To date these trials have given six months' freedom from regrowth and, providing reinfestation by fresh plants during flooding is prevented, complete control is assured. It was found that the incorporation of 0·5% of wetting agent in the mixture gave a far quicker and more effective kill.

A power mister is the more efficient unit for application as it allows areas normally inaccessible to boom sprays, knapsack sprays, etc. to be effectively covered. A knapsack power mister was used when laying out the trials."

A point that should be kept in mind is that the water hyacinth sometimes produces viable seed although increase is normally by vegetative means. What the conditions are that favour seed production does not seem to be thoroughly understood. Constant vigilance is therefore needed for some time in areas where the plant has been known to occur.

F.N.H.

Brevities

West Indies Sugar Co. Ltd. 1966 report.—Sugar production at Monymusk in 1966 was 80,216 tons, and at Frome was 99,108 tons, compared with 80,574 and 106,049 tons, respectively, in 1965. Approximately 18% of the Company's export sugar was sold at prices related to the World Price, reducing profits before tax to £110,000, compared with £575,000 for the 1961–65 average (which includes the very low profit of £40,600 in 1965). During 1966, not only was juice quality generally worse than 1965 in Jamaica as a whole because of a mild winter, but a high incidence of uncontrolled cane fires at Frome resulted in the need to reap a substantial proportion of stale and immature cane. On top of this, crop started 4 weeks late at Monymusk and 6 weeks late at Frome, because of labour difficulties that came in the aftermath of the Douglas Commission, and the resultant dislocation of the industry cost 10,000 tons of sugar which the crop could have yielded, in spite of the climatic conditions, if all had gone well. In 1966 the Jamaican Government decided to appoint a Commission of international experts to examine the situation of the island's sugar industry as a whole, with particular reference to mechanization and the Company's request to develop an installation at Rocky Point to handle bulk sugar shipments more efficiently. The members of the Commission were appointed in the autumn of 1966 and have since been gathering information, hearing evidence and receiving submissions on all aspects of the industry. The recommendations of the Commission may well have a profound effect on the future of the Company and on the whole Jamaican industry.

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Sugar refinery project for Uruguay.—An agreement has been reached between a Spanish Group and Cooperativa Agropecuario Norte Uruguayo Ltda. which will shortly lead to an order for the delivery of equipment for a sugar refinery. The project will involve an investment of 11 million dollars and the Group has secured the cooperation of Soc. Fives Lille-Cail for it. The agreement has received the approval of the Uruguayan Government[4]. The refinery, in Bella Union, is to start operations in 1968 and is to have a milling capacity of 3000 tons of cane per day[5].

[2] *Zucker*, 1966, **19**, 371–377; *I.S.J.*, 1967, **69**, 86.
[3] *Canegrowers' Quarterly Bull.*, 1966, **29**, (4) 1161.
[4] *Zeitsch. Zuckerind.*, 1967, **92**, 38.
[5] F. O. Licht, *International Sugar Rpt.*, 1967, **99**, (4), 14.

Sugar cane agriculture

Effects of light on mating success and egg-laying activity of the sugar cane borer, *Diatraea saccharalis*. G. W. MISKIMEN. *Ann. Ent. Soc. Am.*, 1966, **59**, (2), 280–284; through *Rev. Appl. Ent.*, 1966, **54**, Ser. A, 411–412.—Continuous light, averaging 16 foot-candles, suppressed mating and interfered with egg-laying. The presence of males stimulated oviposition. Normal photoperiods regulated and continuous photoperiods upset oviposition activity. Female age also influenced egg production.

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Yield tests of some foreign varieties in the three mill districts in North Negros. A. V. SOBREPENA, E. CABAHUG and J. MORALES. *Philippine Sugar Inst. Quart.*, 1965, **11**, (1), 18–20; through *Plant Breeding Abs.*, 1966, **36**, 575.—Yield results are tabulated for trials at each of four centres in which a total of five cane varieties from South Africa, India, the U.S.A., Indonesia and Australia were compared with the chief commercial variety used in the district.

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Cold tolerance in sugar cane. ANON. *Agric. Res.*, 1965, **14**, (2), 11; through *Plant Breeding Abs.*, 1966, **36**, 575.—Up to 50 varieties are evaluated yearly for resistance to stalk freezing. Over 1500 plants of Canal Point and Louisiana 1961 and 1962 assignments have been tested for frost resistance of leaves and buds. Many of these varieties had as good or better resistance than CP 44-101 and CP 46-115. Varieties having satisfactory resistance are then evaluated at Meridian for the ability of the cane to regrow from stubble after severe winters. No commercial variety tested so far has shown outstanding resistance.

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Foliar diagnosis applied to the sugar cane. E. MALAVOLTA, E. PIMENTEL GOMES and T. COURY. *Fertilité*, 1965, (25), 5–32; through *Soils and Fertilizers*, 1966, **29**, 407.—Results are presented of 40 factorial experiments with N-P-K at 3 levels on the main sugar cane soils in São Paulo. Nutrient levels in the middle part of the third and fourth leaves were correlated with fertilizer response in the field.

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New sugar cane parasite in Swaziland. ANON. *Bothalia*, 1966, **8**, (Supplement 1), 10.—A new parasite on sugar cane in Swaziland, a flowering plant, has been recorded, viz. *Thesium resedoides*. At first it caused considerable concern, but tests proved that it could be controlled by 2,4-D.

Important plant growth findings at sugar research centre. ANON. *Australian Sugar J.*, 1966, **58**, 183–184. Reference is made to some aspects of sugar cane research at the Colonial Sugar Refining Company's David North Research Centre at Indooroopilly, Brisbane, results having been presented in papers at the Australian Biochemical Congress. Growth, photosynthesis and enzymes in the sugar cane plant were discussed.

* * *

The use of "Eptam" and "Tillam" as weedicides in sugar canefields. K. KAR and R. P. SINGH. *Indian Sugar*, 1966, **16**, 257–261.—Weed infestation may cause losses from 8–35% in cane yield. The use of "Eptam" and "Tillam" in various doses, at different times, in pre- and post-emergence application, is described (both are carbamate compounds, supplied by Gerdau India Corporation, Calcutta). Both proved useful in controlling various weeds whose name are given, nut-grass (*Cyperus rotundus*) being one of them.

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Myllocerus dentifer **attacking sugar cane.** P. N. AVASTHY. *Indian Sugar*, 1966, **16**, 263–264.—This curculionid beetle, known to attack other economic plants, including rice, ground-nut and jute, has been observed at Coimbatore attacking sugar cane leaves—the first record. The nature of the damage is described. Varieties with erect leaves suffered the least damage.

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Losses caused by root borer (*Emmalocera depressella***) to sugar cane in Uttar Pradesh.** K. M. GUPTA, B. SINGH and G. SAGAR. *Indian Sugar*, 1966, **16**, 273–279. Results of observations on losses caused by the root borer are presented. These have been increasing in recent years but damage was only a quarter of that due to shoot borers.

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Aerial topdressing of sugar cane. ANON. *International Fertilizer Correspondent*, 1966, **7**, (9), 1131.—Mechanization in cane cultivation is making rapid progress in Puerto Rico and the use of aircraft or helicopters for top dressing is continually increasing. In 1964 four special aviation companies were operating for the treatment of 80,000 hectares of sugar cane. One aircraft, with a loading capacity of 500–600 kg, can distribute 20 tons of mineral fertilizer per working day with adequate quick feeding facilities, or spray 160–240 hectares with herbicides or pesticides at a level of 40–60 litres/ha.

Sugar cane variety outfield experiments in Louisiana during 1965. H. P. FANGUY, T. J. STAFFORD and R. J. MATHERNE. *Sugar Bull.*, 1966, **44**, 322–331. The main object of these experiments is to compare newly developed varieties with standard commercial varieties; 33 varieties were included, 6 commercial and 27 unreleased—a considerable increase over previous years. For the second consecutive year wind damage caused difficulties. Results are given in various tables. The variety L 60-25 continued to give good results and produced more cane per acre and sugar per ton of cane than the standard variety. Its major disadvantage is susceptibility to mosaic disease. Other promising unreleased varieties during 1965 were CP 60-16, CP 61-37, CP 61-39, CP 61-84, L 61-43 and L 61-45.

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Controlling Johnson grass seedlings and annual weeds in sugar cane planted in Louisiana in summer and fall 1966. E. R. STAMPER *et al.* *Sugar Bull.*, 1966, **44**, 333–334.—Herbicides are regarded as essential for controlling Johnson grass (*Sorghum halepense*) seedlings. Details are given of recommended herbicides, methods of use, rates of application, etc. The weedkillers referred to are 2,4-D, "Dalapon", "Diuron", "Fenac", "Silvex", "Simazine" and TCA.

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Sugar cane planting practices and variety recommendations for 1966. ANON. *Sugar Bull.*, 1966, **44**, 336. The importance of good planting with sugar cane in Louisiana is emphasized and recommendations made under eight different headings, the first being to "begin with a well-prepared seedbed, properly pulverized by rotary-tilling and packed." A list of variety recommendations for Louisiana by areas and according to type of soil is given.

* * *

Field mechanization. D. SMITH. *Sugar y Azúcar*, 1966, **61**, (9), 18–20.—In many sugar cane growing countries interest in field mechanization, especially harvesting, is at a very high pitch and harvester manufacturers are being besieged with requests for machines to suit particular needs. World-wide high labour costs have caused this interest. It is essential that field techniques be geared to the needs of mechanical harvesters, such as wide spacing of rows and well levelled fields. Other important points of field practices are discussed.

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Sugar in Hawaii—1966. R. L. CUSHING. *Sugar y Azúcar*, 1966, **61**, (9), 35–36.—The writer gives reasons for the flourishing state of the Hawaiian sugar industry and considers 85% of increased productivity has been due to technological developments. Hawaiian field workers average $23.98 per day, but they have a high output, owing to the use of mechanical aids.

* * *

Irrigation techniques in Hawaii. ANON. *Sugar y Azúcar*, 1966, **61**, (9), 38–40.—Irrigation of cane fields has increased steadily in Hawaii in recent years. By 1965 about 54% of the 232,598 acres cultivated was under irrigation. The different systems of irrigation in use, their advantages and disadvantages, are described. These are: the level ditch system, widely used in areas where the land is fairly level, the herring bone system, the continuous long line system with aluminium flumes, and overhead irrigation. The latter may be effected by small volume sprinklers, large volume sprinklers, or long-barrel sprinklers.

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Hawaii's mechanized field methods. A. D. STUBENBERG. *Sugar y Azúcar*, 1966, **61**, (9), 42–45.—In Hawaii field mechanization is well advanced and many millions of dollars have been spent on research in this field. With the varied terrain, soil, climate and cultural practice there is limited standardization and much "customized" equipment to fit individual plantations exists. Some of the latest types of equipment are described or illustrated with photographs, especially multi-row equipment. The following are discussed: soil preparation, mechanical seed harvesting, planting, replanting, fertilizing, irrigation, harvesting, transportation and dry cleaning.

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Work at the sugar cane experiment stations. ANON. *Bol. Azuc. Mex.*, 1966, (203), 20-23.—A brief account is given of work carried out or in progress at each of several different experiment stations, viz. Tapachula, Ameca-Tala, Metamoros, Papaloapan and Xicoténcatl.

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Better yields with better cultural practice. ANON. *Bol. Azuc. Mex.*, 1966, (203), 34–36.—A plea is put forward for better weed control and greater use of modern chemical weedkillers in sugar cane fields.

* * *

Bundaberg sugar growing areas and their prospects of irrigation. ANON. *Australian Sugar J.*, 1966, **58**, 243-247. Two drought years have drawn attention to the need for more irrigation in the Bundaberg area of Queensland, where rainfall is normally somewhat unpredictable and inadequate for sugar cane. Underground water supplies, already much used, may not be capable of much expansion. A comprehensive and costly project for supplying surface water for cane farming in six mill areas and for the city of Bundaberg is discussed.

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Sweetness comes to the eastern Transvaal. ANON. *S. African Sugar J.*, 1966, **50**, 716-725.—A description is given of developments and proposed developments in sugar cane cultivation in the eastern Transvaal, mainly in the vicinity of the Crocodile river which supplies water for irrigation, rainfall being inadequate and varying from 28 to 44 inches per annum. Overhead irrigation is to be extensively used, costing some growers up to R 300 (£150) per acre. A new mill and refinery has been erected a few miles from Malelane.

New cane cutting system illustrated to growers. ANON. *S. African Sugar J.*, 1966, **50**, 751–753.—An Australian method of cutting cane by hand, three rows at a time, the cane being laid out in a straight line to facilitate topping, was demonstrated at a field day at Shongweni in Zululand. Australian cane knives were used. An imported Australian push-pile cane grab was also demonstrated, loading on to a lorry and building a cane stack.

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Difficult transport problem solved. ANON. *S. African Sugar J.*, 1966, **50**, 755.—The recent building of a 2-ft gauge tramline route in 2½ months to transport cane from a 600 feet plateau is described. Pulled by a diesel loco, 20 tram trucks carry 100 tons of cane on each trip down the new line or 500 tons a day, each trip requiring about two hours. Reasons are given why the method is cheaper than other forms of transport.

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3½-acre irrigation dam sealed with PVC. ANON. *S. African Sugar J.*, 1966, **50**, 759.—Details are given of how a reservoir on porous soil and used for irrigating 2000 acres of cane in the eastern Transvaal, was successfully lined with PVC. 6½ tons of 12-gauge PVC were used, sheets being welded or joined by a special process. Costs compared with concrete lining are given.

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Assessing the economic merits of proposed irrigation schemes. G. TURCK. *S. African Sugar J.*, 1966, **50**, 771–783.—This article is intended to give the South African cane farmer some indication of the problems involved in the design of an irrigation project and to provide him with rule of thumb methods for arriving at a rough estimate of profitability. How greatly the cost of irrigation can vary is stressed.

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Sugar industry in western Uttar Pradesh. L. B. SWARUP. *Indian Sugar*, 1966, **16**, 321–325.—The deterioration that has taken place in recent years is discussed and the reasons for it. Suggestions for improving the industry are under 10 headings.

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Ratoon stunting disease of sugar cane in India. K. SINGH. *Indian Sugar*, 1966, **16**, 335–337.—The history of the disease in India is traced, it having been first recorded in Uttar Pradesh by S. J. P. CHILTON in 1956. The association of the disease with "running out" of certain varieties in India, such as Co 290 and Co 312 is discussed. A table shows the incidence of the disease in India according to States and varieties grown.

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Irrigation requirements of sugar cane in Uttar Pradesh. K. KAR and S. SINGH. *Indian Sugar*, 1966, **16**, 349–350.—Experiments to ascertain the number of irrigations required and the quantity of water at each irrigation indicated that the increase in yield was proportional to the number of irrigations given at 20-day intervals rather than to the quantity of water at each irrigation. A minimum of five irrigations was found necessary for raising a normal crop. Irrigation during germination (Mid-April) and another at tillering (early May) is regarded as essential.

* * *

Reducing frost damage to cane crops. C. WADDELL. *Producers' Rev.*, 1966, **56**, (7), 13, 85–87.—It is pointed out that cane varieties vary greatly in their resistance to frost but there is no completely frost-proof variety. The degree of resistance of different commercial varieties in Queensland is indicated. Helpful advice to growers under the headings of "long-term planning" and "short-term planning" is given.

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Mechanical stone removal and contour terracing. ANON. *Producers' Rev.*, 1966, **56**, (7), 14–16. The nuisance of stones in cane fields is stressed, particularly with increasing mechanization. Surface stones can result in costly breakages and maintenance to machinery, to say nothing of cane left in the field and damage to ratoon crops when the ground cutter of the harvesting machine has to be raised to avoid them. It is shown that a wide and competitive range of ingenious mechanical stone picking machines is available, some Australian-built models being illustrated. The value of collected stones for making banks for contours is pointed out.

* * *

Advantages of gated-pipe irrigation. N. J. KING. *Producers' Rev.*, 1966, **56**, (7), 19.—Results of work carried out at the Lower Burdekin Experiment Station are given. An overall saving of 36% water was registered by the gated-pipe method over the older conventional headland ditch method. The gated-pipe method is merely an aluminium fluming system, each length of the fluming being fitted with adjustable sliding gates which are the same distance apart as the rows in the field. Water flows from the underground main through a hydrant to which the gated pipe is attached.

* * *

Chemical control of the Childers cane grub by the use of BHC. J. ANDERSON. *Producers' Rev.*, 1966, **56**, (7), 39–45, 51.—The Childers cane grub (*Pseudholophylla furfuraca*) is an indigenous scrubland insect of Australia and is the chief insect pest of sugar cane in some districts, notably the Isis area. Trials showed that broadcast, ploughed-in applications of crude benzene hexachloride ("Lindane") reduced damage substantially. Broadcast application was more effective than drilling Cultivation practices should be combined with insecticidal control for best results. "Aldrin", "Dieldrin", "Heptachlor", "Chlordane" and "Telodrin" were unsuccessful in controlling the pest.

Safety cabins urged for tractors. W. F. BAILLIE and I. W. GREVIS-JAMES. *Producers' Rev.*, 1966, **56**, (8), 21.—In Australia there are about 100 deaths from tractor accidents annually and some 8000 serious non-fatal accidents. Many of these are in sugar cane areas. Recent investigations indicate that the greatest single step that could be taken towards reducing this toll of death and injury would be the universal fitting of approved, tested safety cabins. Such cabins are now compulsory in Sweden and have proved their worth.

* * *

Two-year cane varieties. ANON. *Producers' Rev.*, 1966, **56**, (8), 27.—In southern Queensland and northern New South Wales cane may be left for a second year before harvesting if growing conditions have been poor. Advantages and disadvantages (field problems) are pointed out. The main advantage of two-year harvesting is that it allows early harvesting at higher sugar content. There are some varieties that will stand over very successfully.

* * *

Residual effect of soil insecticides on legume growth. G. C. BIESKE and L. S. CHAPMAN. *Producers' Rev.*, 1966, **56**, (8), 37–38.—Plot trials to evaluate the effects of soil insecticides such as "Heptachlor" and BHC, as used for soldier fly control in Queensland, are described. No harmful effects were observed and it was concluded that in a normal cane cropping cycle insecticides applied prior to planting of the cane crop are not detrimental to legume crops grown in the next fallow period.

* * *

Two new varieties for Herbert River. ANON. *Producers' Rev.*, 1966, **56**, (8), 71.—Two new varieties released for planting in the Herbert River area of Queensland in 1966 are described. They are "Triton" and "Midas", each having its own special characteristics. "Triton" is a fast early grower and strong ratooner, well suited to the medium and poorer soils where it produces an erect crop well suited for mechanized harvesting. "Midas" is a late maturing variety suitable for medium and good soils. It is resistant to the major diseases.

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The distribution of L 60-25, the new variety for Louisiana. L. L. LAUDEN. *Sugar Bull.*, 1966, **44**, 344. Details are given of proposals for allocating available supplies of seed cane of this new variety among Louisiana's 2218 cane farmers. Hurricane Betsy was partly responsible for the restricted supplies.

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Per cent sugar cane mosaic found in Louisiana in 1965 and 1966 in commercial fields planted from rogued and nonrogued seed cane. R. J. STEIB and S. J. P. CHILTON. *Sugar Bull.*, 1966, **44**, 346–349. Data collected during two surveys showed that the rogueing programme undertaken by many growers was very effective in maintaining mosaic at a low level. Planters are urged to make every effort to keep mosaic under control until new, more resistant varieties, known to be "in the pipeline", become available.

* * *

Studies on drought resistance in sugar cane. M. T. CHEN and J. J. BOR. *Rpt. Taiwan Sugar Expt. Sta.*, 1966, (40), 1–34.—Studies on drought resistance in certain varieties of sugar cane carried out since 1960 at the Taichung sugar cane experiment station are recorded. Factors studied included morphology or anatomy, water equilibrium, growth habits and yield. Moisture content in the leaves of drought-resistant varieties was usually higher than that of susceptible varieties. It was found that the upper epidermal bulliform cell band in the leaf of drought-resistant varieties was usually narrower than in drought-susceptible varieties. It was concluded that actual resistance to drought should not be the sole factor in selecting varieties for non-irrigated areas but that growth habit, especially increase in stalk length during the rainy season, is an important factor to be considered.

* * *

A study of the yield of autumn planted sugar cane (variety N:Co 310) interplanted with other crops. F. Y. SHIA. *Rpt. Taiwan Sugar Expt. Sta.*, 1966, (40), 35–51.—The experiments discussed covered the period 1962–64, the intercrops in question being peanut, cotton, soy bean, rape seed and sweet potato. In the early stages of growth the sugar cane was affected in stalk length and number of tillers by all these crops, especially cotton and sweet potato. The number of millable cane stalks was reduced most by these two crops, cotton depressing yield the most.

* * *

A study of interplanting sweet potato with sugar cane. C. K. TANG. *Rpt. Taiwan Sugar Expt. Sta.*, 1966, (40), 71–92.—This consists of two separate papers entitled: (Part III) The interaction of sugar cane varieties and the interplanted crop (pp. 71–80) and (Part IV) The interplanting method of later fall crops (81–92). Yields of sweet potatoes, vines or tubers, were reduced by interplanting sugar cane. Rapid-growing varieties of cane and those that "close in" early affected sweet potato the most. In regard to later fall crops it is stated that sweet potato varieties with small, finger-shaped leaves and short creeping vines are the best suited for interplanting with sugar cane.

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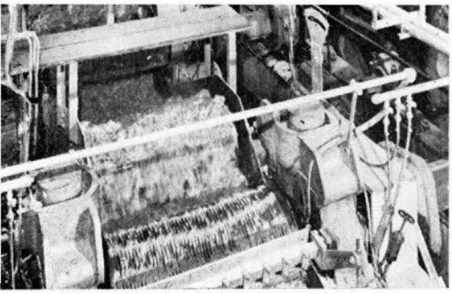
A study of the yields of the new sugar cane varieties F 146, F 148, and N:Co 310 in regard to different planting times, harvesting and ratooning. C. C. TSE and J. M. CHU. *Rpt. Taiwan Sugar Expt. Sta.*, 1966, (40), 93–112.—Under Taiwan conditions it is recommended that a combination of these three varieties gives favourable results, F 148 being an early variety, N:Co 310 a medium and F 146 a late variety. All have high sugar content. Characteristics of these varieties are given.



Cane sugar manufacture

Sugar technology progress. J. C. González Maíz. *Bol. Ofic. Asoc. Técn. Azuc. Cuba*, 1966, **21**, 7–14. Fields of Cuban study and accomplishment discussed in this review include mechanical harvesting and cane milling extraction, and a further list of 30 topics on which work is required in order to achieve the Cuban industry's proper place in advancing technical development is presented.

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Development of acidity and inversion in the clarifiers. W. R. Macallep, H. A. Cook and H. F. Bomonti. *Bol. Ofic. Asoc. Técn. Azuc. Cuba*, 1966, **21**, 73–96. See *I.S.J.*, 1925, **27**, 382–385.

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Rapid destruction of final molasses in storage. J. C. P. Chen. *Taiwan Sugar*, 1966, **13**, (4), 10–12, 17.—Rapid destruction of molasses in storage is discussed, with mention of the possible and known chemical reactions taking place and the various unusual phenomena associated with molasses deterioration, including froth fermentation, abnormal reddish coloration of molasses, high viscosities in low-grade boiling, sticky *A*-massecuites and greater quantities of *B*-molasses. The total nitrogen content is considered to be a useful indicator of possible danger of deterioration leading to rapid molasses destruction, and has been found to be much higher in deteriorating molasses, as shown in data collected from factories in different countries where cases of molasses destruction have occurred. Measures to prevent molasses destruction which are described include control of the temperature of molasses going to storage, ventilation of molasses tanks, continuous withdrawal of stale molasses from all tanks and continuous feeding of fresh molasses to all tanks.

* * *

How to measure and control liquid level. A. A. Troy. *Sugar J.* (La.), 1966, **29**, (4), 15–20.—Some of the more typical methods of measuring and controlling liquid level in cane sugar factories are described. These include the float-type system; the displacement-type system, in which a metal cylinder moves freely up and down over a short travel inside a housing; the static pressure method, which is applicable to open vessels under atmospheric pressure and to closed vessels under vacuum or pressure other than atmospheric; and the electrode method, which uses the electrical conductance of the liquid. Possible applications are described with the aid of diagrams showing typical arrangements.

Cane payment systems in the United Arab Republic. I. B. Sabri. *Sugar J.* (La.), 1966, **29**, (4), 22–25.—The cane payment system that has been used since 1956/57 is described. The nominal price is £E 2·333 per ton of cane for authorized varieties (factories can refuse cane of unauthorized varieties) having a total trash content of up to 2% and giving juice purities in the range 75–85. Deductions are made for higher trash contents, for burnt cane (irrespective of juice quality), and for lower purities, while premiums are paid for correspondingly better factors. Cane having juice of purity less than 60 is paid for on the basis of the calorific value of the fibre content. The juice sampling method is standard for all mills; it involves the use of two electrically-driven 3-roller pilot-scale mills arranged in series, each mill having rollers 400 mm long by 270 mm diameter. The mill speed is 4·5 r.p.m. and the mill openings are 4/2 mm for the first mill and 2/0 mm for the second. The mills were developed and constructed by the Société des Sucreries et de Distillerie d'Egypte. The cane fibre content is determined by daily analysis for each variety and the average figure for a given 10-day period is applied to all supplies during the next ten days, as also is the case with trash content. Although the number of daily samples ranges from 500 for a 4500 t.c.d. factory to 1200 for a 9000 t.c.d. factory, involving considerable expense and volume of work, the system has contributed greatly to an increase in cane quality and in sugar yield.

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Some operating aspects of ring diffusion. J. Dornier. *Sugar J.* (La.), 1966, **29**, (4), 41–44.—Details are given of the Silver Engineering Works "Cane Buster" preparation equipment, a specially-designed hammer mill which reduces cane to bundles of fibres 3–5 inches long. From this equipment the prepared cane is conveyed to a fiberizer by means of a drag conveyor and thence to the Silver ring diffuser. The "Buster" may be replaced by two sets of knives or one set of knives and a shredder without fear of reduction in extraction. A description is given of the ring diffuser, use of which at Pioneer Mill, Hawaii, has resulted in production of raw sugar which is of good enough quality to get a premium for filtrability while also having a good colour. Three possible methods of drying bagasse from the diffuser involve: (i) two mills in series, (ii) a French press and (iii) the Silver cone press. Each gives a final bagasse moisture content of about 47%. The press water is returned to diffusion after treatment using DSM screens. A minimum increase of 8–12 lb of sugar per ton of cane has been achieved over a period of 14 months, the 3600 t.c.d. diffuser at Pioneer achieving almost 97·5% extraction. This higher extraction gives in addition a greater molasses yield on cane weight. The approximate power consumption is 107 h.p. per ton of cane per hour, excluding presses or mills for bagasse drying, and the diffuser requires little maintenance.

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Réunion's automated sugar silo. ANON. *Sugar y Azúcar*, 1966, **61**, (10), 44.—A brief description is given of the 40,000-ton capacity bulk sugar silo at Pointe des Galets, in Réunion, which can receive sugar at 200 tons/hr and from which sugar can be loaded into ships at 400 tons/hr. A further silo is being planned to bring the total capacity of the installation to 140,000 tons. This will be connected to the existing silo and will use the same equipment and personnel.

* * *

New factory designed to process 2200 tons eventually. ANON. *S. African Sugar J.*, 1966, **50**, 851, 859. Details are given of the new Sucoma (Sugar Corporation of Malawi) sugar factory located near Nchalo, Malawi. Designed for an ultimate crushing capacity of 2200 t.c.d., its initial throughput is only 900 t.c.d. It uses a De Smet diffuser and will produce 65% raw sugar and 35% refined white sugar by the phosphate-defecation process. Provision is made for melting of *A*-raw sugar for refining where required and of *B*- and *C*-sugars for making magma.

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Potrero: in the line of progress. ANON. *Bol. Azuc. Mex.*, 1966, (204), 26–29.—A brief illustrated account is given of the factory equipment and comparative results for 1944/45, 1954/55 and 1964/65.

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Automatic cane carrier control by cane weight. ANON. *Sugar J.* (La.), 1966, **29**, (5), 42.—The cane is brought by a feed table driven by a variable speed motor which discharges onto an auxiliary carrier on which are mounted the levelling knives. This discharges onto the main carrier which carries the heavy-duty preparation knives and feeds the mill. In order to maintain a continuous and even flow on the main carrier a section of the auxiliary carrier floats on a number of hydraulic load cells which weigh the cane and produce a signal which is transmitted to the variable speed motor for the feed table. The speed is varied to bring the cane feed slightly above a pre-set datum. This coarse control is backed up by a fine control which is operated by cane blanket depth sensers on the main carrier which govern the control for the variable speed motor on the auxiliary carrier.

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Relation of pith in sugar cane to yields of cane and sugar. L. G. DAVIDSON. *Sugar y Azúcar*, 1966, **61**, (11), 54–55.—Pith, as defined, is the white, low-density, low moisture content tissue present mainly in the upper internodes of the cane stalk. It is usually absent or present in only very small quantities in Louisiana cane, and experiments were made during the 1965 crop to determine the effect of pith on millable stalk density, as well as its moisture and sucrose contents, examining sections of five different cane varieties. The results are tabulated and discussed. Although the pith may occupy 40% of the stalk diameter in some sections, this corresponds to only 16% of the area, and the pith does not extend into the internodes, while it is found in lesser amounts below 30 in and above 75 in from the butt. The average volume found was only 6·8% while the weight % cane was only 2·7%. This amount of pith reduced the estimated sugar recovery by 3·2 lb/ton of cane on average, and also reduced the weight of the cane by 4·4% by volume, which would increase transport costs.

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Sugar factory lubrication: an attempt at standardization. G. K. CHETTY. *Indian Sugar*, 1966, **16**, 463–464. A survey is made of the types of lubricants necessary for sugar factory lubrication as supplied by three companies, and suggestions made whereby these ranges, of 12, 10 and 10 grades, respectively, can be reduced to 5.

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Corrosion in evaporator tubes. M. P. MATHUR. *Indian Sugar*, 1966, **16**, 465.—Three causes of corrosion of copper evaporator tubes are briefly discussed with suggested remedies.

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Boiler design and selection in the cane sugar industry. N. MAGASINER. *Proc. 40th Congr. S. African Sugar Tech. Assoc.*, 1966, 29–63.—A survey is presented of the properties and uses of steam, of the fuels available to the South African sugar industry and of combustion and combustion equipment. Fundamental heat transfer relationships are discussed, with emphasis on the analogy between fluid friction and heat transfer and on circulation in a boiler. Aspects of boiler design are tabulated and discussed, with individual accounts given of the combustion chamber, superheater, convection surface, etc., a number of designs being illustrated.

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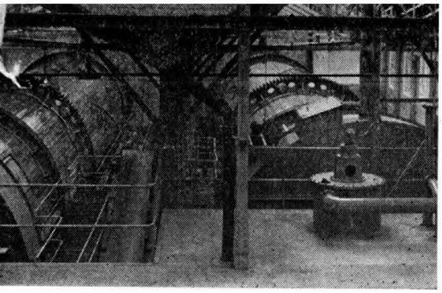
Steam turbines—their construction, selection and operation. W. B. JACHENS. *Proc. 40th Congr. S. African Sugar Tech. Assoc.*, 1966, 113–131.—A detailed account is given of turbines, including the theory, types of turbine and the thermodynamics of steam turbine elements. Differences between and characteristics of reaction turbines and pressure-compounded turbines are described and selection among the four basic types considered. Other factors reviewed include turbine reduction gears and turbine standardization. Turbine operation is discussed in respect of turbine performance at varying loads, lubrication, governors and governor gear, supervision, instruments and causes of failure.



Beet sugar manufacture

Some general principles of lime-carbon dioxide purification in the sugar industry. J. HENRY. *Sucr. Belge*, 1966, **86,** 1–9.—The purposes served by the four basic stages in juice purification (pre-liming, main liming, first and second carbonatation) are discussed individually and the basic principles governing the processes are explained with 18 references to the literature.

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The Steffen method of sugar extraction from molasses. M. RUCIRETA. *Ind. Sacc. Ital.*, 1966, **59,** 169–175. The reactions occurring in the Steffen process are discussed and laboratory studies on two suggested extraction schemes are reported in which analyses of liquors, precipitates and washes at each stage are used to calculate the potential recoveries. To obtain good extraction, the molasses should be diluted to about 9°Bx and the solution cooled to 4°C. The powdered CaO should be of optimum quality and should be added carefully to avoid local over-addition but in a maximum time of 12 min and with agitation. The suspension, which should have a maximum temperature of 15°C, should be filtered quickly. The cake of tricalcium saccharate is suspended in water, heated to 85°C and saturated with CO_2 to give a mud and a sugar juice, while the filtrate is heated to 92°C when mono/dibasic calcium saccharate is precipitated This is filtered and washed to give a final mother liquor and then suspended in water, and saturated with CO_2 to give a mud and a sugar juice. The second process is the same as the first except that an inert substance is added to the mother liquor from the tricalcium saccharate cake. This is in order to improve the physical state of the mono/dicalcium saccharate precipitate obtained on heating to 92°C, making it more easily suspendable in water.

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Tests on a BMA clarifier at a factory using a standard juice purification scheme. V. A. ZAMBROVSKII, B. I. KATS, O. V. STRATIENKO and S. L. SHOIKHET. *Sakhar. Prom.*, 1966, **40,** (9), 24–26.—Advantages of the BMA clarifier (in which carbonatation juice is fed individually to each compartment, the clear juice withdrawn through tubes at the periphery of the compartments and the thickened muds separately from each compartment) over a model produced by the Rostov machine plant are discussed. In tests at Maloviskovskii sugar factory, 1st carbonatation juice had approximately the same alkalinity after clarification in the BMA model as before, the pH fell slightly to 10·7, while the colour rose from 11·9°St to 16·7°St. The ratio of the CaO content in the thickened mud to that in the untreated juice was 5·8, permitting good filtration of the muds in vacuum filters. The clear juice was transparent and contained 0·34 g of suspended particles per litre. No filtration was required before 2nd carbonatation, during which no colour increase occurred. The 2nd carbonatation juice was easily filtered. Throughput of the three clarifiers used in the tests is calculated at an equivalent of 1300 tons of beet per day, assuming the third clarifier uses only three of the five compartments, as suggested by BMA. Some modifications to the clarifier are proposed.

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Classification of beet pilers. V. A. NOVIKOV, N. M. KICHIGIN and N. I. KHISUD. *Sakhar. Prom.*, 1966, **40,** (9), 29–34.—The various commercial types of beet pilers used in the Soviet Union are discussed and the proportions of these that satisfy certain listed requirements (either completely or only partially) are tabulated. Proposals, covering three basic piler specifications worked out, on the basis of two Soviet models, by the Sugar Industry Research Institute for the 1966–70 period, are detailed.

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A classifier for waste from the (beet) washer section. F. G. ZHUKOVSKII. *Sakhar. Prom.*, 1966, **40,** (9), 38–41.—Details are given of a classifier designed by the author for sorting beet tails, pieces, trash and other debris separated from the beet tail catcher. It comprises an endless downward sloping frame rotating opposite the flow of beet waste which is thrown from the tail catcher onto the frame via a rotary rake. Beet tails and large fragments fall onto a screw conveyor taking them to be processed with whole beets, while the other debris falls through the frame and down a chute to a mixer which sends it to the pulp troughs. Should the mixer stop, the waste is sent to an upward sloping conveyor which carries it to a hopper in the beet yard.

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The storage tank as second degree purification of sugar factory waste waters. S. GÓRSKA and B. MAZUR. *Gaz. Cukr.*, 1966, **74,** 189–190.—Experience at Ostrowice sugar factory in effluent treatment has shown that biological purification in a storage tank reduced the BOD_5 from 2500 mg/litre O_2 during the 1964/65 campaign to 803 mg/litre O_2 in April 1965 and 57·4 mg/litre O_2 in August 1965, while the oxidizability was reduced from 2000 mg/litre O_2 to 67 and 46·8 mg/litre O_2 in April and August 1965. The pH increased from 5·5–6·3 to 6·8 and 8·25 in these two months, respectively.

The DDS diffuser in the service of the food industry. H. Brüniche-Olsen. *Abs. of papers presented to 2nd Intern. Congr. Food Sci. Technol.* (Warsaw), 1966, 288–289.—A description is given of the DDS diffuser with details of the process as carried out in a beet sugar factory. Its use in the cane sugar industry is also mentioned.

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Filtration of juices. S. Zagrodzki and S. Zagrodzki. *Abs. of papers presented to 2nd Intern. Congr. Food Sci. Technol.* (Warsaw), 1966, 305.—Tests were carried out on beet juices to determine the optimal conditions of filtration and to select a suitable apparatus for sludge sedimentation and juice filtration. The effect of pressure (1–7 kg/sq.cm.) on the filtration rate was studied by measuring the flow time of 100 ml of filtrate. The relationship between filtration rate and juice alkalinity was determined. The filtration rate was also investigated with diffusion juices of varying purities extracted at a constant temperature of 72°C during process times in the range 70–120 min. In other tests the extraction time was constant at 70 min, while the temperature was varied. The resultant juices were purified under identical conditions. The rate of sedimentation and filtration of the purified juices as dependent on diffusion conditions and raw juice purity were investigated. These tests permitted the effect of juice and mud qualities on the filtration rate to be determined independently. A pressure-vacuum filter was developed and tested on laboratory and pilot-plant scales. The results gave those pressure filtration and diffusion conditions which would give optimum settling and filtration rates.

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Effect of liming on purification of flume-wash waters. L. S. Tverdokhlebov. *Sakhar. Prom.*, 1966, **40**, (10), 18–20.—The positive effect of liming on flume-wash water is discussed with a brief review of the literature. At Korenovsk sugar factory, where in 1963/64 flume-wash water was treated with the residue from the milk-of-lime hydrocyclones, laboratory studies with a 200-mm high column of 30 mm diameter showed that the initial pH of the untreated water has a decisive effect on the mud settling rate and volume of purified water. The optimum pH was found to be 11–12, at which the settling rate was 5·0 cm/min, compared with 0·9 cm/min at pH 8·9, and after 25 min only 8·5% of the initial water (expressed as height) was still unpurified compared with 93·5% at pH 8–9. At pH 12 and above, the settling rate was 30·5 cm/min and only 9·5% of the initial water remained unpurified after 2 min, this percentage falling only very slowly thereafter, reaching 6·75% after 25 min.

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Use of hydrocyclones for purifying flume-wash water. Z. S. Shlipchenko, I. K. Motuz and N. G. Kresan. *Sakhar. Prom.*, 1966, **40**, (10), 21–27.—Tests on flume-wash water purification in a battery of eight hydrocyclones gave results almost identical with those of experiments with a single hydrocyclone, viz. an optimal overflow discharge tube length of 335 mm in the top section of the hydrocyclone, a mud discharge nozzle dia. of 35–40 mm, and a feed pressure of 2 atm. Under these conditions, throughput reached 130 cu.m./hr and the amount of undiluted mud constituted 19% on weight of beet. However, the purification effect was only 39% compared with efficiencies of 80–95% obtained elsewhere. Among recommendations offered regarding means of increasing the efficiency are the omission of sand traps before the hydrocyclones (these remove solids which are considered necessary for efficient purification) and the installation of clarifiers for further treatment after the hydrocyclones.

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Choice of type of centrifugal separator for improving steam quality. Yu. S. Rubinov. *Sakhar. Prom.*, 1966, **40**, (10), 27–30.—The use of centrifugal separators in boilers to prevent foaming and scaling is discussed, and the advantages and disadvantages of the intra-drum and side separators dealt with.

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Concentration of middle product massecuite. G. N. Mikhatova. *Sakhar. Prom.*, 1966, **40**, (10), 32–33. Equations are presented for calculation of the Brix to which the middle product massecuite should be concentrated in order to yield, when cured, a syrup suitable for low-grade boiling, which would permit adequate molasses exhaustion without the need for molasses recirculation. The calculations require knowledge of the middle-product purity, sucrose solubility at the curing temperature and the required purity and Brix of the run-off.

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Experience in obtaining high-quality beet cossettes. A. Sherman. *Sakhar. Prom.*, 1966, **40**, (10), 34–35. Details are given of the techniques used at Krasnoselkovskii sugar factory to improve beet washing and slicing. The modifications resulted in cossettes characterized by length 25·4–29·0 m/100 g and with mush contents of 1·3–2·7% and in 1964/65 the sugar losses were below the expected figure, sugar yield being 15·66%.

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Improving certain types of (sugar factory) equipment. A. I. Kasap. *Sakhar. Prom.*, 1966, **40**, (10), 36–37. The modifications described relate to beet pulp conveyors, lime kiln skip hoists and carbonatation gas scrubbers.

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Level controls—indispensable measures for partial or complete automation in sugar factories. J. Böhme. *Zucker*, 1966, **19**, 510–519.—See *I.S.J.*, 1965, **67**, 151.

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Biological waste water purification with "Mammoth" rotors. J. Muskat. *Zucker*, 1966, **19**, 549–552.—The use of "Mammoth" plate rotors[1], which consist of rigid, relatively wide paddles arranged in rows along

[1] Passavant-Werke, Michelbach, Germany.

a roller, giving the appearance of a rotary brush, for aeration of waste water is discussed. They are claimed to open up new prospects for treatment of waste water and to ensure not only large-scale aeration but also complete mixing of waste water with active sludge. A unit 7·5 m long and of 2 m diameter is claimed to provide partial purification for a population of 85,000, complete purification for 36,000 and mud stabilization for 20,000 population.

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Oxygen removal from the steam circuit of a boiler plant. H. ANDERS. *Zucker*, 1966, **19**, 552–554.—The use of hydrazine as a reducing agent to remove oxygen from boiler feed water and condensate is discussed with information on the mechanism of the process and the chemical properties of hydrazine. A photometric method and a rapid colorimetric method for determining the residual oxygen in water or condensate from the hydrazine usage are described.

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White sugar conveying by fluidization. L. NEUŽIL, M. HRDINA and V. VALTER. *Listy Cukr.*, 1966, **82**, 220–229 and inside front cover.—Laboratory tests were conducted on conveying of white sugar along a slightly sloping grid over an air cushion. Mathematical expressions were derived connecting relative air flow rate (W), the ratio between actual air flow rate and the linear rate of fluidization, the angle of slope of the grid (β) in the range 0·5–3·0° from the horizontal, and the flow rate of the fluidized bed. An equation was also derived for calculation of the critical depth of the sugar layer (h_k), based on the assumption that h_k corresponds to a constant Reynolds number. At higher values of W, with the depth of the bed (h) equal to or less than h_k, the flow rate of the fluidized bed was also higher. For values of h greater than h_k, the air flow rate had little effect on the fluidized bed flow rate, while the values of h_k fell with higher air flow rates. Equations were also developed for calculations of the loading on the grid (material flow/width of fluidized bed), demonstrating its dependence on the depth of the fluidized bed and the angle of slope of the grid. A nomogram is given based on the equations. The advantages claimed for fluidization conveying are low operating costs and absence of crystal damage. Sugar of insufficient fineness can be removed and the sugar may be cooled or heated during transport.

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Optimum temperatures for sugar crystallization and curing. Z. NITSCHKE. *Gaz. Cukr.*, 1966, **74**, 185–189, 215–218.—Data from the literature (63 references) are cited in a study of the effect of temperature on various parameters in boiling, crystallization and curing. To obtain a maximum crystallization rate with minimum false grain formation, undetermined losses, colour formation and steam usage, 1st massecuites should be boiled at approx. 75°C, 2nd massecuite at approx. 80°C, and 3rd massecuites initially at approx. 80°C and subsequently reducing to 70°C about half-way through the boiling, after which it should be held at this temperature. The temperature of the syrup fed to the pans should be about 2–3°C higher than that of the massecuite when dropped. Should the purity of the mother liquor in 2nd massecuite be excessively high, the massecuite should be cooled in crystallizers to 65°C at the rate of about 1·2°C/hr. For cooling of 3rd massecuite, the non-sugars: water ratio should be about 2·75 and the cooling rate should be 0·5°C/hr. To obtain white sugar with a minimum colour content, 1st massecuite should be spun (immediately after a homogeneous mass is produced in the crystallizers) at 70°–80°C (preferably 75°C), the temperature being maintained in the final curing stage by introducing steam at 150°–160°C. Second massecuite should be cured at approx. 65°C, and third massecuite at a temperature corresponding to a molasses viscosity of 44 poises. For washing of 2nd product sugar it is preferable to add small quantities of water of higher temperature (e.g. 90°C) rather than larger quantities of water of lower temperature (e.g. 40°C), while 3rd product sugar should be washed with molasses of 81–83°Bx heated to 80°C. However, it should be remembered that this may possibly raise molasses purity by about 0·2 units.

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(Beet) Quality for processing. A. CARRUTHERS. *J. Nat. Inst. Agric. Bot.*, 1963, **9**, 427–431; through *S.I.A.*, 1966, **28**, Abs. 648.—The use of the "Impurity Value" technique[1] for the estimation of thick juice purity from analysis of beet macerates is discussed. The relationship between Impurity Value (or impurity factor) I_v and the thick juice purity P is the same in all countries of north-west Europe, with a maximum deviation of about ±0·5 purity units: $P = 98{\cdot}5 - 0{\cdot}000831\ I_v$. Beets delivered to some British factories have an unusually high content of impurities.

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Method of using third product raw sugar, without affination, in the form of a crystal mass as a basis for second product massecuite. T. ELEK. *Ind. Alimentara*, 1965, **16**, 632–636; through *S.I.A.*, 1966, **28**, Abs. 662. Low grade sugar is diluted with approx. 18% of thin juice and used as a footing for the 2nd product massecuite. Both 1st and 2nd product sugars are melted for the boiling of a cube sugar massecuite and the run-off from the latter is boiled to a white sugar massecuite. The new process is claimed to give savings in fuel and plant compared with the normal method. Some calculations of mass balance are given.

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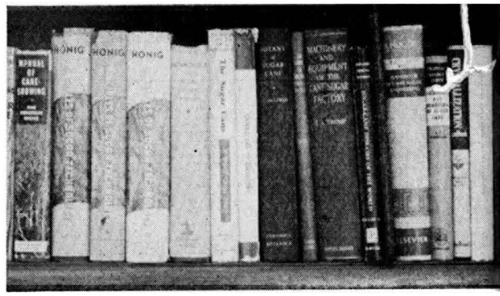
Control of sugar factory centrifugals. M. DELBOE. *Prévention et Sécurité du Travail*, 1965, (2), 22–28; through *S.I.A.*, 1966, **28**, Abs. 729.—Two centrifugal explosions in France in 1961 and 1962 caused the deaths of three workers. They were due to tensional corrosion and a flaw in the metal, respectively. A 3-monthly inspection is recommended, with a 2-yearly overhaul. A list of inspection points is given.

[1] *I.S.J.*, 1961, **63**, 72–74, 103–105, 137–139.

New books



Physiological fundamentals of increasing the sugar content of sugar beet. A. S. OKANENKO. 312 pp.; $6 \times 8\frac{3}{4}$ in. ("Naukova Dumka", Repina 3, Kiev, U.S.S.R.) 1966.

This book has been prompted by the increased sugar production envisaged under the present Five-Year-Plan, whereby beet production is to be increased to an annual 80 million tons. In view of the somewhat poor sugar yield per ha in the Soviet Union, it is obvious that it will be necessary also to increase the sugar content of the beet. The subject of the mechanism of sugar formation and accumulation in beet is covered by 14 sections dealing with the evolution of wild and cultivated beet; sugar formation and transfer of the carbohydrates during growth; migration of the sugars; the rôle of leaves and roots in increasing the sugar accumulation; fermentation synthesis and hydrolysis of sucrose; the sugar content and physiology of various hybrids, including F_2 and F_3, and of polyploids; photosynthesis; and other aspects such as the effect of climate on growth, sugar content and storage of beet. The book concludes with a bibliography containing 333 entries. Unfortunately, the value that the book has outside the U.S.S.R. will be limited by the language in which it is written (Ukrainian).

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Colour atlas of the diseases and pests of the sugar beet. H. LÜDECKE and C. WINNER. 184 pp.; $5 \times 7\frac{3}{4}$ in. (DLG-Verlags-G.m.b.H., Rüsterstrasse 13, Frankfurt/Main, Germany.) 1966. Price: DM.32; 58s 0d.

It is pleasing to welcome this second enlarged and improved edition of this useful book on the diseases and pests of sugar beet, which has now been brought thoroughly up to date. The greater part of the book consists of colour photographs showing the disease or pest or its effect on the sugar beet plant. There are 145 of these photographs which are of a high order and should enable a beet grower or anyone concerned with the sugar beet growing industry to recognize or identify most of the ills that affect sugar beet, at any rate in European countries.

The descriptions of the photographs are given in four languages—German, English, French and Spanish—and the scientific name of the organism concerned is given in each case. The inclusion of Spanish is another desirable new feature in this edition. A reader does not need to have a knowledge of German in order to interpret the colour photographs. In the main text, which occupies 87 pages and is in German, there are brief notes on the main fungal diseases that may attack the sugar beet seedling and different parts of the mature plant. There is also information (with colour photographs) on virus, bacterial, and mineral deficiency diseases, as well as on injury caused by frost or cold. Those diseases causing symptoms which may look somewhat similar outwardly are illustrated next to one another to facilitate correct identification. Insect or animal pests discussed or illustrated include nematodes or eelworms, white grubs, pegomy fly, springtails, various beetles, moths and other insects.

A useful feature of the book is the index of scientific names and of common names in the four languages mentioned. The price is not unduly high under present conditions and having regard to the large number of coloured plates that are included. This little book bears the hallmark of authority and reliability, the authors being well-known scientists concerned with sugar beet cultivation in Germany.

F.N.H.

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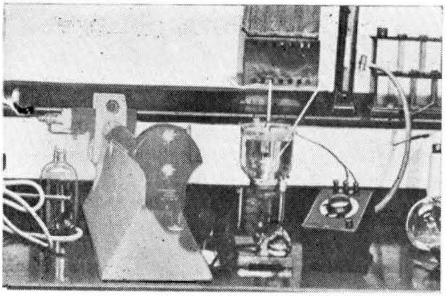
Uganda. 27 pp.; 6×8 in. (Barclays Bank D.C.O., 54 Lombard St., London E.C.3, England.) 1967.

This economic survey of Uganda contains an abundance of useful information which is clearly presented. The sugar industry is comparatively small, comprising two companies, both Asian-owned: Madhvani Sugar Works Ltd., which operates a factory at Jinja, and Uganda Sugar Factory Ltd., which operates a factory at Lugazi and one at Sango Bay. Yields vary from 2·3 to 4 tons of white sugar per acre and production has risen from 54,623 tons in 1950 to 127,000 tons in 1965, while local consumption has increased from 19,250 tons to 82,042 tons in the same period. The bulk of the exportable surplus goes to Kenya and a small amount to the Congo Republic. It is pointed out that by law no land can be alienated from African ownership unless it is to the direct benefit of the native population; hence, since the two sugar companies cannot obtain more land, in order to meet the increasing sugar demand they are endeavouring to encourage cane growing by estates and peasant farmers, and are also experimenting with irrigation methods.



Laboratory methods & Chemical reports

Melassigenic coefficients of individual non-sugars. N. P. SILINA. *Sakhar. Prom.*, 1966, **40**, (9), 15–18. Since the formula for calculating the melassigenic coefficient (m), $m = \frac{\text{purity}}{100 - \text{purity}}$, assumes that only non-sugars are responsible for sucrose retention in molasses, whereas water can also be regarded as melassigenic, it is considered preferable to calculate the melassigenic properties of non-sugars in terms of the specific melassigenic coefficient (μ), which is specific for a given non-sugar composition and denotes changes in sucrose solubility. It value is given by

$$\mu = m_n - 2{\cdot}37 \frac{(m_n + 1)(100 - Bx_n)}{Bx_n}$$

where m_n = melassigenic coefficient of a given non-sugar, 2·37 = sucrose solubility at 40°C, and Bx_n = standard molasses Brix. Comparison of values of m, μ and ($m - \mu$) for molasses from various Soviet sugar factories shows that the change in sucrose solubility per g of non-sugar is considerably smaller than the amount of sucrose which would be dissolved in water per g of non-sugar, particularly in the case of low purity molasses, so that a reduction in molasses water content is of primary importance in increasing molasses exhaustion. Values of m obtained by Z. A. SILINA[1] and KHVALKOVSKII[2,3] for various non-sugars added to molasses are tabulated, as are calculated values of μ obtained from the data. The values of μ, which agree well, in many instances are negative, while most values of m are positive. Where this is so, it is concluded that the salting-out effect of the particular non-sugar was not marked because it was masked by the solvent action of water and that in the original molasses the non-sugar was either present in only a small quantity or was absent. Values of μ for water-sucrose-nonsugar systems, calculated from data obtained by MOEBES[4] and LEBEDEV[5] for a non-sugar concentration approx. the same as that used by SILINA and KHVALKOVSKII, are also tabulated and in some cases compare well with the other data. On the other hand, comparison of the μ values with values of 2·37b (b is a constant for a given non-sugar and has been proposed by VAVRINECZ[6] as a guide to the melassigenic properties of non-sugars) show good agreement only where the salts have a weak salting-out effect, while in the other cases μ has a value smaller than that of 2·37b.

* * *

Sucrose crystallization in the presence of nonsugars. R. BRETSCHNEIDER and P. KADLEC. *Listy Cukr.*, 1966, **82**, 202–205.—Crystallographic studies were made on the growth of sucrose crystals in the presence of potassium carbonate and nitrate, sodium carbonate, ammonium phosphate, calcium chloride, sodium chloride, invert sugar, glutamic aicd, aspartic acid, betaine hydrochloride and magnesium chloride, respectively. The sizes and weights of the sucrose crystals are tabulated together with values of the growth rate constant K. While it was found that the nonsugars affected the growth rate of the sucrose crystals, the investigations failed to show whether they also affected the form of the crystals.

* * *

Studies on the filtrability of Indian raw sugars. S. B. PENDSE, K. C. GUPTA, S. BOSE and S. MUKHERJEE. *Indian Sugar*, 1966, **16**, 329–331.—The filtrabilities of 19 raw sugar samples from different regions were determined as were the starch, wax, silica and phosphate contents. The degrees of correlation between the filtrability and these factors were: (i) starch content —0·584, (ii) wax —0·789, (iii) silica —0·767, and (iv) phosphate —0·467. These compare with corresponding values of —0·535, —0·716, —0·757 and —0·746, found by YAMANE *et al.*[7] using somewhat different techniques. It is shown that poor filtrability of Indian raw sugar cannot be ascribed to any one impurity but is an additive effect of all the filtration-impeding substances.

* * *

Perfected method of characterization of white sugar by means of potassium permanganate. A. PASETTI. *Ind. Sacc. Ital.*, 1966, **59**, 176–180.—A method for evaluation of white sugar is described based on the time required for decolorization of potassium permanganate, containing a small amount of acetic acid. The procedure includes dissolving 50 g of sugar in 50 c.c. of distilled water in a 150-c.c. beaker and heating in a water bath to 70°C, at which it is maintained. Also in the bath are test tubes containing respectively 1 c.c. of N/10 permanganate and 0·5 c.c. of acetic acid. These are mixed and added to the sugar solution, and the time in minutes recorded from the addition to the disappearance of the violet colour.

[1] *Trudy Leningrad. Tekhnol. Inst. Pishch. Prom.*, 1949, **9**, (1); *see also I.S.J.*, 1964, **66**, 254–258.
[2] *I.S.J.*, 1965, **67**, 90.
[3] Dissertation. Voronezh, 1965.
[4] *I.S.J.*, 1959, **61**, 182.
[5] Izb. raboty po tekhnol. i khimii brod. i sakhar. proizvod. (Selected works on the technology and chemistry of yeast and sugar production.) Pishcheprom. 1958.
[6] *I.S.J.*, 1966, **68**, 91.
[7] *I.S.J.*, 1965, **67**, 333–337.

Spectrophotometric study of colouring substances adsorbed by active carbons. L. G. VORONA, A. K. KARTASHOV and G. P. PUSTOKHOD. *Sakhar. Prom.*, 1966, **40,** (9), 19–21.—Changes occurring in water-sucrose-colouring substance-nonsugar systems after active carbon treatment were studied spectrophotometrically. In the case of a solution containing hexose alkaline decomposition products a maximum at 262 mμ was unchanged, while a minimum at 230 mμ shifted to 245 mμ. Alteration in the configuration indicated a qualitative change in the system as well as a change in the nonsugars ratio. The band for a solution containing melanoidins had maxima at 280 and 237 mμ before carbon treatment, whereas after treatment the absorption band had a range of 245–265 mμ and a maximum occurred only in the short-wave spectrum. The same picture applied to a solution containing caramels, which had a band with maxima at 285, 253 and 237 mμ before treatment, and a band of 240–280 mμ with one slight maximum at 270 mμ after treatment. It is concluded that these two contained identical nonsugars which were not easily adsorbed by active carbon. A curve for a solution containing a mixture of all three colouring groups had had two maxima at 275 and 235 mμ but only one at 260 mμ after treatment. The change in configuration was a result, it is suggested, of the dominant effect of hexose alkaline decomposition products. In all cases the changes in the curves were attributed to removal of some of the nonsugars. Comparison of the curves for aqueous solutions of the colouring substances with those for aqueous solutions of the same substances desorbed from active carbon by elution with pyridine, evaporation, distillation and filtration through kieselguhr, showed almost identical configurations for each substance, the curves for alkaline decomposition products and melanoidins having similar forms, while that for caramels was markedly different. It is thus concluded that colouring matter adsorption by active carbon is molecular in character, so that thermal regeneration of active carbon is sufficient and chemical regeneration can be omitted.

* * *

Aspects of the analytical application of complexes formed by glucose and fructose with borate, molybdate and basic lead acetate in the polarimetric determination of sucrose. M. FRIML and R. ČEJKOVÁ. *Listy Cukr.*, 1966, **82,** 198–202.

The effect of borax on sucrose determination in cane molasses in the presence of invert sugar was examined with seven different polarimetric methods. Of these, the JACKSON & GILLIS double polarization method with acid inversion[3] gave the highest value, while direct polarization after clarification with basic lead nitrate gave the lowest value. The difference between the values given by direct polarization after clarification with basic lead acetate and basic lead nitrate averaged 0·16% absolute; this was reduced to 0·04% absolute when borax was added, which increased the polarization in all cases and gave values closer to the true sucrose content, the average value being 45·28 with borax plus basic lead acetate clarification compared with 46·27% true sucrose content. The use of borax is therefore recommended as a control measure for commercial analysis.

Tests with glucose and fructose solutions, respectively, showed that addition of ammonium molybdate before polarization had a reducing effect on the specific rotation, the extent of the reduction decreasing with increase in the sugar concentration. At concentrations of 0·5–4·0 g fructose, a minimum value was reached after which it remained constant, this constant value being approx. the same for all fructose concentrations. On the other hand, basic lead acetate caused an almost linear reduction in the specific rotation of fructose. The amounts of molybdate and acetate used were in the range 1–9 g/100 ml.

* * *

A laboratory method of estimating useful fibre in bagasse. N. D. MISRA and K. S. V. IYENGAR. *Indian Pulp & Paper*, 1965, **20,** 131–132; through *S.I.A.*, 1966, **28,** Abs. 585.—Bagasse (25 g dry weight) in 2·5 litres of water is treated at 3000 r.p.m. in a PMA disintegrator for 33·3 min. The material is then washed gently in small batches over a 1·5-mm round-hole sieve, and the pith and fine fibre are separated from the washings over a 250-mesh sieve. The fibre is disintegrated again at 1% in water for 22 min and further pith is washed out. Sample results show that the Horkel depithing process[1] increases useful fibre from ~52% to ~67%. An accuracy of ± 5% is claimed. Depithing methods and the importance of fibre analysis are briefly discussed.

* * *

Spectrophotometric determination using anthrone for sugars separated by cellulose thin-layer chromatography. D. W. VOMHOF, J. TRUITT and T. C. TUCKER. *J. Chromatogr.*, 1966, **21,** 335–337; through *S.I.A.*, 1966, **28,** Abs. 601.—Sugars were separated on a cellulose thin-layer plate[2]. Sections of the cellulose layer each containing one sugar were transferred to test tubes. The sugar was eluted with 90–95% acetone, and the filtrate was evaporated to dryness. Then 2 ml of deionized water, 0·5 ml of a 2% solution of anthrone in ethyl acetate, and 4 ml of conc. H_2SO_4 were added. The samples were heated at 80°C for 30 min (60°C for 5 min for ketohexoses), and the absorbancies at 625 mμ were measured. Standards were run on each plate. The method is suitable for determination of glucose and fructose in the range 5–100 γ; sucrose can also be determined. Deviation between plates was ~3 γ.

[1] ICUMSA Methods of Sugar Analysis. Ed. H. C. S. DE WHALLEY (Elsevier, Amsterdam), 1964, p. 10.
[2] BHARGAVA: *I.S.J.*, 1966, **68**, 281.
[3] *I.S.J.*, 1966, **68**, 248.

Patents

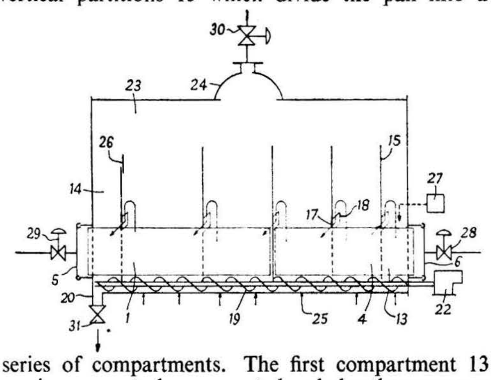
UNITED KINGDOM

Ion exchange processes and apparatus. THE PERMUTIT CO. LTD., of London W.4. **1,048,943.** 22nd June 1965; 23rd November 1966.—Initial ion exchange is effected by entraining resin (a weak-base anion exchanger or a mixture of a weak acid cation exchanger and a strong base anion exchanger) in the liquid (sugar solution) as it flows to a settled bed of resin contained in a vessel, the entrained resin on reaching the bed becoming part of it. Further ion exchange to complete the treatment takes place in the bed. A cyclic mode of operation includes stopping addition of resin at a predetermined bed height followed by passage of more liquid and eventual emptying of the vessel for resin regeneration. Alternatively the resin may be continuously withdrawn from the bottom of the bed and entrained in fresh liquid before adding to the top of the vessel, the whole bed being periodically regenerated.

* * *

Continuous vacuum pan. SOC. FIVES LILLE-CAIL, of Paris, 8e, France. **1,049,798.** 26th February 1964; 30th November 1966.

The horizontal cylindrical pan is provided with clusters of vertical plate elements 1, 4 to supply heat to syrup introduced through feed inlets 25. The elements may be provided with steam at different pressures, governed by valves 28, 29, and extend longitudinally along the pan, passing through the vertical partitions 15 which divide the pan into a

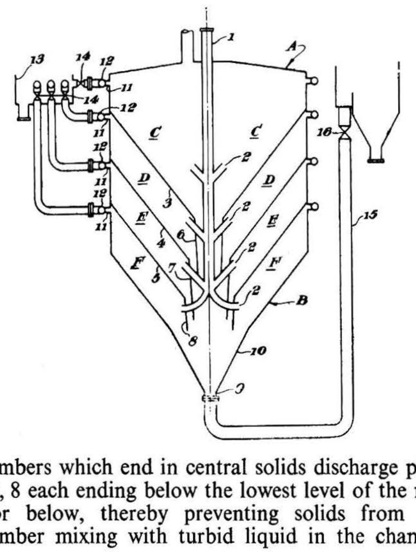


series of compartments. The first compartment 13 receives syrup to be evaporated and also the necessary seed crystals introduced by metering pump 27. The concentrating massecuite passes along the pan from compartment 13 to the succeeding compartments, passing through apertures 17 in partitions 15 and being guided into these by deflectors 18. The crystallized massecuite is withdrawn from the end compartment 14 by way of hopper 20 and valve 31. The level in compartment 14 is governed by the valve 31 and also by adjustment from the outside of the height of the overflow 26. The apertures 17 in partitions 15 are similarly adjustable from outside the pan. Crystals formed in the earlier compartments and settling out are transported towards compartment 14 by the screw conveyor 19, driven by variable speed motor 22, which passes through carefully adjusted apertures in partitions 15.

* * *

Clarifier. INSTITUT FÜR ZUCKER- UND STÄRKE-INDUSTRIE, of Halle, Trotha, Germany. **1,050,040.** 15th June 1964; 7th December 1966.

The cylindrical vessel *A* has a conical floor *B* and is divided into compartments C, D, E and F into which juice is admitted by branches 2 from a central feed pipe 1. Solids settle on the floors 3, 4, 5 of the



chambers which end in central solids discharge pipes 6, 7, 8 each ending below the lowest level of the next floor below, thereby preventing solids from one chamber mixing with turbid liquid in the chamber

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below. The branch pipes 2 pass through the discharge pipes to feed juice into compartments D, E, F, just below the floors 3, 4, 5. The solids collect in the steeper-inclined conical section 10 of the floor *B* and are withdrawn through pipe 15 under the regulation of valve 16. Clear juice is withdrawn from the highest point of each of the compartments through pipes 11 which feed ring conduits 12 delivering by way of valves 14 to a clear juice gutter 13.

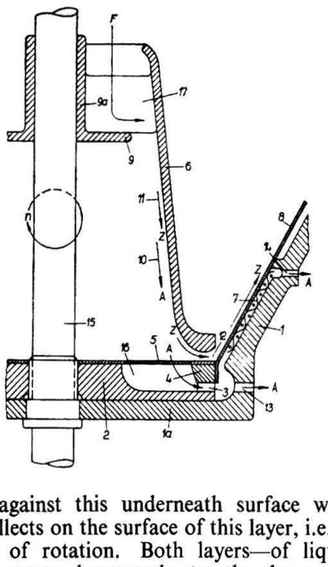
* * *

Improved esterification of sucrose. V. M. DE GAUDENZIO, of Novara, Italy. **1,050,452.** 9th August 1963; 7th December 1966.—Sucrose is treated with an equimolecular proportion of alkyl (C_1–C_4) ester of a fatty acid in the presence of an anion exchanger (a cross-linked polystyrene resin containing substituted amino groups in the hydroxy cycle), using dimethyl formamide or dimethyl sulphoxide as solvent. The alkyl alcohol produced in the reaction is distilled off in the course of the reaction at a pressure of about 100 mm Hg.

* * *

Continuous centrifugal. K. PAUSE, of Grevenbroich, Germany. **1,050,638.** 10th September 1964; 7th December 1966.

Massecuite to be centrifuged is supplied in the direction of the arrow *F* to the feeder plate 9 of a continuous cone-type centrifugal, and is thereby accelerated to the angular velocity and is directed to the underneath surface of the solid drum 6. Under the action of centrifugal force the heavier sugar



collects against this underneath surface while the liquid collects on the surface of this layer, i.e. near to the axis of rotation. Both layers—of liquid and crystals—move downwards to the base plate 2. This has an annular gap 16 near its edge having horizontal passages 3 communicating with the passage 13 leading to the underneath of the conical screen surface. Between the edge 4 of the base plate and the central portion is a screen surface 5 which covers the annular gap 16. The innermost layer of liquid reaching the base plate 2 passes through the screen 5 into gap 16 and thence by way of ducts 3 and 13 joins the molasses discharged, while the crystals, passing in the direction of arrow *Z* through the gap between the bottom of drum 6 and base plate 2, pass onwards over the screen 8 of the cone.

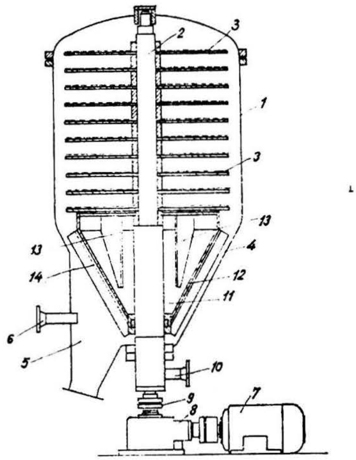
* * *

Beet harvester topping device. VEB BODENBEARBEITUNGSGERÄTE, of Leipzig, Germany. **1,050,819.** 27th September 1963; 7th December 1966.

* * *

Filter. SCHENK FILTERBAU G.M.B.H., of Waldstetten, Germany. **1,051,524.** 1st March 1965; 14th December 1966.

The hollow shaft 2 extends axially through casing 1 and carries a number of filter elements 3 which can rotate with the shaft. The lower conical part 4 of the casing is provided with a mud outlet 5 and liquid to be filtered is introduced through pipe 6 also in lower part 4. A hollow conical displacement body 11 is secured to shaft 2 within the conical part 4 of

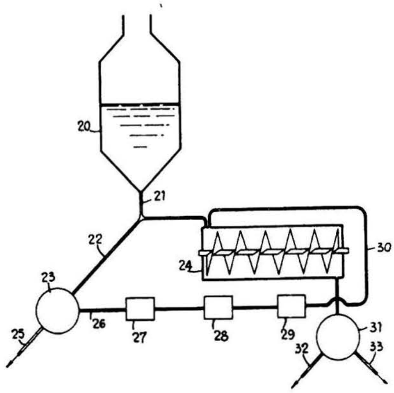


the casing and is reinforced, inside and out, by mouldings 13, 14. During filtration, mud collects on the filter elements 3 while the filtrate passes through shaft 2 to outlet 10 by way of appropriate stuffing boxes. At the end of the cycle the filter is drained and the shaft 2 then rotated by motor 7 through gearing 8 and clutch 9 whereby the mud is flung off the elements by centrifugal force to fall down the inside wall of the casing into the part 4 and thence out through outlet 5.

* * *

Sugar crystallization. A. R. GRANDADAM, of St.-Main (Seine), France. **1,053,042.** 6th January 1964; 30th December 1966.

The contents of a conventional pan 20 are discharged through pipe 21, part [25–75%(30–50%)] being sent direct to a centrifugal 23. This part is separated into sugar, collected at 25, and molasses, separated at 26, which is subjected to diluting and refining operations at 27, de-aerated and heated at 28 and concentrated at 29 before returning via pipe 30 to the crystallizer 24 in which the remainder of the original strike is being crystallized. The dilution with the molasses gives a more fluid mass which can be cooled to a lower temperature and which gives better crystallization before centrifugalling at 31 to sugar at 32 and molasses at 33.



Alternatively, the crystallizer may be operated under vacuum and the part-molasses can be concentrated before mixing with the uncentrifugalled massecuite. The concentration which occurs in the vacuum crystallizer then gives a higher crystal yield than the first alternative. In a third alternative technique the strike is cooled in a crystallizer before part is removed for separate curing; the molasses can then be mixed with the remainder of the massecuite in a second crystallizer without necessarily being treated.

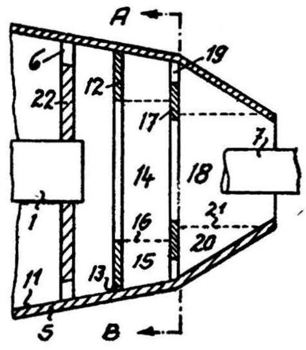
* * *

Separation of dextran from fructose. DOW CHEMICAL Co., of Midland, Mich., U.S.A. **1,054,225.** 24th March 1965; 4th January 1967.—An aqueous solution of dextran and fructose, formed by *Leuconostoc* fermentation of sucrose, is introduced into a bed of (sulphonic acid or quaternary ammonium salt-form) ion exchange resin particles (derived from a styrene-divinyl benzene copolymer containing 0·5–4 mole % of divinyl benzene), followed by the same or a larger volume of water, separating the eluate into sequential fractions and recovering dextran from the dextran-rich fraction(s) and fructose from the fructose-rich fraction(s).

* * *

Accelerator devices for continuous centrifugals. MASCHINENFABRIK BUCKAU R. WOLF A. G. of Grevenbroich, Germany. **1,054,712.** 12th February 1964; 11th January 1967.

Massecuite led by a pipe to the centre of a continuous conical centrifugal which rotates about a horizontal axis is liable to crystal damage when it strikes the webs by which the cone is mounted on the basket hub. To avoid this the massecuite is accelerated



smoothly to the appropriate speed before it comes into contact with the webs; this is done by means of plates located within acceleration cone 5, e.g. 12, 17, so that massecuite entering through pipe 7 enters chamber 18 and forms a "buffer" layer 20 with its inner level indicated at 21. It passes through peripheral holes 19 in plate 17 to chamber 14 where it forms an annular layer 15 which overflows through the central hole in plate 12 onto retaining ring 22 and so by way of webs 6 along the feeder cone to the screen cone.

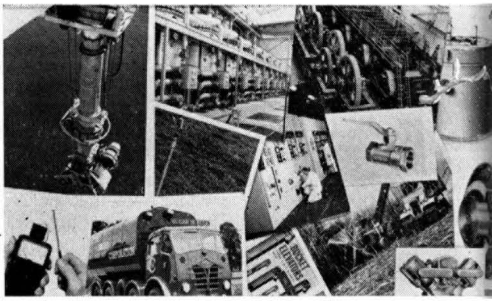
* * *

Making a sugar product. AMERICAN SUGAR Co., of New York, N.Y., U.S.A. **1,055,385.** 2nd April 1964; 18th January 1967.—A sucrose solution containing $\not>$15% (3–15%) of non-sucrose solids [of 85–97 (93) purity] (containing $\not>$12% of invert) is concentrated [under reduced pressure ($\not>$15 inches Hg)] to 95–97% solids at a temperature $\not>$130°C (125°–130°C) and cooled with vigorous agitation to give aggregates of fondant-sized sucrose crystals which are dried and further cooled to $\not>$1% water content. The original syrup may be of 85–91 purity and have an invert:ash weight ratio of $\not>$3·0 or may be of 91–93 purity and have an invert:ash weight ratio of $\not>$3·5. A water-soluble phosphate (Na_3PO_4, Na_2HPO_4, NaH_2PO_4, or H_3PO_4) may be included in the sugar aggregates to the extent of 0·1–1·0% by weight.

* * *

Agglomeration of sugar products. AMERICAN SUGAR Co., of New York, N.Y., U.S.A. **1,055,772.** 2nd April 1964; 18th January 1967.—Fine solid particles of material containing at least a major proportion of sugar are dropped in a substantially continuous curtain; a number of jets of substantially dry steam (at a higher temperature than the particles) are directed at the curtain so as to moisten all the particles. These are then subjected (while still falling freely) to further jets of dry steam at such a velocity to impart turbulence to the particles, causing them to agglomerate, and then are dried to form a dry free-flowing material.

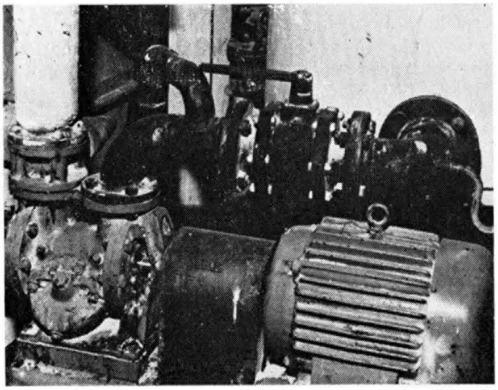
Trade notices



> **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.**

Molasses pump. Goodyear Pumps Ltd., Camborne, Cornwall.

The illustrations shows a model D.9 Goodyear pump[1] installed at an animal feed plant in the U.K. where it handles molasses at 50°C with a viscosity of 35,000 Redwood seconds, pumping 960 g.p.h. against a 150 p.s.i. head. The pump was installed with an



identical standby unit to replace a previous pump which had required overhaul every 1–2 months. The Goodyear pump has now been in use for more than 18 months and the standby unit has not been required.

* * *

"Korela" filters. Korelan Kone Oy., Kotka, Korela, Finland; R. Lord & Sons Ltd., Barnbrook Boiler Works, Bury, Lancashire, England.

The filters, employed for filtration of syrups in the Finnish sugar industry, are provided with circular horizontal leaves delivering filtrate to a central collector pipe. The leaves are covered with filter paper and are made of stainless steel, while the casing may be of stainless, rust-resistant or mild steel. Constructions are available to withstand a range of pressures (90 150, 200, 290 and 350 p.s.i.) and the filter areas available are 4, 6 and 10 sq.m. The syrup is admitted to the filter and filtered under pressure until the cake which builds up on the leaves results in a pressure drop of 9–12 p.s.i., when feed is stopped, the filter emptied and the leaf assembly removed. The filter papers are replaced by new ones and the assembly is again ready for use. Down-time is reduced by having a spare leaf assembly for insertion in the opened filter when the clogged assembly is removed.

* * *

Depth gauges. Eurogauge Co. Ltd., Queens Road, East Grinstead, Sussex, England.

Two new fully-transistorized capacitance-type depth indicators are announced. The EFT.11 is a highly economical unit for continuous depth indicating and has a working range of up to 5000 p.f. The EFT.4. is designed for direct mounting on top of storage vessels and may be used where there is no vibration and where the equipment is not subjected to temperatures exceeding 55°C. It operates on a frequency of 50/60 cycles at a power consumption of 5 V.A. A sensitivity better than 40 p.f./100% is claimed with a linear accuracy of $\pm$ 2%. The temperature drift is 0·07% per °C. Both the EFT.11 and EFT.4 are suitable for all liquids and free-flowing solids, including sugar. While both use a supply voltage of 220/240 volts as standard, a wide range of other voltage supplies, both A.C. and D.C., is available.

* * *

"Pure Aid". Fabcon Inc., 314 Public Square Building, Cleveland, Ohio, 44113 U.S.A.

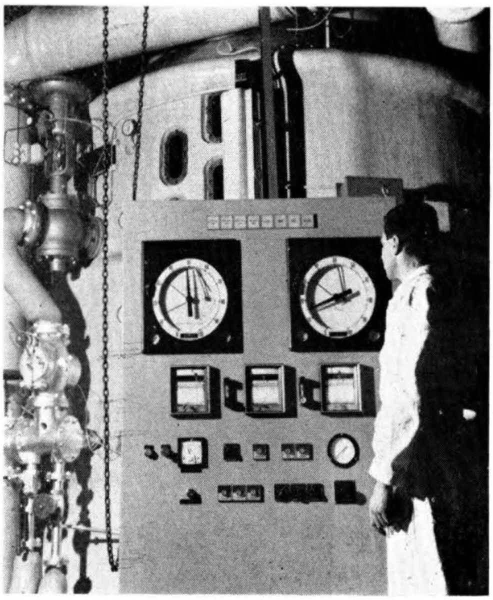
A 20–30% improvement in raw sugar quality is claimed to be possible by adding ¾ lb of "Pure Aid" (previously called "Ash Reducer") to 1000 cu.ft. of *A*- and *B*-massecuites. Data from the Lihue Plantation Co. in Hawaii show that ½ lb of "Pure Aid" per 1000 cu.ft. of *A*- and *B*-massecuites increased raw sugar pol and filtration rate and reduced its moisture content, small grain content and ash content. Beneficial effects were also obtained when 1 lb of "Pure Aid" plus 1 lb of "Pan Aid Concentrate" were added per 1000 cu.ft. of *A*- and *B*-massecuites, and when 1 lb of "Pure Aid" per 1000 cu.ft. was added alone to raw *C*-sugar and washed and screened *C*-sugar. The monetary savings resulting from a 20% improvement in the above-mentioned factors are worked out on the basis of a given price of raw sugar and based on the new standards laid down by The American Sugar Co. for raw sugar refining quality, details of which are obtainable from Fabcon Inc.

[1] See *I.S.J.*, 1958, **60**, 96.

Automatic control of vacuum pan boiling. Honeywell Controls Limited, Brentford, Middlesex.

An automatic control system for vacuum pan boiling of white sugar has gone into operation at the Allscott factory of the British Sugar Corporation. The system is the first of its kind in Europe and one of the most complete control systems in the world, and it was developed by British Sugar Corporation from an original system and equipment supplied by Honeywell Controls Ltd.

The Allscott factory produces 400 tons of sugar daily from 2600 tons of beet. Raw juice, extracted with the RT diffuser under the control of a Honeywell graphic panel, is clarified before being concentrated in



a multiple-effect evaporator to produce a thick juice, in which after-product sugar is melted before boiling in the vacuum pans.

The Honeywell control system provides completely automatic boiling of sugar. The operator presses a pushbutton to start the sequence and draws a vacuum on the pan. A Honeywell absolute pressure controller maintains the vacuum by positioning the water valve in the feed to the barometric condenser. The liquor feed valve is opened when sufficient vacuum is attained and is closed again at a pre-determined level for boiling down prior to seeding. After a programmed value of the vacuum is reached, the seeding point is detected by a Honeywell supersaturation recorder-controller which admits fondant seed to the pan. During the set-grain period the supersaturation recorder controls the feed to the pan.

Mobility of the juice is deduced from the measurement of power to the circulator drive motor. At the predetermined consistency, the control of feed is transferred to the mobility recorder-controller. Level is measured and indicated on the panel. When the pan reaches its required capacity the feed is shut off and the massecuite tightens to the required consistency. The circulator is then stopped, the vacuum broken and the pan is dropped into the crystallizers. The control system is complete with automatic cleaning to prepare the pan for the next batch.

* * *

Level indicator and control. Constantin (Engineers) Ltd., Radnor House, 1272 London Rd., Norbury, London S.W.16, England.

A folder is available giving details of the Fuller Mark III level indicator and control, which can be mounted vertically or horizontally to indicate or control the level of dry, pulverized, fine, crushed and granular materials passing into or out of a bin, silo or bunker. It incorporates a paddle which is constantly rotated by a self-starting synchronous motor located in a housing outside the bin or silo. Since the motor and the reduction gearing are mounted on an extension of the paddle shaft, when the material restrains movement of the shaft, the motor and its mounting rotate about the drive shaft and actuate two microswitches mounted on the base of the indicator, thus reversing their contacts. Use of the unit with material having a temperature exceeding 300°F will depend on the nature of the material and should be referred to the manufacturers.

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Cane harvesters. Thomson Machinery Co. Inc., Thibodaux, La., 70301 U.S.A.

At the recent demonstration of Duncaña cane harvesting machinery at Clewiston, Florida, in addition to the Duncaña Combine[1], Thomson Machinery Co. Inc. demonstrated the prototype of a specially modified version of its new "Fastback" harvester, an experimental harvester that Thomson hopes to market late this year. The "Fastback" is a Louisiana-type soldier cane harvester specially adapted to work in Florida conditions, and is a streamlined, radical departure from the traditional version of harvesters for erect cane. The Thompson "Fastback" has a new hydraulic cutting head called the "Cane-Saver" which gives automatic adjustment of cutting height, plus an automatic piler capable of windrowing six rows onto a single heap row. The automatic features mean only one operator is needed for the harvester.

The new "Cane-Saver" cutting head is a revolutionary development. It enables the operator to pre-select a cutting height that ranges from slightly below ground level to just above. Once set, the harvester will cut at a uniform height from the beginning to the end of the row, compensating automatically for contour changes as drastic as those encountered in quarter drains. The low cutting height enables the grower to bring in cane with a higher sucrose content, and eliminates the need for stubble shaving in normal years.

[1] *I.S.J.*, 1967, **69**, 125.

Another new machine which was undergoing tests during the week-long Duncaña demonstrations was a Duncan-designed two-row cut windrow harvester. This machine will cut two rows of cane simultaneously. Four rows of recumbent or semi-recumbent sugar cane can be windrowed into a single heap row for pick-up. Only one operator is needed to control the harvester. Delivery of the Duncaña 2-row harvester is planned for late 1967.

More than 250 persons representing sugar cane growers, cane leagues and mill owners from the United States, Guadeloupe, Trinidad, El Salvador, Jamaica, Venezuela, Peru, Puerto Rico, Colombia and Hawaii viewed the Thomson Machinery's field demonstrations in Clewiston.

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PUBLICATIONS RECEIVED

IMACTI PROCESS FOR ION EXCHANGE TREATMENT OF BEET JUICES. Industrieele Mij. Activit N.V., Postbox 240-C, Amsterdam, Holland.

Details are given, in a 10-page booklet, of the IMACTI process which involves deliming of 2nd carbonatation juice, followed by demineralization. The juice is demineralized by passing it through "Imac C 12" strongly acidic cation exchanger in H^+ form, then through "Imac A 27" weakly basic anion exchanger in OH^- form. The cation exchanger is regenerated with H_2SO_4 and the anion exchanger with NaOH. The treated juice has a very light colour, and a marked reduction in molasses yield is claimed to be possible.

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PERMUTIT ION EXCHANGE RESINS FOR CHROMATOGRAPHY. The Permutit Co. Ltd., Pemberton House, 632/652 London Road, Isleworth, Middx., England.

The use of ion exchange resins for chromatographic separations of closely similar materials is now well established. Two major types of cation exchangers currently available are the sulphonic and carboxylic acid resins. All Permutit anion exchangers are now produced on the new principle of isoporous resins introduced by Permutit in 1965. The crosslinking of isoporous resins is much more uniform than in any materials previously available, with consequent improvement in absorption characteristics.

Publication IE.71(P)a gives details of water regain and crosslinking characteristics of both cation and anion exchange resins, grading tables and prices.

Publication IE.77(P) is a chart which summarizes the chemical and physical properties of the principal Permutit ion exchange resins available in commercial quantities in the standard size range 0·3–1·2 mm (14–52 B.S.S. dry screen analysis). Hydraulic and other practical data required in connexion with the application of these resins are provided, as are brief notes on their fields of application.

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ELECTROCHEMISTRY AND MEMBRANE PROCESSES. Ionics Inc., 65 Grove St., Watertown, Mass., 02172 U.S.A.

A well-produced brochure gives details of the company's developments in electrochemistry and membrane processes. Of possible interest to our readers is the section giving information on electrodialysis and ultrafiltration. The latter process uses semi-permeable membranes made of insoluble organic polymeric film and having low permeability for solvents and solutes of high M.W. Future applications of this process include sugar juice clarification.

* * *

HEATING ELEMENTS. Thomas French & Sons (Electrical) Ltd., Chester Road, Manchester 15, England.

A series of five brochures gives information on "Keleflex" glass fibre tape which has the heating element woven into it. The flexibility and robust construction of these tapes makes them ideal for industrial applications, a number of which are covered in these brochures.

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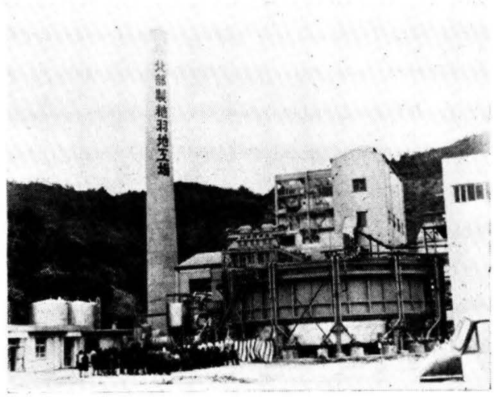
Silver ring cane diffuser in the Ryukyu Islands.—The illustration shows the dedication ceremony in progress for the 3600 t.c.d. Silver ring diffuser at Hokubu Sugar Co., Naha, Okinawa[1]. The plant was built by Mitsubishi Heavy Industries Ltd. of Japan.



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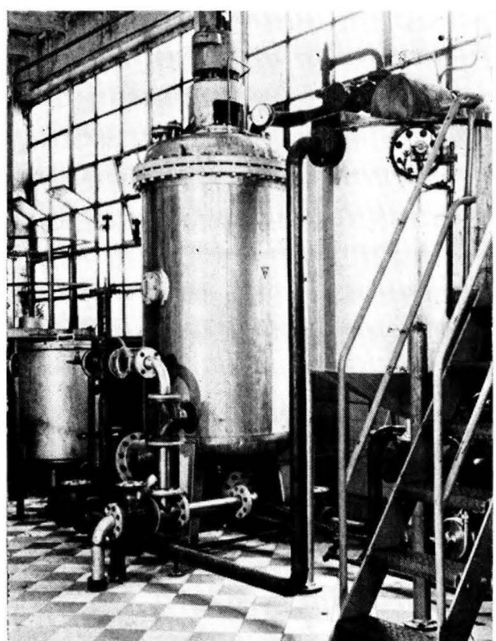
Liquid sugar refining.—The illustration shows an installation of A.15 "Funda" pre-coat filters used at the Plaistow Wharf refinery of Tate & Lyle Refineries Ltd. for liquid sugar treatment The filters are manufactured by Alfa-Laval Co. Ltd., of Great West Road, Brentford, Middx.



[1] See *I.S.J.*, 1966, **68**, 94.

Brevities

Cuba bulk handling progress[1].—One of the two warehouses being built at the bulk sugar terminal at Cienfuegos port has been completed and is expected to start operations in June 1967. It has a storage capacity of 90,000 metric tons and is the first of two warehouses at the terminal. They have been designed and are being built by Cuban personnel and will be capable of handling 1200 tons per hour, perhaps the highest rate in the world. The stores will ship 1,700,000 tons of sugar annually and will be supplied from more than 40 mills.

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U.S. beet area 1967/68[2].—The U.S. Dept. of Agriculture has announced that there will be no acreage restrictions for the 1967/68 beet crop in the U.S.A. The beet area was limited in the two previous seasons to 1,435 000 acres in 1966/67 and 1,375,000 acres in 1965/66. Before then no area restrictions had applied since the 1960/61 campaign. Sugar production from the 1966/67 beet crop is now estimated at 2,885,000 short tons, raw value, or about 140,000 tons below the 1967 calendar year quota for domestic beet sugar. It is hoped that, by removing area restrictions for the sowings during this spring, sugar production next season will rise by between 325,000 and 475,000 tons above the forecast for the current crop and so prevent further reductions in carry-over stocks.

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Polish sugar situation[3].—The proposed expansion of sugar production capacity by construction of new factories in the Lublin and Bialystock districts has been cancelled because of world conditions. There is no factory in the second of these districts and factory capacity in the Lublin district is insufficient to process all the beet grown; consequently these beets have had to be transported to factories in western Poland, particularly in Lower Silesia. This has caused difficulty because the Polish railways had not got sufficient capacity to transport this beet at the proper time and the campaign has been extended in consequence. Sugar beet cultivation in the eastern and central regions of Poland is therefore to be restricted and the beet areas in the western regions are to be increased. The former beet areas will be sown to wheat.

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Cooperative sugar factories in India[4].—Cooperative sugar factories produced 900,000 tons during the 1966 season, representing about 26% of the country's total production of 3,472,000 tons. Cooperative factories also accounted for nearly 40% of the total Indian production of raw sugar during the season. There were 52 cooperative factories in operation during the season, while a further 24 are in various stages of installation and development. Total licensed capacity is 1,440,000 tons. The cooperative factories are mainly owned by cane growers, to the extent of 247,000 out of 270,000 total membership.

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Philippines sugar expansion plans[5].—The Philippines plans to increase its sugar production to meet foreign and domestic requirements. The National Federation of Sugarcane Planters has announced that the first phase of the programme calls for a minimum output of 1,900,000 tons in 1967/68 through the maximum use of existing facilities. For 1968/69 a target of 2,050,000 tons has been set, to be achieved by improving and extending existing facilities. In the longer term, it is planned to expand to 2,200,000 tons by 1969/70 and 2,400,000 tons by 1973/74 through the establishment of new mills and the expansion of cane area.

Sugar refinery for Singapore[6].—Singapore will produce its own refined sugar by the middle of 1968 when work on the £1,600,000 factory complex in the Jurong Industrial Park is completed. The Government has not yet announced quotas or the import of sugar to protect the local industry but is expected to do so before the new refinery begins its operations. Singapore imported over 50,000 tons of sugar in the first half of 1966.

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Bagasse paper project in Grenada[7].—The Windwards Pulp & Paper Co. Ltd. was registered in Grenada on the 30th December 1966 with the Government underwriting 30% of the authorised capital of W.I. $250,000. The Company has among its objects the manufacture of and dealing in paper of all kinds and articles made from paper and pulp, including cardboard, millboard, ceiling board and other products which may be made from bagasse.

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Malagasy sugar exports[8].—Exports from the Malagasy Republic during 1966 totalled 89,770 metric tons, tel quel, as against 34,961 tons in 1965 and 64,360 tons in 1964. Principal outlets were to Senegal (23,827 tons), Lebanon (13,534 tons), France (13,302 tons), the U.K. (12,802 tons) and Sweden (10,414 tons).

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Portuguese sugar imports[9].—Imports of sugar into Portugal in 1966 totalled 169,756 metric tons, the major supplier being Mozambique (118,727 tons). Angola supplied 22,120 tons while Brazil supplied 18,073 tons and Rhodesia 7,079 tons. Imports in 1965 totalled 143,082 tons.

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Cooperative sugar mills for India[10].—The Haryana Government proposes to set up a new cooperative sugar mill, probably at Karnal. Another cooperative sugar factory is to go into production in 1967 at Una in Janagadh district, Gujerat.

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Bagasse utilization in roofing tile manufacture[11].—Successful experiments are being made in the use of bagasse to the extent of 10–25% as a raw material in the manufacture of corrugated roofing sheets. The bagasse imparts a better quality and more flexibility in the finished product.

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New Philippines sugar factory[12].—A new sugar factory is planned for the island of Panay in the south-east of the Philippines, at a cost of 50 million pesos, which is to be raised by the local producers together with the Philippine National Bank.

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[1] *Cuba Economic News*, 1967, **3**, (20), 7.
[2] C. Czarnikow Ltd., *Sugar Review*, 1967, (797), 18.
[3] F. O. Licht, *International Sugar Rpt.*, 1967, **99**, (2), 11.
[4] *Indian Trade J.*, 1966, **238**, B 311.
[5] F. O. Licht, *International Sugar Rpt.*, 1967, **99**, (2), 19.
[6] *Foreign Trade* (Ottawa), 1967, **127**, (5), 31.
[7] *Chron. W. India Comm.*, 1967, **82**, 91, 93.
[8] C. Czarnikow Ltd., *Sugar Review*, 1967, (808), 68.
[9] F. O. Licht, *International Sugar Rpt.*, 1967, **99**, (10), 11.
[10] *Indian Sugar*, 1966, **16**, 595.
[11] *Cuba Economic News*, 1966, **2**, (18), 4.
[12] F. O. Licht, *International Sugar Rpt.*, 1967, **99**, (4), 14; (6), 18.

Brevities

Watson Laidlaw centrifugal spares supply.—The General Utility Co. Ltd., of 71 Craigton Road, Glasgow S.W.1, Scotland, have acquired the rights to manufacture and supply all spares and components of centrifugal machines for the sugar industry, previously supplied by Watson Laidlaw & Co. Ltd., now in creditors' voluntary liquidation. The acquisition will ensure continuity of a very old-established Scottish business with a world-wide market.

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U.K. beet crop[1].—A total of 6,495,000 tons made the 1966/67 sugar beet crop the third biggest to date, only the 1960/61 and 1965/66 seasons having produced better results. Average yield was 15·1 tons per acre, and average sugar content 15·78%, marginally higher than the 15·6% of the previous season. Estimated yield of white sugar is 847,000 tons.

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Symposium on sugar esters.—An International Symposium on Sugar Esters will be held at the Jack Tarr Hotel in San Francisco on the 9th-11th August 1967. Topics to be covered are development of sugar esters, applications in agriculture, pharmaceutical products, foods, soaps and detergents, and use of sugar ester detergents for water pollution control. Registration forms and further information may be obtained from Edward Greenblatt, Research Corporation, 405 Lexington Avenue, New York, N.Y., 10017 U.S.A.

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South African sugar crop, 1966/67[2].—Sugar production in the 1966/67 season in South Africa rose to 1,794,100 short tons made from 15,546,570 short tons of cane, according to final figures issued by the South African Sugar Association. In 1965/66 1,001,784 tons were produced from 9,266,325 tons of cane.

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Bagasse board plant in Peru[3].—Papelera Trujillo plans to invest 700 million soles (£9,300,000) in building a paper and cardboard plant in Trujillo to use bagasse as raw material. Annual production is estimated at 46,000 tons initially.

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Irish sugar imports and exports, 1966[4].—In the calendar year 1966, Ireland imported 101,105 metric tons of sugar, raw value, of which 51,604 tons was from Guyana, 23,010 tons from Barbados, 11,837 tons from Jamaica, 7519 tons from British Honduras, 7124 tons from the U.K., and 11 tons from Holland. During the same year she exported 29,130 tons, of which 25,782 were to the U.K. and 3348 tons to the U.S.A.

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D.D.S. cane diffuser for Brazil[5].—A D.D.S. cane diffuser is to be installed by August 1967 at Usina São Francisco, Ceará Mirim, in the state of Rio Grande do Norte. The unit will treat 1500 tons of cane per day and is guaranteed to provide 97% extraction of sucrose.

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Swiss sugar imports, 1966[6].—Imports of sugar by Switzerland during 1966 totalled 220,333 metric tons, tel quel, as compared with 243,906 tons in 1965. The principal sources were France (77,963 tons), the U.K. (58,113 tons), Czechoslovakia (40,808 tons) and Cuba (35,439 tons).

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Puerto Rico closure[7].—C. Brewer Puerto Rico Inc., which owns three mills in Puerto Rico, is to cease operations at the end of the 1967 season, as a result of losses which over the past 5½ years have totalled $23,000,000. The Commonwealth Government is considering the possibility of acquiring the properties of the Company, which include Centrals Fajardo and Juncos.

European Sugar Beet Area Estimates 1967[8]

	1967	1966
Western Europe	—— *hectares* ——	
Austria	42,000	46,637
Belgium/Luxembourg	75,000	66,540
Denmark	50,000	53,971
Finland	17,000	17,012
France	285,000	259,500
Germany, West	305,000	292,379
Greece	16,300	15,746
Holland	95,000	91,949
Ireland	25,840	21,840
Italy	325,000	294,850
Spain	148,000	140,000
Sweden	40,000	41,250
Switzerland	8,650	8,374
Turkey	160,000	152,540
U.K.	177,000	173,785
Yugoslavia	105,000	106,000
Total Western Europe	1,874,790	1,782,373
Eastern Europe		
Albania	6,000	6,000
Bulgaria	75,000	75,000
Czechoslovakia	200,000	221,880
Germany, East	210,000	213,000
Hungary	105,200	108,700
Poland	420,000	435,000
Rumania	200,000	190,000
U.S.S.R.	3,900,000	3,800,000
Total Eastern Europe	5,116,200	5,049,580
TOTAL EUROPE	6,990,990	6,831,953

Government subsidy for South African sugar.—The South African Government has agreed to lend up to ten million rand (£5,000,000) to the sugar industry in South Africa for the 1966/67 season[9]. A new Company, SA Sugar Export Corporation (Pty.) Ltd., a subsidiary of the South African Sugar Association, has been set up to administer the loan. An increase of one cent per pound in retail prices was announced in March and this, with the loan, should help the industry and cane farmers through the period of low returns from export sugar. Similar Governmental assistance in the form of loans was recently granted to the Australian sugar industry.

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Sugar for animal fodder[10].—It is reported that about 8900 tons of a 12,000-ton cargo of Brazilian raw sugar was being discharged at New Orleans Free Trade Zone and at least part was being processed into animal feed by addition of kaolin and grain middlings. The mixture can enter the U.S. under an ad valorem duty of 2·5% instead of the sugar duty of 62·5 cents per 100 lb.

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Iran sugar expansion[11].—Sugar factories, to be financed by the Industrial and Mining Bank, are to be built in Lorestan, Eghlid and Kache.

1 *British Sugar Beet Review*, 1967, **35**, 118.
2 *Public Ledger*, 15th April 1967.
3 *B.O.L.S.A. Review*, 1967, **1**, 224.
4 F. O. Licht, *International Sugar Rpt.*, 1967, **99**, (10), 14.
5 *Brasil Açuc.*, 1967, **69**, (2), 4.
6 C. Czarnikow Ltd., *Sugar Review*, 1967, (806), 61.
8 F. O. Licht, *International Sugar Rpt.*, 1967, **99**, (12), 1–2.
9 C. Czarnikow Ltd., *Sugar Review*, 1967, (811), 79.
10 *Willett & Gray*, 1967, **91**, 128.
11 *Zeitsch. Zuckerind.*, 1967, **92**, 151.