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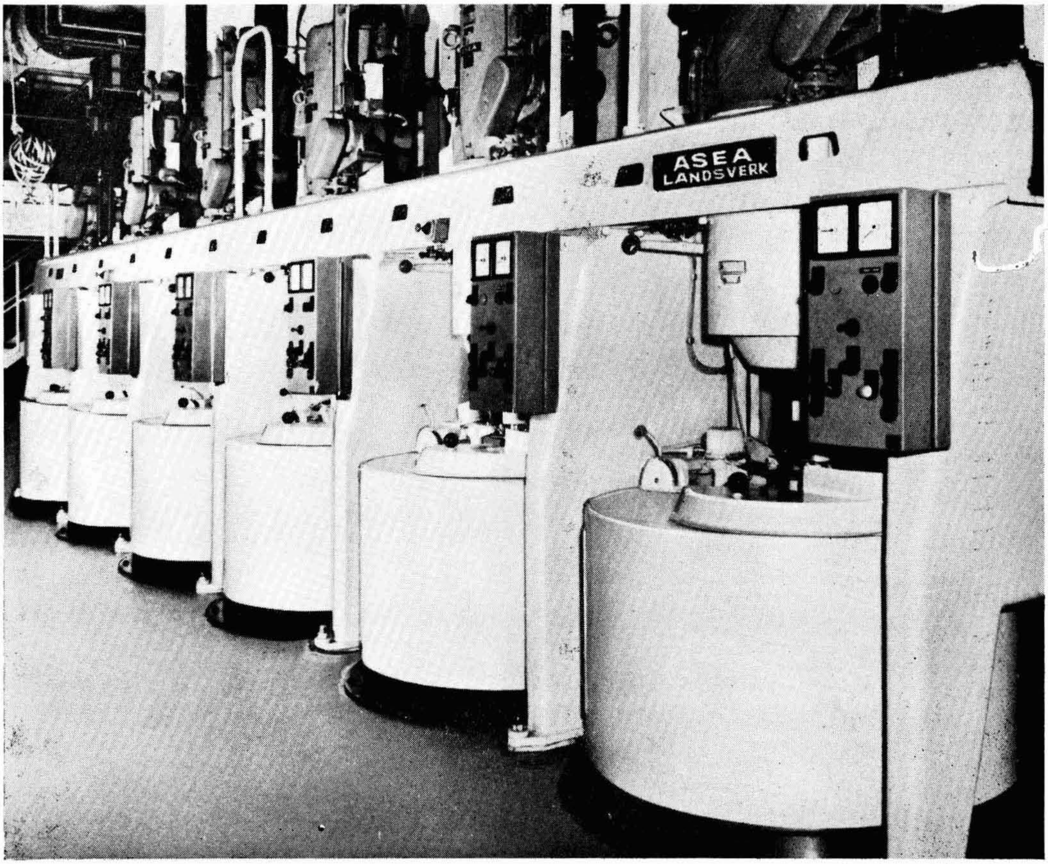

One of the batteries delivered to The Colonial Sugar Refining Co., installed in the Pyrmont Refinery, Sydney.

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INTERNATIONAL SUGAR JOURNAL

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NOTES AND COMMENTS

International Sugar Council.

The 22nd Session of the International Sugar Council was held at the seat of the Council in London on 23rd June 1966. The Session was presided over by Sir ROBERT KIRKWOOD (Jamaica) and was attended by representatives of forty countries as well as by observers from Bolivia and the E.E.C.

The Council reviewed the developments that had taken place since its last Session in January, both within the Council and under the auspices of the Secretary-General of U.N.C.T.A.D.

It noted that the Exporting members concerned had decided not to proceed further with their short-term minimum price scheme.

It also noted the initiative of the Secretary General of U.N.C.T.A.D. to appoint a Preparatory Working Group "to examine, in the light of the U.N.C.T.A.D. recommendation on 'International Commodity Arrangements and Removal of Obstacles and Expansion of Trade' (Annex. II.1. of the Final Act of the 1964 Conference on Trade and Development), and report on, the general content of a comprehensive long-term International Sugar Agreement that is desirable and appears likely to be negotiable."

The Council recognised the urgency which was being attached to the need for preparations for such a comprehensive long-term agreement and the way in which the Preparatory Working Group is approaching its task. The Council noted that the Group would be reporting to the Secretary General of U.N.C.T.A.D.

* * *

Cuban sugar statistics.

Details of sugar movements in Cuba in 1965 have recently been published by the International Sugar Council[1], and appear elsewhere in this issue. Commenting on these statistics, C. Czarnikow Ltd.[2] write:

"Exports showed a marked rise over the 1964 level, the total of 5,315,630 metric tons, raw value, being the largest quantity shipped since 1961. This expansion was almost entirely accounted for by increased deliveries to the centrally planned countries with which Cuba has bilateral trade agreements, with exports to the Soviet Union alone showing an increase on 1964 of more than 500,000 tons. Somewhat surprisingly, shipments to China were up by only a marginal tonnage and, at less than 400,000 tons, were well below many trade estimates. Several East European countries took substantially more Cuban sugar in 1965 than in the previous year.

"The volume of deliveries to other countries varied considerably; shipments to Canada rose to the 1963 level of about 70,000 tons after being almost eliminated in the intervening year while Iran and Iraq both took much more Cuban sugar than in earlier years. Deliveries to Japan showed a further recovery while Jordan, Portugal and Venezuela, all of which took a few cargoes, reappeared on the export list after a break of some years. On the other hand noteworthy reductions were made in exports to Italy, Morocco and Spain.

"The tonnage of sugar carried over into 1966 is, at 472,000 metric tons, much smaller than had been anticipated, which makes this year's Cuban statistical position even tighter than had been earlier believed. The 1966 campaign is now completed with output having reached approximately 4,455,000 tons which brings the total availability this year to 4,927,000 tons. Average domestic consumption during the past three years is shown from the figures submitted to the I.S.C. to be 450,000 tons and if this level is maintained in 1966 and stocks are permitted to dwindle to the end-1963 level of 186,000 tons, which was the lowest quantity carried forward since 1942, there will still be only 4,291,000 tons available for export.

"At the beginning of this year it was officially stated that Cuban exports to the Soviet Union would amount to three million tons while shipments to China would be in the region of 600,000 tons. Totals specified within trade agreements with various East European countries also ran into several hundred thousand tons while, according to our records, more than one million tons are committed to what are loosely referred to as world market destinations.

"Clearly there is insufficient sugar available to meet all these outlets. It is to be presumed that all open market contracts will be fulfilled, which indicates that tonnages to be delivered under trade agreements

[1] *Stat. Bull.*, 1966, **25**, (5), 33–34.
[2] *Sugar Review*, 1966, (770), 125–126.

will have to be drastically reduced. Whatever may have been the intention six months ago, when the crop was thought likely to reach a figure two million tons more than has actually been achieved, it now seems improbable that deliveries to the Soviet Union and China can even amount to last year's figures while shipments to other countries with which trade pacts exist will also have to be severely curtailed.

"It might be possible, of course, to start the next crop some weeks early in an endeavour to alleviate some of the current statistical difficulties, but this tends to be a temporary expedient; the milling of cane before it is completely ripe will presumably reduce the total output from the new campaign and, unless there is a substantial increase in the tonnage of sugar produced next year, the effect of such an operation would be merely to carry forward the tight situation into 1967. It must be borne in mind, of course, that first official forecasts put production from the 1967 campaign at a level well above seven million tons, but there have since been reports of damage to standing cane caused by the recent hurricane and it is not now anticipated that such a level could be reached."

* * *

European sugar beet area, 1966.

Licht has recently published his second estimate of the beet sowings in European countries[1], and these are reproduced elsewhere in this issue. The total of 7,063,000 hectares is about 260,000 ha below his first estimate[2], a reduction due largely to the 200,000-ha lower estimate for the U.S.S.R. Elsewhere in Eastern Europe the figures are unchanged except for East Germany where the figure is 12,000 ha lower and Rumania where the area is smaller by 30,000 ha.

The French area is set at only 259,500 ha as against 355,400 ha in 1965, while the Turkish reduction is 7348 ha. The earlier estimate for Yugoslavia is up by 23,000 ha or more than a quarter, while the estimate for Italy is raised by 10,000 ha.

* * *

Demerara Co. Ltd. 1965 report.

Sugar production at Diamond and Leonora estates totalled 56,961 tons in 1965, all but 2801 of which was from estate cane. This compared with 48,004 tons in 1964, of which 398 was produced from farmers' cane. Rum production amounted to 973,435 gallons, as against 702,284 gallons in 1964.

1965 was again a difficult year on the estates. Although unrest diminished, incidents occurred from time to time at Diamond and Leonora which made it difficult for the staff to give all their time to the growing of sugar, as precautionary measures had to be taken to prevent acts of sabotage. During 1964 little replanting of cane had been possible but quieter conditions and better weather enabled a start to be made in catching up. The canes did not recover from the serious effects of 1964, however; spring canes were short and juice quality only average. Even after good rains at the end of 1964 and early in 1965 little effect was apparent on large areas of autumn cane which would normally have shown a rapid and vigorous recovery. This was because ratoon cane reaped during the 1964 strike period lacked the usual attention given after reaping and were not manured at the proper time owing to shortage of labour.

Old varieties which have given excellent results in the past are now producing only average yields while promising new varieties have not done well under recent unfavourable weather conditions. The increased tonnages forecast for 1966 are doubtful because of the worst drought for almost a century.

The new mill at Diamond estate started work at the beginning of the autumn crop and after initial teething troubles has produced noticeable improvement in recovery.

* * *

U.S. sugar quotas, 1966.[3]

The U.S. Secretary of Agriculture declared deficits totalling 415,000 short tons, raw value, on the 1st June, of which 410,000 tons were in respect of the Puerto Rican quota and the balance against the quota for the Virgin Islands. Of this total, 195,963 tons were allotted to the Philippines and the balance to Western Hemisphere producers. Details are as follows:

	Shortfalls/ redistributions	*Revised quota*
	short tons,	*raw value*
Domestic beet	—	3,025,000
Mainland cane	—	1,100,000
Hawaii	—	1,173,474
Puerto Rico	−410,000	730,000
Virgin Islands	−5,000	10,000
Philippines	195,963	1,278,543
Argentina	5,027	50,904
Australia	—	177,019
Bolivia	486	4,925
Brazil	40,867	413,800
British Honduras	1,189	12,042
British West Indies	16,325	165,301
Colombia	4,325	43,788
Costa Rica	4,952	50,138
Dominican Republic	40,867	413,800
Ecuador	5,946	60,209
El Salvador	3,060	30,984
Fiji Islands	—	38,846
French West Indies	5,135	51,998
Guatemala	4,173	42,251
Haiti	2,270	22,988
India	—	70,808
Ireland	—	5,351
Malagasy	—	8,359
Mauritius	—	16,227
Mexico	41,786	423,104
Nicaragua	4,952	50,138
Panama	3,027	30,651
Peru	32,596	330,054
South Africa	—	52,122
Swaziland	—	6,392
Taiwan	—	73,758
Thailand	—	16,227
Venezuela	2,054	20,799
	—	10,000,000

[1] *International Sugar Rpt.*, 1966, **98**, (19), 1–6.
[2] *I.S.J.*, 1966, **68**, 162, 191.
[3] C. Czarnikow Ltd., *Sugar Review*, 1966, (766), 105, 109.

SUGAR CANE PRODUCTION IN THAILAND

FEW countries can have increased their sugar production so rapidly as has Thailand (or Siam) in recent years. A production figure of some 151,000 tons for the 1961/62 season had been increased to over 313,000 tons for 1964/65. As with some other tropical Asian countries, sugar cane has been grown in the country by farmers and others for their own domestic use for many centuries. Crude sugar or jaggery, for local use, has also been made. Large scale cultivation of sugar cane to meet the needs of modern factories producing centrifugal sugar is of comparatively recent date in Thailand. In 1938 the first of the modern sugar factories was built at Lampang, 700 kilometres north of Bangkok.

It was the well directed assistance given by the Government to the industry, in its desire to curb imports of sugar, that accounted for its growth and development. In 1957 the Minister of Agriculture in Thailand, who was also Chairman of the Board of the Thai Sugar Industry Corporation, was able to inform the Government that Thailand would not only be able to produce sufficient sugar for her domestic requirements but would have some available for export. The programme decided upon was to prohibit importation of sugar from then onwards, provide exemption from import duty on machinery and equipment required for the modernization of factories and plant, and to grant certain concessions to cane growers similar to those enjoyed by rice growers. A special fund was set up to assist sugar cane planters and sugar factories. The programme also provided for the improvement of communications and for irrigation[1]. In recent years the employment of skilled and experienced sugar technicians or scientists from Taiwan and Japan has done much to expand or improve the sugar industry of Thailand.

A recent account of the industry, as it is today, has been given by J. C. Chou[2]. The annual domestic sugar consumption of the country is given as 120,000 metric tons. With a population of some 24 million this means about 5 kg per head of the population per annum. Production now being over 300,000 tons, there remains an appreciable quantity for export. There are now 28 sugar mills or factories in operation with a total grinding capacity of 25,000 metric tons of cane per day. Three of these mills are Government owned while 25 are privately owned and managed. Five factories have their own plantations but rely on the product of individual cane growers as well. With most of the 28 mills the cane received is paid for on a weight basis. Three mills have adopted the "c.c.s." system (commercial cane sugar or sucrose content) of payment for cane.

Cane Growing Areas

A large part of Thailand is considered suitable for sugar cane cultivation with soils suitably fertile and adequate rainfall. Irrigation facilities should, in time, greatly increase the sugar growing potential. Sugar is produced in four Regions—Northern, Central, Eastern and North Eastern. The average annual rainfall in the 13 districts of these four Regions varies quite considerably from 779 mm in Petchburi to 1424 mm in Cholburi and 1635 mm in Ubolrajthani. Rains are largely seasonal, there being a rainy and a dry season, the latter approximately from November to April. The main sugar producing areas are in the Central and Eastern Regions. The Eastern Region has the most factories but the Central Region has actually the highest grinding capacity. These two Regions together account for 82% of the milled cane. Except in Supanburi in the Central Region, irrigation is not yet available for cane growing. Large dams are, however, under construction, notably in the Northern, Central and North Eastern Regions. These should greatly benefit cane growing during the dry season.

Sugar cane is normally grown as a one year crop, being planted mainly from December to April. A plant cane crop is usually followed by two or three ratoons. The average yield is 32 metric tons per hectare (or 5 tons per "rai"). Some of the cane planted in recent years has been on land just cleared of jungle and thus rich in humus, fertile and relatively free of cane pests. Balanced feeding and use of fertilizers will be needed to maintain the fertility. Some factories have, in fact, conducted systematic fertilizer trials on their plantations with encouraging results.

Cane Varieties

Varieties of sugar cane from other cane growing countries have been freely introduced and established in recent years. A large collection of varieties is maintained at the Bangpra Experiment Station of the S.I.A.F. (Sugar Industrial Aid Fund). Variety testing has also been enthusiastically carried out on several factory plantations. The main varieties grown for the 1964/65 harvest have been given (by Chou[2]) as follows:

Northern Region—N:Co 310, Co 281, Co 421, POJ 2878,

Central Region—N:Co 310, Co 281, Co 421, POJ 2878,

Eastern Region—F 108, POJ 2878, Co 421, Co 419,

North Eastern Region—Co 421, Co 281, Co 419, POJ 2878.

Pests and Diseases

Damage from pests and diseases has not been regarded as heavy although a number of important sugar cane diseases have been recorded, viz.: white leaf, mosaic, ratoon stunting disease, yellow spot, brown stripe, eye spot, leaf rust and leaf scald. Control measures have, in some instances, been adopted, including hot water treatment of planting cane for ratoon stunting disease at the Lampang

[1] *I.S.J.*, 1957, **59**, 2.

[2] *Taiwan Sugar Quarterly*, 1965, **12**, (3), 29–33.

Sugar Factory. Damage to cane, of varying degrees, is caused by borers. Termites and root pests have also caused trouble, notably in the Northern and Eastern Regions.

Future Development

It has been pointed out that during the early stages of the development of centrifugal or factory-made sugar in Thailand generous help and support was forthcoming from the Government—also from the public. Now that the country's sugar needs have been met and there is a surplus for export other considerations must be taken into account. Sugar producers may face competition among themselves for the local or domestic market. The sugar earmarked for export will have to face competition in world markets in quality and price with sugar from other sugar producing countries. It is therefore important that production costs should be kept as low as possible and efficiency increased, both in the field and in the factory.

It is considered that there is still much scope for increasing technical efficiency in cultivation and production of millable cane. To this end research work has in fact been initiated by S.I.A.F. With a wide expanse of country suitable climatically for cane growing the room for expansion of the industry, if need be, is regarded as enormous and the possibility of Thailand one day becoming one of the world's main sugar producers is by no means remote.

F.N.H.

BRITISH SUGAR CORPORATION 18th TECHNICAL CONFERENCE

THE 18th Technical Conference of the British Sugar Corporation Ltd. was held at the Grand Hotel, Folkestone, during the 8th–10th June 1966. Technologists from most of the West European sugar producing countries assembled during the 7th and were addressed on the following morning by the Conference Chairman, W. B. BOAST, Technical Director of the Corporation, who reviewed progress in the U.K. during the two years since the 17th Conference, and outlined the programme of the 18th. He introduced J. F. T. OLDFIELD, Director of Research, British Sugar Corporation who, with H. J. TEAGUE, presented a paper in which the effect of topping on beet quality, and the losses resulting from inadequate crown removal by mechanical harvesters, were discussed.

Control of dust, particularly at sugar and pulp dryers, was described by T. RODGERS of the B.S.C. and P. SWIFT and J. J. GILBERT of Dust Control Equipment Ltd. R. TAYLOR, Agricultural Director of the Corporation, then outlined the changes which have been taking place in British farming as a result of the increasing use of chemicals, rationalization of small farms into larger units, specialization of areas, and marketing through Government Boards. He reviewed the prospects for the 1966 beet crop which is expected to be lower than that of 1965. Representatives of the other European countries then gave an account of conditions in their own countries where, in many cases, poorer than usual crops were expected as a result of bad weather.

Dr. R. PIECK then presented two papers, the first, by P. DUPONT, describing the latest developments in the G.P. bag pressure filter, and the second describing a mobile laboratory which is used to visit sugar factories of the R.T. group in Belgium to permit examination of problems without disturbing the factory routine. The same evening saw the Conference Dinner given by the Corporation to delegates, who were welcomed by the Chairman, Sir EDMUND BACON.

On the 9th June a group of papers dealing with automatic control of pan boiling were presented by Dr. P. MOTTARD of France (on behalf of MM. D. AHARI, J. GENOTELLE, –. HODENT and R. MICHEL), R. F. MADSEN of Denmark, W. PARTALE of Germany and R. M. J. WITHERS and R. J. BASS of the B.S.C., Mr. WITHERS referring to a similar symposium which had been held at the February 1966 meeting of the Amercian Society of Sugar Beet Technologists.

In the afternoon, a party of delegates visited the Dungeness Nuclear Power Station while another toured Dover Harbour and Car Ferry Terminal and other delegates played golf. After this break, the Conference reassembled on the 10th June, to hear a paper on the constituents of standard liquor filter cake presented by Dr. A. CARRUTHERS, J. F. T. OLDFIELD and M. SHORE, who indicated the amounts of materials in the cake which, had they not been removed by filtration from the standard liquor, would have resulted in deterioration of the white sugar quality.

W. M. LANYON then gave an account of experience with Stord and Rose, Downs & Thompson beet pulp presses in the British Sugar Corporation and, extending from this, the similar problems arising from corrosion in diffuser drums. Following this, A. M. LLOYD and N. SNAITH of Rose, Downs & Thompson Ltd. described experiments that had been made at the Spalding factory in order to obtain more factual knowledge of conditions within a press, with the object of improving the design so as to obtain higher efficiency and throughput. After discussion on these papers the Conference adjourned.

A paper prepared by Dr. CARRUTHERS, J. V. DUTTON and J. F. T. OLDFIELD on the use of CAL carbon at York factory was left unread through insufficient time, as was the survey of heat usage and power in the Corporation prepared by B. HUTCHINSON.

CANE DIFFUSION PROGRESS IN HAWAII

Report on HSPA Diffuser Investigation at Pioneer Mill Co. Ltd.[1]

By Dr. JOHN H. PAYNE

(Hawaiian Sugar Planters' Assoc. Experiment Station)

Condensation of a talk given before the 24th annual meeting of the Hawaiian Sugar Technologists, November 1965.

THIS investigation was set up by the Hawaiian Sugar Planters' Association Experiment Station to study factors associated with the commercial operation of the Silver Ring Diffuser and associated equipment at the Pioneer Mill Co. Ltd.[2] The areas of concern were primarily those generally characteristic of a bed-type process as well as those peculiar to the ring-type machine.

Five phases of the operation were studied:

1. Control—feed and diffuser
2. Operation—establishment of optimum conditions
3. Cane liming and clarification
4. Press return handling
5. Process control

The investigational work being conducted on a production unit was subject to the characteristic problems. Conditions often had to be set in ranges far from optimum in order to establish the effect of different variables. Daily and weekly efficiency figures often suffered. Tests were made which, of necessity, involved substantial losses. In some instances the extent of these was not measured. But the overall provided information necessary for the most efficient operations.

Two major problems, however, remain without solution and require comment: (1) the screw press and (2) the boiling house. The diffuser and preparatory equipment were designed to handle 150 tons of prepared cane per hour. The screw press was designed for only 90 tons per hour and the boiling house has a rated capacity of only 115 tons cane per hour, but parts of this—the juice heater and evaporator station—are rated at only 100 tons cane per hour. Crop requirements necessitated a processing rate averaging 125 tons cane per hour. Thus the boiling house was overburdened continuously and often the diffuser had to be slowed down or stopped or the dilution reduced. For many weeks the dilution rate had to be held substandard in order to enable the evaporators to handle the output of juice.

Starting in September 1965, it was possible to extend the work week, and from that time on operation steadied down and operating conditions approached more nearly the desired level. The weekly figures reflect this, as shown in Table I.

It will be noted that since September extraction has been above 97% every week and occasionally it has approached 98%. This has been achieved without abnormal dilution. Bagasse moistures have been consistently in the 46% range. Production has been steady and efficiency high. Most of the conditions for optimum operation have been established.

Cane Liming and Clarification

One of the major subjects of investigation was that of liming in the diffuser. Some scouting observations had indicated that the diffuser might be used as a clarifier and filter as well as an extraction unit. At the beginning of the project this was studied in the laboratory. The results demonstrated that it was possible to lime disintegrated cane and obtain clarified juice in a bed-type extraction unit. Critical conditions were temperature, bed depth and number of passes of juice.

[1] *Ind. Agric. Research & Management Newsletter* (American Factors Associates), 1965, **5**, (4), 2–3.

[2] *I.S.J.*, 1965, **67**, 169.

Table I

Weekly factory report of Pioneer Mill Company

	Cane			*Diffusion*				*Efficiency*		*Bagasse*		*Mixed Juice*		*Syrup*	*Lime*
Week ending	*TFC*	*Trash % FC*	*TPC*	*TPC/ NH*	*Extract.*	*Draft*	*Dil % Ab. J.*	*Diff. eff.*	*Grind. eff.*	*Pol*	*Moist.*	*pH*	*Turb.*	*pH*	*lb CaO/ TPC*
27 Aug.	16,949·15	26·2	13,929·50	120·0	96·08	95·01	11·99	99·7	97·9	1·81	45·55	6·8	27	6·1	0·93
3 Sep.	16,184·05	24·7	13,722·01	121·0	96·70	98·48	16·52	96·7	92·5	1·41	46·83	6·9	21	6·1	1·06
10 Sep.	13,570·10	26·9	11,013·85	124·9	96·96	100·47	17·91	97·6	91·3	1·31	48·15	6·8	21	6·1	0·80
17 Sep.	17,556·00	27·0	14,270·91	119·9	97·33	103·39	21·26	98·8	96·5	1·18	46·75	6·8	25	6·1	0·85
24 Sep.	14,753·95	23·4	12,920·62	114·3	97·76	106·39	23·62	97·6	96·3	1·05	46·29	7·0	21	6·3	1·06
1 Oct.	18,124·30	31·7	14,643·91	124·0	97·52	100·31	18·83	99·3	96·2	1·14	46·90	7·0	19	6·2	1·22
8 Oct.	16,134·46	24·6	13,8894·2	124·8	97·69	100·87	18·65	92·2	90·3	1·04	44·42	6·9	26	6·3	0·83
15 Oct.	16,123·60	43·9	10,434·57	113·7	97·18	101·67	20·87	97·0	92·9	1·07	46·46	6·9	30	6·5	0·84
22 Oct.	18,606·25	38·7	13,205·30	123·2	97·79	108·17	27·97	98·1	92·6	0·92	46·31	6·9	24	6·1	0·59
29 Oct.	16,315·85	26·8	13,913·75	128·1	97·89	104·61	23·03	99·2	92·5	0·93	46·46	6·9	24	6·1	0·95
5 Nov.	17,839·50	29·2	14,455·70	122·2	97·91	106·63	23·76	100·0	95·4	0·91	46·05	7·0	23	6·3	1·13

Success in the laboratory led to trials on the production diffuser. These were started in mid-April. They were successful from the start and the procedure has been continued since that date. Lime is added as a slurry directly to the cane in the chute ahead of the cane buster. Control is on the weight of cane and the pH of the diffuser juice—the juice being recycled twice through the bed before discharging. This juice goes to the scales, then through the heaters and on to the evaporators. The conventional clarification system has been abandoned.

Liming control still presents some problems but the juice has been satisfactory for processing. In general, it contains less suspended solids and has better clarity than mill juice. One problem has been scaling in the juice heaters. A soft scale builds up by mid-week and must be removed. It is thought that this will be minimized by better temperature and liming controls.

Cane Preparation

As the HSPA pilot plant study in 1958 at Kekaha Sugar Co. indicated, a direct correlation between degree of cane preparation and extraction has been established with the commercial machine. This is illustrated in Fig. 1. Although extent of cell rupture is a routine laboratory control analysis, the effect was shown most dramatically when the speeds of the preparatory equipment were changed. Up to the week of 10th September (see Table I) the buster and fiberizer had been running at a speed of about 980 r.p.m. At that time the speed was increased to 1150 r.p.m. The extraction increased so significantly that the speed has been maintained at this level ever since. The curve with one preparatory unit, the buster, shows that with poor preparation, good extraction cannot be achieved. The buster and fiberizer have proved to be rugged, reliable, and effective devices.

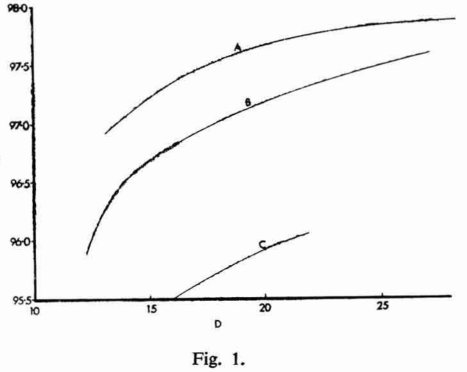

Fig. 1.

Extraction E as a function of dilution % absolute juice D. Key: A, buster and fiberizer, higher speed, bed saturated; B, buster and fiberizer, lower speed; C, buster only.

Dilution

Likewise validating pilot plant data, a direct relationship between dilution and extraction has been confirmed. This is also shown in Fig. 1. With good preparation the extraction level of 97% can be reached at a dilution on absolute juice of below 15%. Water efficiency in the diffuser is much greater than in a mill. This, of course, was also anticipated.

Diffuser Operation

General conditions for operating the equipment have been determined. These include bed depth, speed, position of distributors and temperature. Standard operating procedures have resulted. Fig. 2 shows average conditions at various positions in the diffuser with respect to pol, solids and purity.

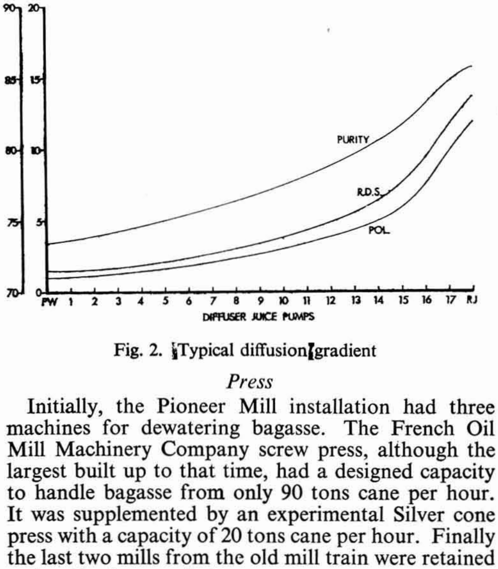

Fig. 2. Typical diffusion gradient

Press

Initially, the Pioneer Mill installation had three machines for dewatering bagasse. The French Oil Mill Machinery Company screw press, although the largest built up to that time, had a designed capacity to handle bagasse from only 90 tons cane per hour. It was supplemented by an experimental Silver cone press with a capacity of 20 tons cane per hour. Finally the last two mills from the old mill train were retained to handle the remainder.

After some experimental work the cone press was removed. Gradual improvement in the French press has resulted in it averaging close to 120 tons capacity. At times it handles the entire output of the diffuser at an average moisture level of 46%. It has been developed into an efficient machine and one which should provide an acceptable dewatering device for bagasse. A larger machine, now being built, will handle 25 tons fiber per hour, or the equivalent of about 185 tons cane.

Press Return

As originally installed, the only provision for treating the press return juice was coarse screening on DSM screens, followed by 100 mesh screening on Sweco screens. These proved inadequate. Laboratory percolation tests showed that untreated press returns plugged the cane bed very rapidly. Screening, even through 325 mesh screens, provided little improvement. The bed would come close to sealing near the surface.

Conventional settling provided the solution. Overflow from a clarifier showed little bed plugging characteristics. A Rapi-Dorr clarifier was installed. Press return goes to this without treatment and the overflow returns to the diffuser.

The suspended matter has rapid settling characteristics. It forms a heavy mud but is granular in character and proved almost impossible to handle in a conventional bottom-feed Oliver filter. The solution to this came with top feed. One of the filters was converted to a top-feed type. This has proven efficient, with filter cake pol averaging about 0·5. The whole operation is being made automatic by the installation of a consistency controller and filter speed controller.

Inversion

Careful study of the diffuser has shown there is essentially no occurrence of inversion due to micro-organisms or chemical processes. The juice from the diffuser is remarkably free from micro-organisms and tests have shown that it can stand in the laboratory for an hour without measurable inversion. It is evident, therefore, that losses attributable to inversion should be less than those in a milling train.

Process Control

In process control some new concepts have been introduced. Since these give figures with slight relation to those mill people are accustomed to, some questions may arise.

The control system is simple and straightforward, and is an official method of the Hawaiian Sugar Technologists. Extraction is based upon weight and pol of mixed juice and weight and pol of bagasse. Bagasse is weighed by a gamma-ray device.

Cane, as it enters the diffuser, is sampled periodically and is analysed directly for pol and fibre by the direct disintegrator method. Since the values are real and not calculated they may look strange to those used to conventional methods.

STUDIES ON SUGAR CRYSTALS

Soft Nature of Khandsari Crystals and its Influence on Sugar Losses in Khandsari

By S. K. D. AGARWAL

(National Sugar Institute, Kanpur, U.P., India)

INTRODUCTION

SUCROSE crystals have been obtained in various crystalline forms and shapes. Abnormality in crystal form has been attributed to the presence of various impurities in the mother liquor from which these have been developed and grown. For instance, the presence of raffinose is known to produce needle-like crystals[1], while formation of triangular or pyramidal forms has been attributed to high invert content[2]. Elongated crystals have often been reported at various times in many places. GUNDU RAO *et al.*[3] observed elongation in low grade crystals at Ravalgaon, India, towards the end of the season, for a number of years. They attributed this to use of stale cane and high calcium content in the juice. The inclusion of liquids, solids or gases (and even vacuum) within the structure of the crystals is well known.

It has been reported that sucrose forms what are termed "hard" and "soft" crystals but no conclusive evidence could be found to prove the existence of these. HONIG[4] considers meaningless the scientific use of the words "hard" and "soft" for physical characterization of sucrose crystals, while MCGINNIS[5] states "There is no denying the actuality of the phenomenon, although the physical explanation is obscure. It is reasonably definite that all crystals of sucrose have the same physical hardness, and the effect may be due to the presence of small clusters of little crystals, loosely stuck together, which break down when rubbed." This belief may be because of the fact that almost all sucrose crystals are manufactured by the vacuum pan process. During pan boiling the hardening of the grains invariably occurs. In India, however, while the major portion of the sugar manufactured is produced by the vacuum pan process, the open-pan process is also employed to make khandsari. While 30% of the cane produced in India goes to making vacuum pan sugar, 7% is utilized in khandsari production (the majority is used in manufacture of gur). Khandsari manufacture is a medium scale industry. A unit normally crushes 2 to 5 tons of cane per hour using a 6- or 8-roller milling tandem. The juice is clarified by the usual lime and sulphitation process, but the major difference

[1] HONIG: Principles of Sugar Technology, Vol. II. (Elsevier, Amsterdam), 1959, p. 27.
[2] VAVRINECZ: *I.S.J.*, 1939, **41**, 29, 345.
[3] *Proc. 5th Conv. Deccan Sugar Tech. Assoc.*, (India), 1948, 34.
[4] Principles of Sugar Technology. Vol. II. (Elsevier, New York), 1959, p. 33.
[5] Beet Sugar Technology. (Reinhold, New York), 1951, p. 351.

comes in the technique employed in boiling and crystallization. The juice is concentrated in open pans to a Brix of nearly 86° to 88° and a temperature of 107° to 108°C. This highly concentrated mass is treated as massecuite and poured directly into crystallizers, where the crystals are grown and developed for about 30 hours. It may be emphasized that the complete crystallization process therefore is done in the crystallizers, whose holding capacity is about half a ton to a ton. The first massecuite ("rab") thus obtained is cured in the centrifugals and the crystals obtained after washing in the machine are known as first sugar. The studies reported here refer to such first sugar. The molasses obtained is again concentrated in open pans to a consistency of 89°–90°Brix and is called the second rab. This is kept in crystallizers for about 3 days after which it is ready for centrifugalling. The third and fourth rab are made likewise. The general boiling has been described to focus attention on the fact that no seeding is done in any case and the nucleation and crystal growth is brought about by cooling of the massecuites. The question of hardening of the grain does not arise as it does in vacuum pans. The author has observed that the crystals obtained by the khandsari process were generally flattened in nature and the average axis ratios were a:b:c 1·3:1:0·5 compared with 1·2595:1:0·8782 in the case of ordinary crystals. The variation in the ratio of the axis a:b was found to vary from 1:1 to 3:1 compared with near uniformity in crystal size from all vacuum pan factories. The present communication reports the nature of khandsari crystals and the effect of their softness, as explained hereunder, on the yield of crystals in different stages of manufacture.

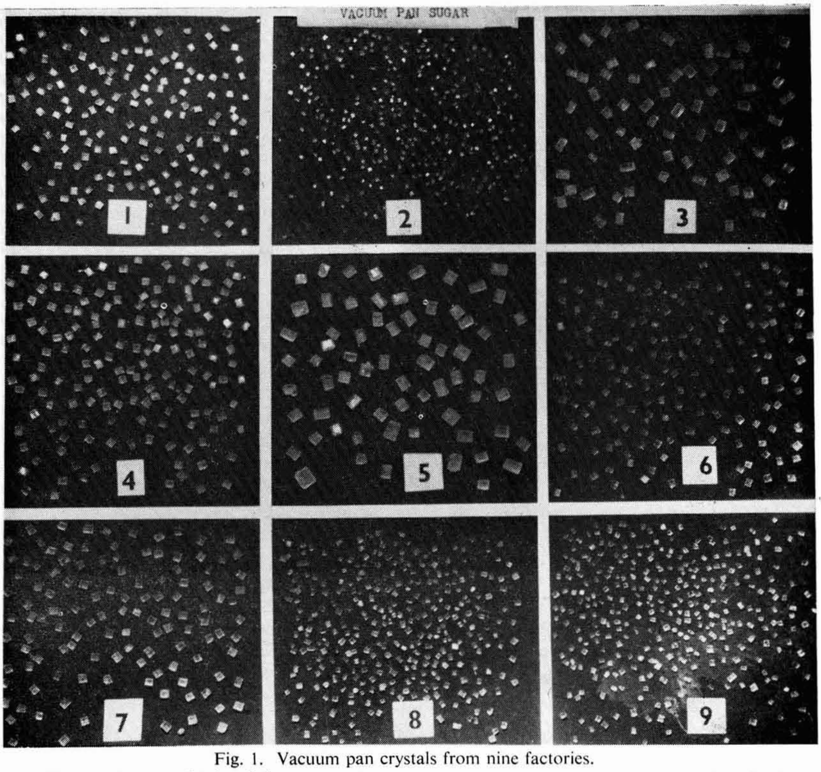

Fig. 1. Vacuum pan crystals from nine factories.

Experimental

The initial size of the crystals selected varied from 1 mm to 1·5 mm. These were photo-micrographed.

The soft nature was studied by measuring the time required for solution of khandsari and vacuum pan sugars of the same grain size and at the same speed of rotation of the stirrer. A speed of 30 r.p.m. was selected for this study after studying the effect of lower and higher speeds. The amount of sugar going into solution was followed by examining the refractometric Brix at different times.

The effect of washing of the crystals on the actual working of the factory was studied, wherein a known weight of the massecuite (rab) was purged and the weight of the unwashed and washed crystals taken. The available sugar and the actual sugar from the unwashed crystals was calculated with the aid of the *s-j-m* formula after recording the pol of the crystals. This was done to determine the amount of sugar lost in the washing operation.

Results and Discussions

Figs. 1 to 6 are six photomicrographs of the crystals. Fig. 1 shows a large number of vacuum pan crystals, while khandsari crystals appear in Fig. 2. Fig. 3 shows enlarged vacuum pan crystals, while Figs. 4–6 are enlarged pictures of khandsari crystals. It may be noted that the boundaries of the khandsari crystals are invariably ill-defined, irregular and without sharp edges in contrast to vacuum pan crystals. These crystals were from regular production, where the crystals were washed free of the molasses film towards the end of the centrifugalling process. The vacuum pan crystals were without any disorder in the crystal edges and faces, while the edges and faces of the khandsari crystals may also be seen to have had well defined edges and corners before centrifugation. The khandsari crystals' faces have a very large number of small pits and angular cavities, whose frequency and depth is much greater than is observed with vacuum pan crystals. It has been shown by KUKHARENKO[6], PHELPS[7], VAVRINECZ[8], POWERS[9] and many others that a number of impurities, air bubbles, vacuum, water globules and cracks are introduced during crystal growth in the case of even ordinary crystals. The presence of these in large numbers is well exhibited in the photographs of khandsari crystals, which may be attributed to the difference in the technique of nucleation, crystal development and presence of high invert content (due to higher temperatures and higher Brixes). It has been shown by the author[10] that during nucleation and development of the khandsari crystals, the supersaturation varies to a much wider extent than the range of 1·0 to 1·2 occurring during sugar crystallization in a vacuum pan. The temperature, instead of remaining nearly constant (under constant vacuum) as in a vacuum pan, changes throughout the crystallization process from 108°C to room temperature by the time the final material is obtained after about 30 hours. These drastic variations in supersaturation and temperatures considerably increase the possibility of further inclusion of air bubbles, water globules and formation of cracks. Such inclusions make the crystals hollow with weaker binding force. The feel[2] of the grain between the

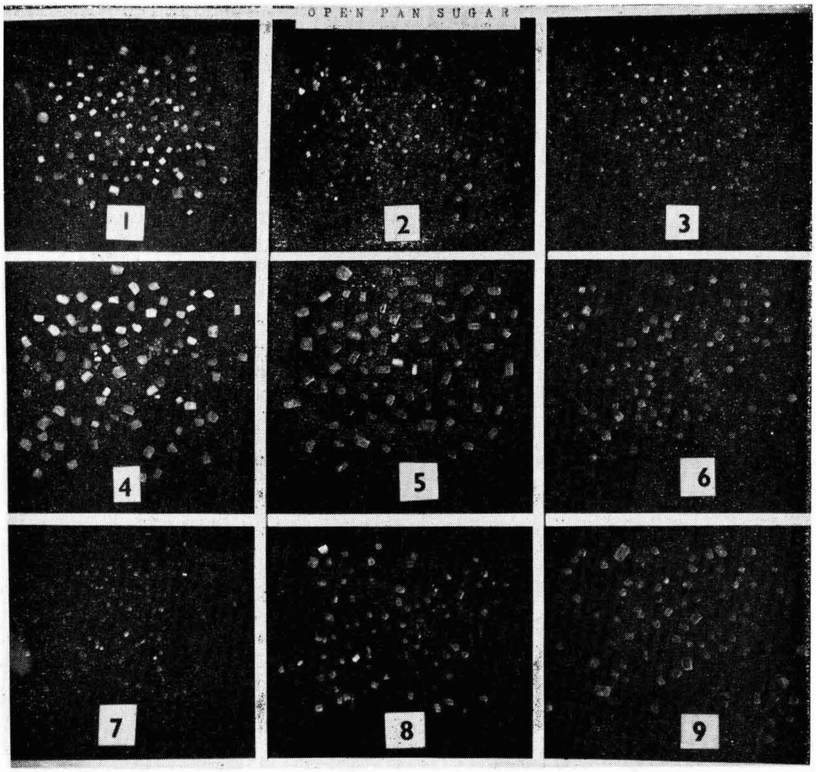

Fig. 2. Open pan crystals from nine factories.

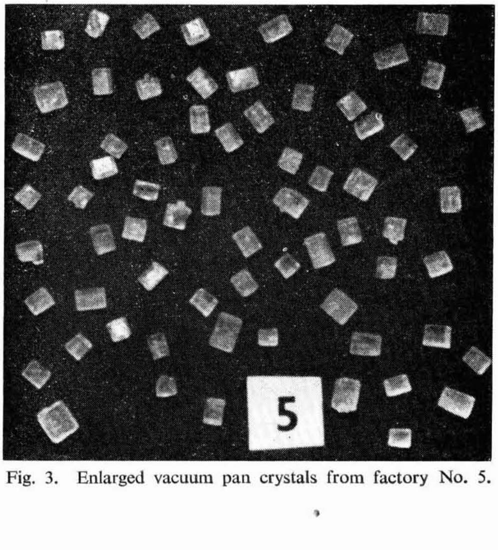

Fig. 3. Enlarged vacuum pan crystals from factory No. 5.

[6] *Planter & Sugar Mfctr.*, 1928, **80**, 382, 424.
[7] *Proc. 4th Congr. I.S.S.C.T.*, 1932, 104.
[8] *Z. Ver. Deut. Zuckerind.*, 1941, **66**, 683, 728, 739, 753, 775, 788, 801, 834.
[9] *I.S.J.*, 1956, **58**, 246; *Proc. 21st Meeting Sugar Ind. Tech.*, 1962, 106.
[10] *Proc. 33rd Conv. Sugar Techn. Assoc. India*, 1965, 125.

fingers therefore varies; soft khandsari grain easily "rubs out", whilst ordinary crystals of vacuum pan sugar are "hard" and feel like little glass particles.

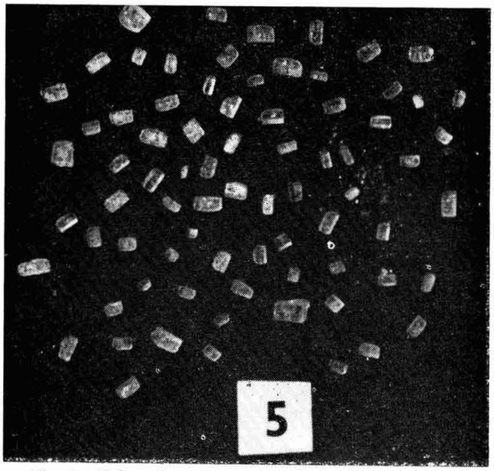

Fig. 4. Enlarged open pan crystals from factory No. 5.

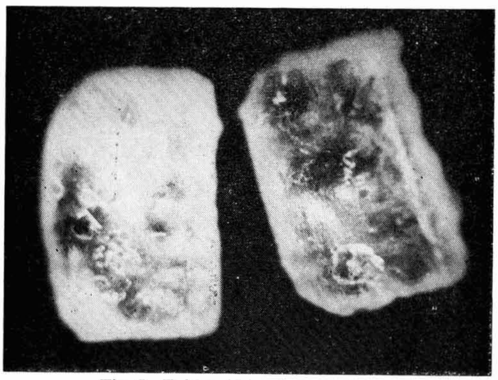

Fig. 5. Enlarged khandsari crystals.

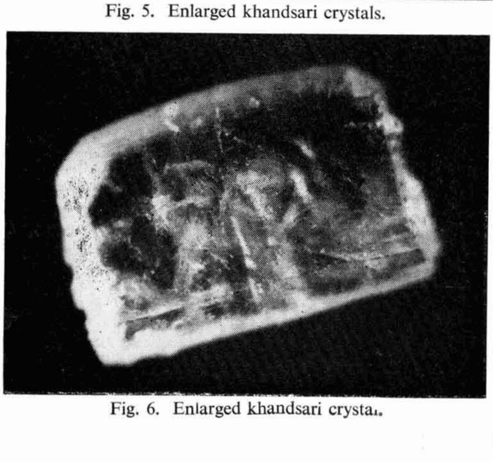

Fig. 6. Enlarged khandsari crystal.

All the khandsari crystals met with by the author were found to rub out easily without any necessity for excessive pressure to be applied to crush them. In the case of vacuum pan crystals, the author was not able to find crystals from any factory which behaved in a similar fashion, and crystal hardness was invariably felt.

The soft nature of the khandsari crystals may also be associated with the flat nature of the crystals. The author has pointed out earlier that these crystals were invariably flat and attributed this partly to the near absence of circulation during crystal growth. The rate of circulation in vacuum pans varies from 1·5 to 2·5 ft/sec compared with a speed of rotation of the stirrer in the khandsari crystallizers of 3 to 5 r.p.m. This results in local oversaturation and disorders during crystal development. The movement in the crystallizers may lead more to abrasion than to circulation. This abrasion results in flat crystals which require less force for crushing than for the normal ones, which are comparatively thicker.

The soft nature of the khandsari crystals was studied by another method. The solution rate of the crystals of both the types of sugars was determined. The sugars were sieved to obtain E grain crystals on the B.S.S. scale by collecting sugar passing through 20 mesh and retained by 28 mesh. In all, 15 samples of vacuum pan and 15 of khandsari sugars were thus sieved. The solution rate of each was determined by taking 50 ml of distilled water in a 150 ml beaker. The stirrer was started and 50 g of sugar was added in each case. The speed of the stirrer was arbitrarily selected at 30 r.p.m. At higher speeds, the time of solution was found to be too short to measure a significant difference while, at lower stirrer speeds of 10 r.p.m. or so, mixing was not homogeneous. The dissolution was followed by measuring the refractometric Brix. Smooth solution curves were obtained. The vacuum pan sugars all required between 8 and 10 min to dissolve, while the open pan crystals required between 6 and 7 min. This difference of 15 to 30% in the time of solution indicated the comparative softness of the khandsari crystals.

The effect of the soft nature of these crystals during the manufacture was studied by examination of the amount of sugar dissolved by washing during

Table I

Sample	*Weight of massecuite (kg)*	*Weight of unwashed sugar obtained (kg)*	*Calculated available white sugar in unwashed sugar (kg)*	*Actual weight of washed sugar (kg)*	*Loss of sugar (kg)*
		First rab			
1	27·0	12·25	11·63	10·00	1·63
2	24·0	10·25	9·64	8·50	1·14
		Third rab			
3	30·0	7·7	6·44	5·00	1·44
4	27·5	7·0	6·84	5·50	1·34
		Fourth rab			
5	27·0	5·25	5·00	4·50	0·50
6	27·0	5·0	4·76	4·00	0·76

centrifugalling. These studies were made by purging known amounts of different types of massecuites (rabs) and estimating the amount of washed and unwashed sugars obtained under the same conditions of speed, time of centrifugation, etc.

The unwashed sugar was weighed and the available sugar was calculated using the *s-j-m* formula. The difference in the available sugar from the unwashed crystals and the actual sugar gave the sugar dissolved during washing. These studies were made for first, third and fourth rab. The second rab could not be tested as it was not available during the studies. The results are given in Table I. It may be seen that in each case, 10 to 20% of the crystallized sugar was dissolved during washing, because of the comparative ease with which the crystals were dissolved. The fines associated with the crystals, which dissolved so quickly, are a further indication of the soft nature of the crystals.

ACKNOWLEDGMENT

The author thanks Shri S. C. GUPTA, Director, and Shri S. L. PHANSALKAR, Professor of Sugar Technology, National Sugar Institute, Kanpur, India, for permission to publish this paper.

GALACTINOL IN BEET MOLASSES

Part I. An Ion-Exchange Procedure for the Isolation of Galactinol

By J. V. DUTTON

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INTRODUCTION

GALACTINOL was first indentified as a constituent of sugar beet juice by BROWN and SERRO[1] who obtained a crystalline product from Steffen's "discard" molasses and showed the product to be O-α-D-galactopyranosyl-myo-inositol dihydrate.

The isolation procedure now described can be applied to normal straight-run beet molasses. The method is based on the original lead acetate precipitation procedure of BROWN and SERRO but galactinol and inositol are recovered from the precipitate by treatment with a strong cation exchanger instead of hydrogen sulphide, and the compounds are separated by an ion exchange fractionation instead of by carbon column chromatography.

The fractionation of carbohydrates on the lithium form of strong cation exchange resins has been reported previously[2]. The effect observed in these experiments was, however, considered to be a molecular sieve effect rather than ion-exchange, since a neutral form of the resin was employed and carbohydrates appeared in the resin effluent in the order of descending molecular size.

The present work was prompted by observations of the behaviour of carbohydrates on the hydroxide form of strong-base resins. "De-Acidite FF", "Amberlite IRA 400 and 401" and "Dowex 1(X8)" were employed. With such resins it appears that ion-exchange does occur, so that some carbohydrates are taken up by the resin and are not readily removed by washing with up to 15 bed-volumes of water. These carbohydrates include sucrose, raffinose, kestose, fructose, and glucose. After 15 bed-volumes some leakage of these carbohydrates occurs, but galactinol and inositol are only weakly held by the resin and are removed by washing with 1 to 2 bed-volumes of water and are consequently separated from the other carbohydrates. Inositol appears in the effluent before galactinol, so that a molecular sieve effect is clearly not involved.

Similar observations have been made by AUSTIN *et al.*[3], who separated glycosides on the hydroxide form of strong-base resins, and by SCHWARZ[4] who separated glycosides, trehalose and sucrose on such resins.

For those carbohydrates that are taken up by the resin, the exchange capacity was found to be approximately 15 μmoles of carbohydrate per ml of resin. In the isolation procedure, therefore, a preliminary separation of galactinol from the bulk of the carbohydrates in molasses was effected by precipitation with basic lead acetate. Using excess basic lead acetate the precipitation was found to be quantitative as will be reported in Part II of this paper. Admixture of a strong cation-exchange resin in the hydrogen form with the lead precipitate yielded a more concentrated solution of galactinol which was then applied to the anion-exchange column to absorb the unwanted carbohydrates and de-acidify the concentrate. The column was then washed with water to fractionate the inositol and galactinol.

EXPERIMENTAL

Materials

Basic lead acetate A.R. [approximately $(CH_3COO)_2Pb$, $Pb(OH)_2$] was obtained from British Drug Houses Ltd., Graham St., London N.1. "Zeo-Karb 225" (14–52 mesh, 8% DVB) and "De-Acidite FF" (52–100 mesh, 7–9% average crosslinking) ion exchange resins were obtained from The Permutit Company Ltd., Gunnersbury Ave., London W.4.

Chromatographic methods

Paper chromatograms were run on Whatman No. 1 paper using the following solvents (proportions by volume) and development times : (A) 7:1:2 *n*-propanol:ethyl acetate:water, 16 hours, (B) 3:3:1 ethyl

[1] *J. Amer. Chem. Soc.*, 1953, **75**, 1040.
[2] CARRUTHERS *et al.*: *I.S.J.*, 1963, **65**, 234, 266.
[3] *J. Chem. Soc.*, 1963, 5350.
[4] Private Communication, 1964.

acetate-acetic acid-water, 16 hours, and (C) 10:1:2 *n*-butanol:ethanol:water, 64 hours.

Thin layer chromatograms were prepared with "Kieselgel G" (E. Merck A.G., Darmstadt, Germany) and developed in solvent D (2:2:1 *n*-propanol:ethyl acetate:water)[2] for 1–2 hours.

The carbohydrates were detected with the following spray reagents:

(i) Silver nitrate—potassium hydroxide.

This was a modification of the reagent described by TREVELYAN, PROCTER and HARRISON[5]. The silver nitrate solution was prepared by diluting 1 volume of a 20% (w/v) aqueous solution of silver nitrate to 20 volumes with acetone. The potassium hydroxide solution was prepared by diluting 1 volume of a 50% (w/w) aqueous solution of potassium hydroxide to 20 volumes with methanol.

The reagent was used to detect carbohydrates on paper or thin-layer chromatograms. The chromatogram was sprayed first with the silver nitrate reagent and allowed to dry at room temperature. It was then sprayed with the potassium hydroxide reagent when carbohydrates reacted in the cold to give brown-black spots.

(ii) α-naphthol—sulphuric acid[2].

This was prepared by dissolving 1 gram of α-naphthol in methanol, adding 5 ml of concentrated sulphuric acid slowly, with mixing to prevent boiling, and finally making up to 100 ml with methanol.

This reagent attacks paper and it is therefore only suitable for the detection of carbohydrates on thin layer chromatograms. Sprayed plates were heated at 80°–90°C for 3–5 minutes. Galactinol and aldose sugars reacted to give pink spots which with stronger heating became brown. Heating was therefore usually discontinued before deterioration of the pink colour occurred.

The isolation of galactinol

500 grams of straight-run beet molasses were diluted with water, 150 grams of dry basic lead acetate were added and the mixture further diluted to a total volume of about 2 litres. The suspension was stirred thoroughly for 15 minutes and filtered on a Buchner funnel. The precipitate was sucked dry (until the cake began to crack) and was removed from the funnel, stirred with 2 litres of water and filtered again. This washing process was repeated twice more and was essential to reduce the concentration of occluded carbohydrates, principally sucrose, so that the anion-exchange column should not be overloaded in the next operation.

The washed precipitate was dissolved by mixing with 1 litre of drained "ZeoKarb 225" in the hydrogen form and the resin slurry poured into a 35 × 7 cm glass column. This column was connected in series with a 50 × 5·5 cm column of "De-Acidite FF" in the hydroxide form. The acidic solution associated with the "ZeoKarb" resin was allowed to drain on to the "De-Acidite" column and then washing with water was commenced. The effluent from the "De-Acidite" column was collected automatically as 10-ml fractions at 26-minute intervals. Samples of fractions were spotted on duplicate thin layer chromatograms which were developed in 2:2:1 *n*-propanol: ethyl acetate:water for 1 hour and sprayed successively with reagents (i) and (ii). A typical set of results is as shown in Table I.

Table I
Qualitative analysis of ion-exchange fractions

Fractions	Reaction with— (i) $AgNO_3$-KOH	(ii) α-naphthol-H_2SO_4	$R_{sucrose}$ in developer solvent
1–74	— ve	— ve	—
75–108	+ ve	— ve	0·64
109–122	— ve	— ve	—
123–181	+ ve	+ ve	0·40
181–200	— ve	— ve	—

Fractions 75–108 were bulked and evaporated to dryness yielding a colourless crystalline product which was identified as myo-inositol by the fact that it had no optical activity and was not separable from myo-inositol by either paper or thin-layer chromatography.

Fractions 123–181 were also bulked and evaporated to dryness to give a white amorphous powder. This was crystallized initially with some difficulty, by using a butanol-methanol technique similar to that described by WHISTLER and DURSO[6], though in subsequent experiments the product crystallized readily from approx. 80% aqueous methanol yielding 0·5 to 0·9 g of colourless needle-like crystals. These were recrystallized from aqueous methanol, washed with methanol and air-dried at room temperature. Examination was carried out as described below.

Physical properties of the recrystallized product

The physical properties of the recrystallized product are very similar to those reported by BROWN and SERRO for galactinol dihydrate as may be seen from their comparison in Table II. Small, but significant, differences are however apparent. In particular, the weight lost at 90°C *in vacuo* is not as close to the theoretical 9·52% for the dihydrate as the result obtained by these authors. They did not specify the procedure used to dry the crystalline galactinol.

Table II
Comparison of the physical properties of the recrystallized product with those of galactinol

	$[\alpha]_D^{20}$ *2% aq. soln.*	*% weight loss (at 90°C, 16 hr. in vacuo)*	*Melting point (°C)* *Open tube*	*Closed tube*
Recrystallized product	+136°	9·2	226–228°	
Galactinol (Brown & Serro)	+135·6°	9·57	220–222°	113–114°

It was found that if the crystalline product was dried *in vacuo* over calcium chloride at room temperature, the product lost weight so that the residual water content was only about 6% after 16 hours and only 3·5% after 10 days. The specific rotation increased with drying to an extent equivalent to the

[5] *Nature* (London), 1950, **166**, 444.
[6] *J. Amer. Chem. Soc.*, 1951, **73**, 4189.

weight loss. Under similar drying conditions, a weight loss of 4–5% in 16 hours was observed with raffinose pentahydrate.

The technique subsequently used to air-dry the recrystallized product was on an open dish at room temperature. Constant weight was reached after 1–2 hours.

It is postulated that even under these conditions partial dehydration occurs so that the water content is slightly lower than the theoretical for the dihydrate.

When allowance is made for the differing water contents, the specific rotation of the recrystallized product is identical with that of the galactinol prepared by BROWN and SERRO. The specific rotation of the product dried at 90°C was found to be +150°, which is also identical to the calculated specific rotation of anhydrous galactinol.

The recrystallized product melted at 115–116°C, but on continued heating it was observed that the resultant liquid boiled, yielding a white powder which subsequently melted, without decomposition, at 226–228°C. As an explanation of these observations, it is suggested that at 115–116°C the product dehydrates and dissolves simultaneously in the liberated water. The syrup obtained then boils dry and the anhydrous product melts at 226–228°C.

These melting point observations are similar to those reported by BROWN and SERRO for galactinol but both temperatures are somewhat higher.

From the results obtained it is concluded that the recrystallized product is galactinol hydrate. Since the degree of hydration is dependent on the drying conditions, it is considered that the residual water content should be measured simultaneously with the optical rotation when assaying galactinol hydrate by specific rotation.

Chemical properties of the recrystallized product

1. *Treatment with Clerget acid.*—0·4 gram was dissolved in a few ml of water, 1 ml of concentrated hydrochloric acid was added and the solution made up to 20 ml with water. The optical rotation in a 2 decimetre tube was found to be 5·47°. The solution was then heated at 69°C for 5 minutes, cooled rapidly to 20°C and the rotation was found to be almost unchanged at 5·45°.

2. *Acid treatment at* 100°*C.*—Whereas no hydrolysis occurred under Clerget acid conditions, it was found that the product was completely hydrolysed by heating with 0·2N hydrochloric acid at 100°C for 2·5 hours. The products of hydrolysis were identified as galactose and inositol by chromatography on paper and on thin-layer plates.

3. *Treatment with enzymes.*—An invertase solution was prepared by diluting 1 ml of "Sumasuco" invertase concentrate (The Sugar Manufacturers' Supply Company Ltd., 196 Bermondsey St., London S.E.1) to 50 ml with water.

A solution of invertase containing melibiase was prepared by dissolving 0·10 gram of Wallerstein scales (Wallerstein Laboratories, 180 Madison Ave., New York 16, N.Y., U.S.A.) in 5 ml of water.

2 ml of each enzyme solution were then added to two 2 ml aliquots of a 2% aqueous solution of the product. Control digests in which the invertase solution had been added to sucrose and the melibiase solution had been added to melibiose were also prepared and all digests placed in an incubator at 60°C for 1 hours.

Complete hydrolysis of sucrose and melibiose occurred under these conditions. Examination of the other two digests showed that the product was unaffected by invertase but had been completely hydrolysed by the melibiase solution to yield galactose and inositol.

Chromatographic data

Although no authentic specimen of galactinol was available for comparison, the chromatographic results obtained for solutions of the crystalline product are shown in Table III.

Table III

Chromatographic properties of the isolated material

	Solvent	$R_{sucrose}$	$R_{glucose}$
Paper chromatograms	A	0·43	0·35
	B	0·45	0·42
	C	0·18	0·09
Kieselgel G chromatograms	D	0·40	0·34

CONCLUSIONS

The crystalline product isolated from molasses corresponds to galactinol hydrate. The degree of hydration is dependent on the drying conditions but on air drying the residual water content of the crystalline product was slightly less than the theoretical value for galactinol dihydrate.

The advantages offered by the ion-exchange procedure described in this paper for the isolation of galactinol are as follows:—

1. Sucrose, which generally overlaps galactinol in carbon column chromatography, is completely taken up by the ion-exchange column and does not interfere with the subsequent fractionation.
2. Inositol, which also overlaps galactinol in carbon columns, is readily separated by the ion-exchange method.
3. The use of a strong cation exchange resin to remove lead eliminates the use of hydrogen sulphide and subsequent filtration of lead sulphide.
4. No separate de-acidification step is necessary prior to fractionation.
5. Effluent fractions are neutral and can therefore be concentrated immediately, whereas fractions from carbon columns are often acidic and require neutralization.

This ion exchange technique obviously lends itself to other carbohydrate fractionations and further applications are being examined.

It should also be noted that, if deionization of carbohydrate solutions with strong-base resins is employed prior to quantitative determination of the carbohydrate, allowance should be made for possible carbohydrate uptake on the resin.

Cultural and manurial trials with sugar cane ratoons. V. P. Vaidya. *Proc. 20th Ann. Conv. Deccan Sugar Tech. Assoc.(India)*, 1965, 47–59.—Results are given of attempts to grow better ratoon crops on the farms of the Godavari Sugar Mills Ltd., Sakarwadi. Large-scale replicated trials were carried out with different ratoon treatments and combinations of N, P and K. Stubble shaving and interrow cultivation is considered well worthwhile. Optimum levels of N were between 250 and 300 lb per acre.

* * *

Preliminary trials with trace elements. G. K. Tonapy *et al. Proc. 20th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1965, 205–207.—Zinc sulphate, manganese sulphate, borax, copper sulphate and iron sulphate were applied with the 3rd dose of manure, at the rate of 2 kg/acre to 25 plots of different types of soil. Treated plots on the whole gave better cane, except on red alluvial soils where there was little or no response. Some varieties of cane appeared to be more responsive than others.

* * *

Physico-chemical changes in the major soil types of the Nira canals under the prevailing system of sugar cane cultivation. K. S. Pharande. *Proc. 20th Ann. Conv. Deccan Sugar Tech. Assoc. (India)*, 1965, 215–229. Numerous soil profiles from the 5 major soil types were examined. In general cane cultivation had not modified the soil reaction appreciably. The free lime status had been depleted. There were losses in humus in the lower layers and gains in the middle layers.

* * *

The production of new varieties of sugar cane. M. L. Bruzzo. *La. Ind. Azuc.*, 1965, **71**, (865), 405–407. The principles underlying selection work in Tucumán are described. Early maturity, high sugar content and resistance to mosaic are regarded as of major importance, other important characters being erect growth with uniform height and low fibre content.

* * *

The value of residual herbicides. Anon. *Ann. Rpt. Research Dept. Sugar Manuf. Assoc. Jamaica Ltd.*, 1963, 5–6.—Residual herbicides may be useful with cane under certain conditions, e.g. when heavy rain is expected or as band treatment in suppressing weeds. The results of trials with various residual herbicides are given.

* * *

Rotting of maturing stalks after lodging. Anon. *Ann. Rpt. Research Dept. Sugar Manuf. Assoc. (Jamaica) Ltd.*, 1963, 19.—Yields of two varieties had an upper limit imposed by the rotting of maturing stalks. Rotting started after lodging with the death of the spindle and then progressed to the base of the stalk. The cause of the rotting is not clear. It has sometimes been noted in more than 40% of the stalks.

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The value of some forms of "slow release" sulphate of ammonia and urea. Anon. *Ann. Rpt. Research Dept. Sugar Manuf. Assoc. (Jamaica) Ltd.*, 1963, 21.—Slow release urea and slow release sulphate of ammonia were compared against the standard materials at three rates of nitrogen application (equivalent to 0, 2 and 4 cwt per acre sulphate of ammonia) in 4 plant cane and 4 ratoon experiments. The type of N carrier, slow release or conventional, did not influence leaf composition. Further results, presumably on yield, are awaited.

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Mixtures *versus* single-element fertilizer. Anon. *Ann. Rpt. Research Dept. Sugar Manuf. Assoc. (Jamaica) Ltd.*, 1963, 22.—Trials to compare the relative merits of mixtures of N, P and K against single-element fertilizer in both plant and ratoon cane are reported. Yield data showed a perceptible, though small, difference in favour of single-element materials (43% to 34% over the control).

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Cane fly. Anon. *Ann. Rpt. Research Dept. Sugar Manuf. Assoc. (Jamaica) Ltd.*, 1963, 23.—Cane fly (*Saccharosydne saccharivora*) continued to be a serious pest, especially on irrigated estates. Aerial spraying (1 pint of 50% "Malathion EC" per acre) has largely superseded ground application. Proper collaboration between adjacent properties is essential for efficient cane fly control to prevent or minimize re-infestation.

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Root distribution. Anon. *Ann. Rpt. Research Dept. Sugar Manuf. Assoc. (Jamaica) Ltd.*, 1963, 24.—Profile studies of the root systems of commercial varieties showed that each had a characteristic feeding root distribution: 0–2 inches shallow: 0–8 inches intermediate and 0–12 inches deep. The two varieties most susceptible to "Worthy Park Root Failure" (cause not definitely known) are both essentially surface feeders.

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Release of phosphorus at various levels of soil reaction. I. A. P. Gupta. *Proc. 32nd Ann. Conv. Sugar Tech. Assoc. India*, 1964, 53–57.—The variation of available phosphorus in the different types of sugar cane soils in Bihar is discussed.

A field study of some effects of salinity on sugar cane. T. Y. RIZK and W. C. NORMAND. *Sugar Bull.*, 1966, **44,** 154–155.—The effects on cane of a leaking underground pipeline carrying brine adjacent to a cane field are described. On the side of the field nearest the pipeline there was only about 10% germination. Most of the young plants subsequently died and the survivors were reduced in height by 80%. As the distance from the pipeline increased, the reduction in height decreased until at about 200 feet from the pipeline cane grew normally. Tables showing sodium percentage and effects on yield and juice quality are given. It was concluded it was not economical to grow cane (variety CP 47-193) in soils containing more than 1% sodium.

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Recommendations for the control of Johnson grass and other weeds and grasses in sugar cane in Louisiana. E. R. STAMPER and D. T. LOUPE. *Sugar Bull.*, 1966, **44,** 167–172.—Fallow ploughing, six or more times, in late spring or summer is still considered necessary for control. There are no chemicals, at present, that may be economically substituted for a fallow ploughing programme. Recommendations for treating growing cane or ratoons that are infected with Johnson grass by chemical weedkillers ("Silvex", TCA and "Fenac") are given. New weedkillers that have shown promise for weed and grass control are "Sinbar", "Tordon" and "Banvel D".

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Water culture studies on the deficiency of major elements in sugar cane during early growth phases. H. P. VERMA and S. SINGH. *Proc. 32nd Ann. Conv. Sugar Tech. Assoc. India*, 1964, 1–9.—Water culture experiments with young cane and deficiencies in N, P and K are reported with details of the symptoms produced. N deficiency responded first with short pale yellow leaves. Tiller and root formation were inhibited. K and P deficiency showed later; the former produced patches on leaf midribs and browning. With P deficiency leaves showed marginal drying and then yellowing.

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Recent trials with chemical weedkillers at Shahjahanpur. P. S. MATHUR and R. P. SINGH. *Proc. 32nd Ann. Conv. Sugar Tech. Assoc. India*, 1964, 25–32.—The results obtained from the use of "Atrazine", "Paraquat", and "Eptam", in various doses and applied at different times, are discussed. "Atrazine" was best used by pre- and post-emergence application and controlled both dicotyledonous and monocotyledonous weeds, except nut grass (*Cyperus rotundus*) which was controlled by "Eptam".

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On certain yield attributes of sugar cane. T. A. G. IYER *et al. Indian Sugarcane J.*, 1965, **10,** (1), 28–33. An attempt is made to ascertain to what extent leaf weight, leaf sheath moisture and leaf nitrogen may have a bearing on yield. Leaf weight was found to have the greatest influence.

Effects of soil cover and trash-veins on the productivity of alkaline soils for sugar cane culture. R. R. PANJE, P. S. GILL and M. ALAM. *Indian Sugarcane J.*, 1965, **10,** (1), 1–8.—Reports are made on three small-scale experiments at the Sugarcane Research Institute, Lucknow, to test the effects of soil moisture conservation treatments on sodium alkaline soils. Black polyethylene sheet was effective but too expensive. Packing chopped cane trash in the planted furrows conserved moisture and gave improved tillering and crop growth, resulting in an average increase of 17 metric tons of cane per hectare. Black polyethylene sheet gave an increase of 22 tons.

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Inter-relationship between physico-chemical properties and drought resistance in sugar cane under varying conditions of age, nutrition and soil moisture. K. N. LAL *et al. Indian Sugarcane J.*, 1965, **10,** (1), 9–21. Changes in osmotic pressure and solute concentration were studied with numerous varieties under various conditions—in the field and in pot culture. As a rule the higher the osmotic pressure and solute concentration the greater the variety's resistance to drought. Potassium deficiency significantly reduced osmotic pressure. Age increased solute concentration more markedly than osmotic pressure.

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A new method of determining drought tolerance in sugar cane varieties. K. K. P. RAO and A. SANANDACHARY. *Indian Sugarcane J.*, 1965, **10,** (1), 22–23.—A description is given of a laboratory method developed for testing drought resistance of cane varieties, based on the % decrease in shoot moisture, root and shoot weights in plants grown in sucrose solutions under increasing levels of osmotic pressure and by working out a discriminant function using these three characteristics. Agreement between laboratory results and field observations on 5 varieties of known drought resistance was found to be quite close.

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On the utility of trash mulch in sugar cane ratoons. P. S. MATHUR and M. M. SAKSENA. *Indian Sugarcane J.*, 1965, **10,** (1), 24–27.—Results are given of two seasons' trials on sandy loam soils at the Sugarcane Research Station, Shahjahanpur. A trash mulch, 15–30 cm thick, after harvesting plant cane conserved soil moisture, suppressed weeds and eventually gave yields better than those obtained with normal methods of cultivation, i.e. dismantling of ridges and hoeing. Early shoot borer infestation was also reduced.

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Further observations on the utility of trash mulch in sugar cane fields. P. S. MATHUR and M. M. SAKSENA. *Proc. 32nd Ann. Conv. Sugar Tech. Assoc. India*, 1964, 11–16.—Results confirmed earlier findings; compared with hoeing, a trash mulch conserved moisture (requiring less irrigation water), smothered weeds, resulted in less infestation from early shoot borers and finally resulted in higher yields. Tiller formation was not seriously affected.

Outstanding canes of Bihar. X. B.O. 34, a mid-early variety suited to drought affected areas. C. THAKUR *et al.* *Indian Sugarcane J.*, 1965, **10**, (1), 34–38.—A detailed description, with coloured plate, of this variety is given. It has proved outstanding in Bihar, being drought-resistant, quite early and with good tonnage and juice quality.

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"Telodrin"—an effective insecticide to control soil and foliage pests of sugar cane in Uttar Pradesh. T. P. S. TEOTIA *et al.* *Indian Sugarcane J.*, 1965, **10**, (1), 39–41.—The favourable results obtained with this insecticide on a variety of pests (termites, shoot and root borers), are described.

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Preliminary survey of the mealybugs attacking cane at Agra. R. L. YADAVA. *Indian Sugarcane J.*, 1965, **10**, (1), 45–50.—An account is given of the method and severity of attack of two species of mealybug, i.e. *Saccharicoccus sacchari* and *S. saccharifolii.*

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Chemicals for effective control of woolly aphis. ANON. *Victorias Milling Co. Expt. Sta. Bull.*, 1965, **13**, (1 & 2), 3.—Several modern insecticides are listed as having shown good control of woolly aphis or "cosim" (*Oregma lanigera*) on cane in field testing. Thirteen gave 100% kill after 4 days.

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Extending harvesting age increases yield. ANON. *Victorias Milling Co. Expt. Sta. Bull.*, 1965, **13**, (1 & 2), 5.—Results of a comparative study on harvesting age with 4 different varieties of cane are given. Raising it from 11 to 12 months increased yield (about 15%) in all varieties. Beyond 12 months one variety (Phil. 58-260) failed to register any increase. The other three averaged a yield increase of 13% on raising harvesting age from 13 to 14 months.

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New varieties. L. L. LAUDEN. *Sugar Bull.* (La.), 1965, **44**, 24.—Reference is made to five promising new unreleased varieties to be transferred from primary stations to secondary increase stations, viz. CP 61-37, CP 61-39, L 61-43, L 61-45 and L 61-67. These canes have good vigour and high sugar and it is hoped that some will show good resistance to mosaic disease. Hurricane Betsy broke nearly 100% of the tops out of CP 60-23 at many stations and this variety may be discarded or held for future consideration.

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Wild sugar canes in new crosses at Coimbatore, India. P. H. DUNCKELMAN. *Sugar Bull.*, 1965, **44**, 25–29. Reference is made to the hybridization of American and Indian sugar canes with *Saccharum spontaneum* clones and the importance of this work in improving resistance to sugar cane diseases and pests and unfavourable environmental conditions. The great genetic diversity of *S. spontaneum*, with more than 450 clones varying from dwarf bushy types with wiry leaves to plants over 20 feet in height, is described.

The Louisiana sugar cane variety census for 1965. R. J. MATHERNE. *Sugar Bull.*, 1965, **44**, 33–35.—The relative importance of the more important varieties are given. CP 52-68 was the most extensively grown variety occupying 41·34% of the state acreage. Second place was taken by CP 44-101 (23·72%) and third place by the long established variety N:Co 310 (12·61%) which showed a large decrease (3·72%). It is thought that resistance to mosaic disease may be all-important in the choice of variety by growers in the future.

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Sugar cane planter research at Louisiana State University. M. M. MAYEUX. *Sugar Bull.*, 1965, **44**, 36–39.—It is pointed out that the planting operation is the last obstacle to a completely mechanized sugar industry in Louisiana. The difficulties facing the designer of a mechanical cane planter are stressed, e.g. lack of uniformity of setts and the bulk of the material (2 to 4 tons per acre). Progress made so far is described.

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A study of response of CP 44-101 to salt. W. C. NORMAND and T. Y. RIZK. *Sugar Bull.*, 1965, **44**, 41–42.—Under greenhouse conditions it was found that the stage of growth most sensitive to salt was at germination of planted cane and that rooting of cuttings was less affected than bud germination. At a concentration of 0·26% no buds or roots were seen on the cuttings. Plants grew more resistant to salt with time. It is considered that under field conditions much more salt can be tolerated than under greenhouse conditions. In a field at maturity 3% salt was necessary to kill the plants.

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Historical highlights in sugar beet harvest mechanization. A. A. ARMER. *J. Amer. Soc. Sugar Beet Tech.*, 1965, **13**, 318–332.—The development of the sugar beet harvester since 1913 is reviewed and considered from the point of view of topping, digging, and cleaning. Machines currently in use are also described.

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Resistance to the sugar beet nematode (*Heterodera schachtii*), in F_1 tetraploid hybrids between *Beta vulgaris* and *Beta patellaris*. H. SAVITSKY and C. PRICE. *J. Amer. Soc. Sugar Beet Tech.*, 1965, **13**, 370–373.—Studies are reported on the resistance of hybrids between sugar beet and *Beta patellaris* to sugar beet nematode. In the genus *Beta* only 3 species, including *B. patellaris*, have proved to be highly resistant to this nematode.

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Varietal position, sugar recovery and cane production in Bihar. V. PANDEY and S. A. ZUBAIR. *Indian Sugar*, 1965, **15**, 433–439.—A list is given of varieties in North and South Bihar. Improved varieties have increased average yield from 9 to 19 tons per acre. Sugar cane agronomy in Bihar is discussed.

SUGAR HOUSE PRACTICE

The Foster Wheeler boiler at San Carlos Milling Co. Inc. R. L. DULCE and F. SALVADOR. *Sugar News*, 1965, **41**, 612–614.—The San Carlos Foster Wheeler boiler is the first single-pass "A" type unit to be installed in the Philippines. Its specification is listed and descriptions are given of the air-cooling system for the main furnace floor, the cinder return system, the forced- and induced-draught fans, meters and instruments, combustion controls, feed water regulator, soot blower and dust collector.

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Arching in hopper units overloaded with raw cane sugar. N. T. SERGEL' and E. A. BANIT. *Sakhar. Prom.*, 1966, **40**, (1), 39–42.—Investigations were made into the arching of sugar in the vicinity of the discharge port at the bottom of a hopper and, where applicable, below the deflecting cone. The sugar had a density of 0·6–0·7 tons/cu.m. and a moisture content of 0·4–0·5%. The effects of the ratio of cone diameter to discharge port diameter (d_c:d_o) and that of the height of the cone above the discharge port to discharge port diameter (H:d_o) on the time taken for the sugar to flow through the discharge port were determined, but the effects of sugar moisture and purity were not considered. It was found that the minimum angle of slope of the hopper should be 55°, and the values of d_c:d_o and H:d_o 1·0–1·2 and 1·5–1·8 respectively. The angle of slope of the cone in the range 43°–60° had no effect on flow or arching.

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Continuous cane diffusion at Nag-Hamadi. H. M. ELZEINI. *Sugar y Azúcar*, 1965, **60**, (12), 27–29, 47. The theoretical basis for the BMA-Egyptian cane diffuser is discussed, with an account of practical conditions at Nag-Hamadi, where it is applied. Factory data from the 1962/63 and 1963/64 seasons are tabulated, as are 1964/65 estimates. Goals which are set for the plant, and planned extension of the system to the other Egyptian factories, are listed.

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Salient features in Taiwan's middle juice carbonatation process. C. M. MADRAZO. *Sugar News* (Philippines), 1965, **41**, 666–668.—A flow sheet and description of the middle-juice carbonatation process in use in Taiwan is presented, with an account of its advantages. The Philippines produces raw sugar for the preferential U.S. market, but when the preference ends in 1974, white sugar made by the Taiwan process may be attractive as an alternative process.

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Application of Stearns magnetic separators in sugar cane milling. W. J. BRONKALA. *Proc. Amer. Soc. Sugar Cane Tech.*, 1965, **12**, 31–35.—See *I.S.J.*, 1966, **68**, 55.

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Some ideas and remarks about evaporation. C. M. ALONZO. *Proc. Amer. Soc. Sugar Cane Tech.*, 1965, **12**, 36–51.—See *I.S.J.*, 1966, **68**, 146.

Some thoughts on "Autocane". A. L. WEBRE. *Sugar J.* (La.), 1965, **28**, (7), 34–35.—An account is given of use of the Edwards Engineering Corp. "Autocane" equipment, based on a full crop's operation at Glades Sugar House, Florida. It controls carrier speed so as to limit and control the volume of cane supplied to the mill, in accordance with a previously adjusted setting. This setting requires adjustment once or twice daily to allow for variable cane density, and this has been adopted at Glades. It is recommended to carry a spare hydraulic motor and pump for minimization of shut-down in case of failure of the unit on the "Autocane" controller.

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Spontaneous destruction of final molasses in storage. ANON. *Sugar J.* (La.), 1965, **28**, (7), 41–43.—An account is given of the loss of 1500 tons of molasses which deteriorated spontaneously at Mulgrave Mill, Queensland, in January 1963.

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Experimentations and innovations may lead to further breakthroughs in Louisiana cane handling. J. N. FAIRBANKS. *Sugar Bull.*, 1965, **44**, 98–102.—Illustrated descriptions are given of the cane handling techniques used in the mill yards of Lula and St. James sugar factories in Louisiana. At Lula, tractor-trailer units are loaded by in-field derricks and brought to the factory where the tractors are uncoupled for return to the field. Trailers are assembled during the day for night crushing. Part of the cane is delivered to the factory in chain-net wagons dumping directly onto the feed table; these operate during the day and partly during the night. Expansion of direct night haulage from the field is under consideration. At St. James, night cane is windrowed during the day and loaded into side-dump trailers during the night for transporting to the factory.

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New R9½ m. Amatikulu sugar mill in production. ANON. *S. African Sugar J.*, 1965, **49**, 1156–1161. Illustrations and a brief description are given of this new mill which has replaced the old Amatikulu mill, built in 1908. The milling train, believed to be the largest in the world, consists of seven 43 × 84 inch mills, each with a gear-driven feed roller incorporated in the headstock. Total installed h.p. is 11,400. A further feature is the nine-cell in-line water cooling tower which has a capacity of one million gallons per hour. All *B*- and *C*-sugar is to be remelted.

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The moving-bed system for carbon reduces costs and improves quality. THE TECHNICAL STAFF of CENTRAL RÍO TURBIO. *Bol. Azuc. Mex.*, 1965, (196), 30–32. See *I.S.J.*, 1966, **68**, 23.

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Gatke moulded fabric bearings on sugar cane journals and auxiliary equipment. N. RADLOFF. *Proc. Amer. Soc. Sugar Cane Tech.*, 1965, **12**, 24–30.—See *I.S.J.*, 1966, **68**, 118.

Moving cane storage away from the mill—is it feasible? H. A. WILLETT. *Proc. Amer. Soc. Sugar Cane Tech.*, 1965, **12,** 84–88.—Difficulties in cane transportation between field and factory in Louisiana are discussed and requirements for an economical and practical system are analysed. A series of recommendations are made, based on this analysis; they include: cutting of cane on a one-shift basis sufficiently ahead that a loader never has to wait for cane, cane cart modification for net-type unloading and operation at least 16 hours a day, use of a transfer station where carts are unloaded and the cane reloaded by grab into trucks as a 24-hour operation, the transfer station to be the main surge point, the trucks to be equipped for net unloading and mills prepared for acceptance of these trucks at their feed tables, and formation of a committee to set standards for the trucks, whereby they can deliver cane to another mill in the event of breakdown.

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Inclined feeder table and dumping system at the Raceland factory. J. L. MATHEWS. *Proc. Amer. Soc. Sugar Cane Tech.*, 1965, **12,** 89–92.—Cane is delivered to the Raceland factory in field carts and in box trucks which are provided with chain baskets, the chain being attached to a pipe on one side which is raised by a dragline, so unloading the cane onto an inclined feed table. An 80-ft derrick is used to unload sling cane during the day for night crushing, and to transfer this cane from the pile onto the feed table during the night.

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Cane handling at Cajun Sugar Cooperative Inc. L. A. SUAREZ and F. SERRATE. *Proc. Amer. Soc. Sugar Cane Tech.*, 1965, **12,** 93–95.—See *I.S.J.*, 1966, **68,** 85.

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The side-dump system of sugar cane handling. L. G. FOWLER. *Proc. Amer. Soc. Sugar Cane Tech.*, 1965, **12,** 96–140.—A detailed study is presented of the comparative economics of cane haulage, unloading and feeding into a Louisiana mill using the conventional carts unloaded by revolving derricks, and using side-dump carts delivering cane onto a feed table and into a storage area with a bridge crane for supplementary feeding from storage during the day and for complete mill feeeding during the night. The side-dump system is preferred to the conventional and chain net systems.

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Screening juice with the DSM. L. ENGEL. *Sugar y Azúcar*, 1966, **61,** (1), 35–37.—The design and operation of the DSM screen are described with quotations from the literature[1,2] on its performance in primary screening of mixed cane juice. The screen has been shown to result in higher clarifier throughput when used for secondary screening of mixed juice (after passage through a conventional screen for primary screening); it can also be used for fine screening of clarified juice, particularly where muds are difficult to settle.

Clarification and filtration at Imperial Sugar. ANON. *Sugar y Azúcar*, 1966, **61,** (1), 29–30.—The Imperial Sugar Co. refinery at Sugarland, Texas, U.S.A., has been provided with new plant including a North rotary water filter through which washed sugar liquor passes on its way to process. It is aerated and defecated under automatic control before going to the two Nadler low-temperature clarifiers, the effluent from which is filtered through four U.S. Filter Corp. stainless steel Model 1000 filters which are interlocked and operate on automatic filter cycles to give a filtrate which is sent to the char house. Clarifier scum is diluted and further clarified, the effluent being returned for concentration and the secondary scums filtered.

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Lubrication of sugar cane mills. C. GUERRERO. *Bol. Azuc. Mex.*, 1965, (197), 24–27.—Lubrication requirements for the bearings, crown gears, etc. of a cane mill are described and the suitability of the author's employers' lubricants pointed out. Mobil Oil de México S.A. also produce oil suitable as hydraulic fluid. Preparation of machinery for the crushing season is referred to and the importance of thorough cleaning and lubrication is emphasized.

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Chemical products in the sugar factories. R. F. HEMMER. *Bol. Azuc. Mex.*, 1965, (197), 28–29.—A survey is presented of products supplied to sugar factories by Betz de México S.A. de C.V. for numerous purposes including boiler scale and corrosion reduction, anti-foaming, reduction of microbial infection in juice, coagulation of cane muds, etc.

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Automatic measurement, (and) control in cane sugar factories. A. G. KELLER. *Sugar J.* (La.), 1966, **28,** (8), 12, 14.—Factors in instrument operation which should be borne in mind are discussed; these include inaccuracy resulting from "averaging" by an instrument of widely-fluctuating values of the variable being measured, and the effects of time lag and non-smooth supply, e.g. of juice through lack of a surge tank or storage capacity. Personnel should be trained for instrument maintenance, and a separate clean air supply provided for pneumatic systems.

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Dry bulk granulated sugar—storage, delivery, in-plant handling. ANON. *Sugar J.* (La.), 1965, **28,** (8), 19–22.—The reception, storage and melting of bulk refined sugar at the Double Cola bottling plant at Memphis, Tenn., U.S.A., are described. The sugar is received in trucks and rail cars which are unloaded pneumatically.

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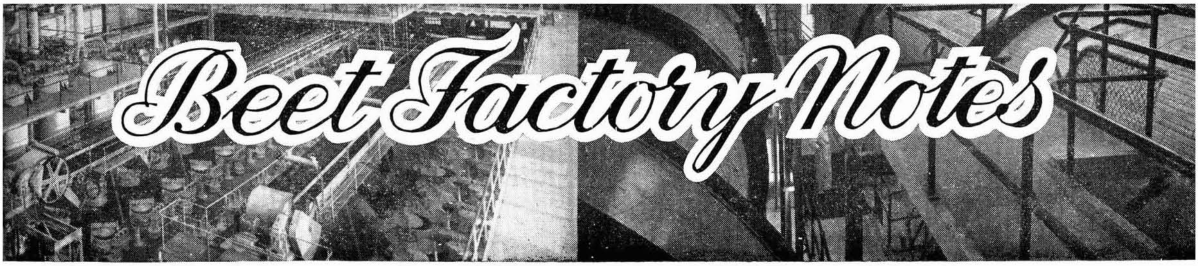
Mill settings. ANON. *Sugar J.* (La.), 1966, **28,** (8), 30–33.—Methods are suggested for calculation of initial mill settings (to be adjusted during crop in the light of actual results), together with a graphical method for the trash plate setting.

[1] RANDABEL: *I.S.J.*, 1964, **66,** 157.
[2] ADKINS & JENSEN: *I.S.J.*, 1965, **67,** 373.



Campaign experiences with a new juice purification system. G. Quentin. *Zucker*, 1965, **18**, 623–626. The carbonatation scheme described earlier[1] was adopted at Leopoldsdorf sugar factory, Austria, and observations and results are reported. The scheme was slightly modified, whereby the over-flow from the settler after "precipitation saturation" (defeco-saturation) and the filtrate from the rotary filter were limed separately and the filtrate returned to precipitation saturation. The system proved to be very stable. The settling rate of mud after precipitation saturation was 8–10 cm/min at an alkalinity of 0·10% CaO and a settler feed temperature of about 80°C. The mud volume was about 13% and the weight ratio of thick mud to muddy juice was about 1:5. The settling rate after final saturation was 12 cm/min, giving a mud volume of 4% and a "thickening" ratio of 1:10. The filtration coefficient after defeco-saturation was 2 and the rotary filter muds contained less than 0·5% sugar by weight after sweetening-off. Candle filters were used for the continuous, fully-automatic fine filtration. The juice pH fell only very slightly from final saturation to thick juice (8·8 to 8·4) and less than 0·01% SO_2 on beet was required. The lime salts content averaged 0·06% CaO on Brix. The thick juice colour rose from about 8°St to 16°St in the course of the campaign. This is attributed to increase in the invert content. Average purity of raw juice was 87·5 and that of the thick juice 92·1. The difference between thick and thin juice purities was less than 1 unit. The purity figures correspond to a non-sugars separation of about 40%.

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Growth of fungi in stored beet. J. Orlowska. *Gaz. Cukr.*, 1965, **73**, 246–249.—Beets were sprayed with 5°Bé milk-of-lime and stored in piles, the tops of which were sprayed with 20°Bé lime solution. The piles were cooled by forced ventilation vertically and laterally. The losses were lower than in an unsprayed pile, the sides of which were covered with earth, while the greatest losses occurred in the controls. Of the various fungi found in the piles during the period 1960–1963, *Botrytis cinerea* was by far the most abundant, followed by *Penicillium* sp. and *Fusarium* sp. The levels of certain other fungi (*Trichothecium roseum, Cladosporium herbarum* and *Gliocladium*) were sometimes higher than that of *Fusarium*.

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The chrome process for prevention of scale, rust and corrosion in heating plant. H. Anders. *Zucker*, 1965, **18**, 661–663.—The addition of chromic acid solution to water in a heat vessel dissolves incrustation, including sulphate scale, and inhibits further scale formation and corrosion. The amount is 0·15 litres for dissolving that amount of scale deposited by 1 cu.m. of water per degree of temporary hardness, and 0·15 litres/cu.m. of feed water/° of temporary hardness for inhibiting formation. Scale removal is facilitated by vigorous circulation of the water at a high temperature.

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Notes on a visit to the Hereford, Texas, factory of Holly Sugar Corporation (near Amarillo). G. Duchateau. *Sucr. Belge*, 1965, **85**, 137–153.—A detailed and illustrated account is given of this new factory which started production in October 1964. The sugar beet contract operated by the factory is reproduced, as is the text of a capital contribution agreement between the Corporation and farmers and landowners of the area.

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Thermal resistance of a strain of *Leuconostoc mesenteroides* isolated from beet sugar factory diffusion juice. J. N. Morfaux and P. Bidan. *Ind. Alim. Agric.*, 1965, **82**, 1145–1154.—Behaviour of an Ab_5 strain of *L. mesenteroides* was examined by counting survivors after a suspension of the organism had been subjected to heat treatment at various pH levels. The strain proved more resistant at fixed pH than most of the other lactic bacteria which have been reported in the literature. Variation of pH showed that maximum resistance to heat occurred at pH 9·0. The results can be used in calculating the times necessary for pasteurization of the juice.

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Temperature conditions in the operation of a KDA-25-59 tower diffuser. E. T. Koval', V. G. Yarmilko and N. Ya. Artemova. *Sakhar. Prom.*, 1965, **39**, 889–894.—Laboratory tests showed that the optimum mean temperature in diffusion, i.e. at which losses and draught are minimal and raw juice purity maximal for a given diffusion period and cossette quality, lay in the range 68–80°C for normal cossettes. Above 80°C there was marked drop in juice quality and below 68°C there was a considerable increase in bacterial activity. Even over the range 70–80°C there was a slight deterioration in juice quality. To minimize the quantity of colloids and pectins passing into the juice at a given diffusion temperature, the difference between the temperature of the juice used for cossette pre-scalding and that of the water fed to the diffuser should not exceed 5°C. Tabulated data demonstrate the drop in purity of juice and increase in colloids and pectins in raw juice and

[1] *I.S.J.*, 1965, **67**, 53.

corresponding increase in 2nd carbonatation juice lime salts with increase in diffusion temperature from 65° to 90°C. The effect of temperature on plasmolysis was also studied. Complete plasmolysis occurred at about 80°C, compared with 80% plasmolysis at 70°C.

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Increase in the colour of juice during evaporation. M. L. Vaisman and E. S. Kislenko. *Sakhar. Prom.*, 1965, **39**, 895–901.—Investigations of abnormal colour increase in evaporator juice were carried out at five Soviet factories. It was found that the primary cause was the decomposition of reducing matter during evaporation, the relationship between invert formation and coloration being almost linear. Secondary factors affecting the colour increase were juice temperature and retention time in the evaporator, although their importance was enhanced if the juice had low thermal stability. Other factors involved in the evaporation process also contributed to colour increase. The experiments are being continued.

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Automatic control of the rotary speed of the paddles of a beet washer. G. A. Kaminskii. *Sakhar. Prom.*, 1965, **39**, 902–905.—The flow of beet to process can be regulated through the drive of the paddles of a beet washer, the control being based on the weight of beet in the hopper feeding the beet slicer. In the scheme described, changes in weight of the beet are measured by at least two sensing elements. Their output is converted into signals transmitted to a damping unit, consisting of electrolytic capacitors and resistances, which accepts signals corresponding to an increase in beet weight of 10–24 seconds' duration, thus eliminating stray disturbances. The output from the damper is fed finally to an inductor friction clutch governing the speed of the paddles. Manual control is possible.

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Making proper use of condensate at sugar factories. M. T. Molchadskii. *Sakhar. Prom.*, 1965, **39**, 917–919.—Formulae are presented for calculating the maximum permissible sugar content in condensate used as boiler feed. The expressions are applicable where the condensate is used only once and where it is used for a long period of time, and are based on the actual and minimum alkalinities and oxidizabilities of the condensate.

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Scheme for hydrocyclone purification of milk-of-lime. L. P. Sofronyuk. *Sakhar. Prom.*, 1965, **39**, 920–921. At Gindeshtskii sugar factory the under-flow from a battery of hydrocyclones, containing up to 10–11% lime on weight of wet sand, is added to the flume-wash water.

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Increasing the throughput of pulp briquetting presses. L. A. Radman. *Sakhar. Prom.*, 1965, **39**, 922–924. The throughput of presses supplied by Czechoslovakia has been increased by over 50% by modifying the gearing and increasing the size of the compression chamber.

Sugar centrifugal drive with thyristor supply and "Transidyn-B" control. J. Christ and W. Freymann. *Zeitsch. Zuckerind.*, 1965, **90**, 693–694.—Advantages claimed for D.C. motors provided with thyristors (silicon rectifiers) and "Transidyn-B" control[1] include: free selection of current limit values for high speed and braking, thus avoiding current peaks; adjustable speed of rotation; and up to 50% reduction in power consumption per charge. The operational characteristics of the system are described. Experiments during the last campaign indicated less mechanical strain, as a result of the constant moment of acceleration, and more uniform distribution of the massecuite over the basket wall.

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Means of raising sugar yield and quality. M. M. Makhinya, V. L. Mar'yanchik, L. I. Rozhinskii and E. V. Litvinov. *Sakhar. Prom.*, 1966, **40**, (1), 6–13.—The need to raise the quality of Soviet white sugar to meet the requirements of export markets is discussed. Instead of aiming at the production of high quality white sugar by reconstructing all factories, the author suggests converting most of the beet factories into "specialist" factories, which would aim at producing high quality sugar, while the remainder of the factories would concentrate on maximum output of lower quality sugar, subsequently sent to the refineries or specialist factories. These "lower quality" sugar factories would use a 2-product scheme giving a sugar of 8–15°St colour content.

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Effect of beet marc on juice quality. V. G. Yarmilko. *Sakhar. Prom.*, 1966, **40**, (1), 19–24.—Juice from the heater and the pre-scalder preceding a tower diffuser and raw juice from the heater before preliming were analysed to evaluate the effect of the marc content. The "tower" and pre-scalder juice were heated only very slightly, from approx. 73° to 76°C, so that at a marc content of 3 g/litre the pectin content did not increase, while the colloid content fell slightly as a result of coagulation of some of the albumins. On the other hand, the raw juice was heated from 51° to 86°C, so that at a marc content of 2·2 g/litre the pectin content increased by 12–13% from the initial content as a result of decomposition of the proto-pectin, while the total colloid content fell, again because of albumin coagulation. At a content of 2 g/litre and in the absence of recycled 1st carbonatation juice, beet marc was found to act as a flocculant, improving settling and filtration of 1st carbonatation juice and reducing the 2nd carbonatation juice lime salts content; but when carbonatation juice was recycled to pre-liming, the presence of marc during carbonatation increased the 2nd carbonatation juice lime salts content. The optimum marc content as regards settling, filtration and lime salts content must be determined for each case, since it depends on the quantity of pectins dissolved in the raw juice.

[1] Siemens-Schuckertwerke A.G., 852 Erlangen, Germany.

Some features of the juice purification scheme at Timashevskii sugar factory. A. K. KARTASHOV, V. A. ZAMBROVSKII, R. G. ZHIZHINA, V. A. NAGORNAYA, O. V. STRATIENKO and R. V. BELONOG. *Sakhar. Prom.*, 1966, **40**, (1), 24–30.—Details are given of the modified BMA carbonatation scheme at Timashevskii which has been shown to give better juice filtration properties but a higher 2nd carbonatation juice colour than does conventional carbonatation, particularly after heating. While the 2nd carbonatation juice from both schemes contained approximately the same quantity of reducing matter, the quantity in BMA thick juice after evaporation increased considerably compared with the 2nd carbonatation juice content. This is attributed to high evaporation temperatures (133°C in the first effect). While the juice colour increase was greater with higher pH, with lower pH the increase in reducing matter was greater. While sulphitation with SO_2 reduces colour formation, it also increases the reducing matter content. Therefore it is suggested that sodium sulphite be added, whereby colour increase is retarded until complete oxidation of the SO_2.[1] An ion-exchange unit incorporated in the BMA scheme before the evaporators has not yet started operations, so that it is not known to what extent this will affect the colour and reducing matter. While turbidity present in the 2nd carbonatation juice also contributed to colour increase, its effect was smaller than that of other factors, and in this respect secondary filtration of 1st carbonatation juice is considered of minor importance. A simplified scheme with simultaneous liming and carbonatation at pH 9 has been developed by BMA, but tests at another Soviet factory have not given the improved filtration properties indicated by BMA.

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Investigation of a (sugar) drum dryer designed by Ukrgiprosakhar (Ukrainian State Sugar Planning Institute). D. S. SHEVTSOV and B. F. MILYUTENKO. *Sakhar. Prom.*, 1966, **40**, (1), 30–35.—Information is given on a drum dryer of 18·6–23·6 tons/hr capacity which rotates at 3 r.p.m. and in tests reduced the sugar temperature from an average of 49°C to 24°C in 4 min, the moisture content being reduced from 0·30–0·56% to 0·024–0·030%. However, considerable crystal breakage occurred and the amount of dust trapped by the collectors was 0·13% on dried sugar. A vacuum of 5–10 mm w.g. was maintained in the centre of the drum.

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Automatic control of beet hopper charging. N. R. FREPON. *Sakhar. Prom.*, 1966, **40**, (1), 42–46.—Details are given of two schemes for automatic control of the feeding of beet into the hopper above the slicer. One scheme controls the weight of the beet by means of four springs placed below the hopper at each corner. Signals corresponding to the weights are transmitted, by each of four sensing elements located near the springs, to a summator. The signal is compared with a pre-set weight and the speed of rotation of the shaft carrying the beet washer paddles is adjusted accordingly. The other scheme stops and starts the paddles according to the level of the beet in the hopper as measured by an electrode sensing device in conjunction with a photo-relay or membrane system at the hopper walls at two levels (upper and lower). This second scheme functioned successfully at one factory in 1964/65. A hopper with a capacity equivalent to 20–30 minutes' processing is desirable.

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Effect of circulation rate and specific heat flow on the intensity of heat exchange. M. A. GEISHTOVT and V. V. MAIOROV. *Sakhar. Prom.*, 1966, **40**, (1), 47–53. Values of heat transfer coefficient α_2 determined experimentally for 90·3 purity sugar solutions were compared with values calculated from the formula

$$Nu = 0{\cdot}0219\ Re^{0\cdot8}Pr^{0\cdot4}$$

(Nu = Nusselt number, Re = Reynolds' number, and Pr = Prandtl number) where this defines the mean curve of α_2 *vs.* circulation rate W_o. Agreement was to within ± 15%. Generally, specific heat flow had no effect on α_2. It is considered feasible to increase the number of evaporator effects, and the advantages of this are briefly mentioned.

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Heat calculation of pulp drying. I. Heat calculation. T. BALOH. *Zucker* 1966, **19**, 5–17.—The fundamentals of heat calculation in pulp drying are explained. Here the calculation is restricted to determination of the fuel consumption and quantity and condition of the gas and product during drying. A simple analytical method for determination of the factors is described, involving use of the coefficient β, which can be calculated for any type of fuel and any feed and discharge temperature. [$\beta = \dfrac{i_T - i_L}{\left(1 - \dfrac{V}{100}\right) i_T - i_T^*}$, where i_T and i_L are, respectively, the enthalpies of the drying gases at feed and of the surrounding air, V = heat loss % in the drum, and i_T^* = enthalpy of the drying gases at their water content on entering the drum and at the temperature of the waste gases.] Nomograms are presented for calculations when open-burning coal or oil are used as fuel, and a precise method is also described, which involves the use of a Mollier diagram for wet air. It takes account of furnace and drum losses and heating of the wet pulp during drying.

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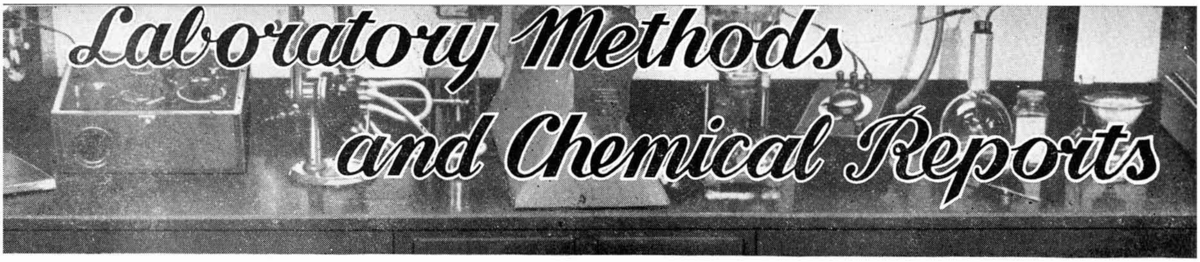
Ways of improving white crystal quality. B. NOWAKOWSKI. *Gaz. Cukr.*, 1965, **73**, 268–271.—The problem of white sugar purity is discussed with reference to two 3-boiling schemes described by SÁZAVSKÝ[2] and to the results obtained at Moses Lake sugar factory with an experimental boiling technique[3].

[1] *See* PIECK & HENRY: *I.S.J.*, 1964, **66**, 199.
[2] *Zeitsch. Zuckerind.*, 1963, **88**, 252–260; *I.S.J.*, 1963, **65**, 372.
[3] *I.S.J.*, 1964, **66**, 23.



A proposed standard run report form and some comparative comments on the 1963 factory operations. J. J. SEIP. *Proc. Amer. Soc. Sugar Cane Tech.*, 1964, **11**, 68–108.—An account is given of attempts made during 1963/64 on the establishment of a standard factory control report form and standardized terms for use in the Louisiana sugar industry so that comparisons may be made between factories and seasons. The I.S.S.C.T. System of Sugar Factory Control, 2nd edition, provides the basis for definition of the terms suggested and for certain of the calculations.

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Formation and composition of beet molasses. III. Influence of some typical non-sucrose substances on sucrose solubility. G. VAVRINECZ. *Cukoripar*, 1965, **18**, 167–174.—See *I.S.J.*, 1966, **68**, 28.

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Thermal stability of sugar factory juices. IV. Colour intensity of invert sugar decomposition products. K. VUKOV. *Cukoripar*, 1965, **18**, 178–182.—See *I.S.J.*, 1965, **67**, 346.

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Application of complexonometry in the factory control of juice purification. V. GRYLLUS. *Cukoripar*, 1965, **18**, 208–212.—The total lime content in 1st carbonatation juice can be determined with EDTA (disodium salt), which is added to 5 ml of the juice as a 10-ml solution, equivalent to 10 mg CaO/ml, together with 40–50 ml of distilled water. After boiling for 3 sec, 10 ml of an ammonium hydroxide-ammonium chloride buffer solution is added together with Eriochrome Black T indicator and the excess EDTA titrated with $MgSO_4$ solution having a concentration equivalent to 10 mg of CaO/ml. The Ca content is given as 0·2(10 — ml $MgSO_4$) g CaO/100 ml; this also applies to limed juice. The lime content in predefecation juice is 0·1(10 — ml $MgSO_4$) g CaO/100 ml, a 10-ml sample being used. For Ca determination in clarification mud, 10 ml of the mud sample is diluted to 100 ml and a 20-ml aliquot taken for titration. The Ca content is then 0·5(10 — ml $MgSO_4$) g CaO/100 ml. For milk-of-lime, 10 ml of the test solution is diluted to 100 ml and to 10 ml of this mixture (1 ml of the original) is added 40–50 ml of distilled water and 30 ml of the EDTA solution. The CaO content is then 10(30 — ml $MgSO_4$) mg/ml.

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Determination of the lime consumption on beet in juice purification. I. OSIM. *Cukoripar*, 1965, **18**, 233–236.—The return of unfiltered juice containing lime complicates determination of the lime consumption in modern carbonatation process. Analytical methods and formulae for determining the lime consumption in a number of different carbonatation schemes where unfiltered juice or thickened mud is recycled are given. These are illustrated by worked examples.

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Enzymatic determination of L-lactic acid in sucrose-containing liquids. I. Sucrose-L-lactic acid model solutions. W. MAUCH, S. SCHMIDT-BERG and H. BOURUTSCHKY. *Zeitsch. Zuckerind.*, 1965, **90**, 625–630. General and enzymatic methods of lactic acid determination are surveyed and details are given of an enzymatic method in which the lactic acid (LA) is determined by oxidizing it with lactate dehydrogenase (LDH) to pyruvic acid (PA) in the presence of diphosphopyridine nucleotide (DPN): $LA + DPN \overset{LDH}{\rightleftharpoons} PA + DPNH + H^+$. The DPNH, or DPN in its reduced form, which is equivalent to the quantity of lactic acid, is determined photometrically at 300 μ. In 60 tests with model solutions of lactic acid-sucrose, the standard deviation was calculated as 0·13 μg of lactic acid per 0·1 ml. A single determination takes 2 hr. A description is given of a set of reagents especially prepared for the determination of L-lactic acid in blood and serum and supplied by C. F. Boehringer & Soehne, Mannheim, Germany.

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Tests on the spontaneous decomposition of a Brazilian cane molasses. H. OLBRICH and S. PEETZ. *Zeitsch. Zuckerind.*, 1965, **90**, 643–648.—A molasses sample from Usina Barra Grande had a strong burnt smell and was black and viscous. It contained small, solid particles that were easily friable between the fingers and soluble in water. The pH was 3·7 compared with a normal cane molasses pH of about 6. The molasses had been stored in a closed concrete tank during a period of drought and extremely high temperatures, when the tank became so hot that it was impossible to approach nearer than 1 metre from the tank wall. Full analytical details are given. Alcohol yield was extremely low and insufficient for tests to determine the alcohol quality. Paper chromatographic analysis revealed the presence of hydroxymethyl furfural and psicose. Reference is made to the literature on similar phenomena.

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Undetermined losses of sugar in beet sugar manufacture. A. YA. ZAGORUL'KO, A. K. BURYMA, S. A. BOGDANOV and T. P. KHVALKOVSKII. *Sakhar. Prom.*, 1965, **39**, 833–837.—The discrepancy between total sugar losses and the losses (undetermined and otherwise) occurring in waste products and the individual factory stations is attributed to the presence of dextrorotatory substances in the beet which are not found in the sugar and molasses but decompose or are discharged with other waste material. Of these, the most important is dextran. Moreover, throughout the campaign the proportion of fructose to glucose falls until fructose finally disappears (none was found chromatographically in beets stored until January-February) and the raw juice specific rotation falls as a result of glucose decomposition. The true undetermined loss can be found by adding the differences between cossette sugar content, as determined by direct polarization after hot water digestion and that determined by polarization after alcohol extraction, to the total drop in defecation. This method is preferred to an iodometric technique which is considered too complicated and liable to error.

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Setting the norm for molasses sugar content. A. D. GOLUBEVA. *Sakhar. Prom.*, 1965, **39**, 837–840.—It is considered that the molasses sugar content should be expressed as a percentage of the sugar entering the factory and not as % weight of beet, as is done in the Soviet Union. This would avoid the anomalous position of a factory that increases sugar yield as a result of increased beet cossette purity but forfeits any reward for this because at the same time it has exceeded the norm for molasses sugar. This is exemplified by data from a number of factories. A method is given for checking the molasses sugar from thick juice data.

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Viscometer for sugar factory molasses. P. M. SILIN, I. F. BUGAENKO and A. MUSTAFA. *Sakhar. Prom.*, 1965, **39**, 840–844.—Based on a model developed by STEINER[1], the viscometer described comprises a 9-mm dia. glass tube, the ends of which are closed by rubber bungs. The tube is housed inside a glass cylinder also closed by bungs but with an inlet and an outlet for continuous flow of water at constant temperature. The inner tube is filled with molasses, leaving only enough space for a 1-cm air bubble (measured from two calibration marks on the tube). The glass cylinder is clamped at each end to arms of a rotatable frame, the axis of rotation passing through a stand having a plumb line for maintaining the cylinder in an exactly vertical position. The viscosity is determined from the time taken for the air bubble to travel between two calibration marks, 100 mm apart on the glass tube, when the cylinder is inverted. Tests showed that the time taken was independent of the size of the bubble at constant temperature. Comparison of the results with measurements obtained with a Höppler viscometer showed negligible differences for molasses of 77·2–80·3° Brix at 30°, 40° and 50°C. The Höppler viscometer is considered too expensive and complicated to operate.

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Filtration equations. B. BRUKNER. *Zucker*, 1965, **18**, 626–629.—It is considered more suitable to calculate filter efficiency in terms of the "specific filtration resistance" of the filter (W_f) and of the mud suspension (W_s), and equations are presented for calculation of these two factors in terms of other filtration factors: $W_f = \frac{P_f \, . \, t_1}{l_1}$ kg/sq.cm., where P_f = pressure loss, t_1 = time (sec) up to flow of a given volume of filtrate, and l_1 = "height" of filtrate (volume of filtrate/filter area). $W_s = \frac{2 P t}{\alpha s^2}$ kg/sq.cm, where P = pressure in filter at time of measurement (kg/sq.cm.), t = filtration time (sec), α = ratio of "height" of filtrate:cake thickness, and s = cake thickness (cm). Both equations correspond to a filtration rate of 1 c.c./sq.cm./sec and W_s also corresponds to a cake thickness of 1 cm. The validity of the equations depends on the assumption that the cake pores are so small that the Poiseuille law applies, that the pore volume remains constant, and that the flow rate is proportional to pressure. Since the Brieghel-Müller apparatus operates under vacuum, so that the measurements must be made at below boiling point, a laboratory filter has been devised* for measurements at higher temperatures and pressures. This consists of a round-bottomed chamber provided with a stirrer and connected at the bottom by a narrow tube section to a mud chamber housing the filter. A discharge tube below the filter feeds the filtrate to a burette. The thermostatically-controlled main chamber is connected to an air chamber and is sufficiently large to ensure only negligible pressure drop. The mud suspension is fed into the main chamber, the stirrer started and the valve between the air chamber and the main chamber opened. The time between opening of the valve and flow of a given amount of filtrate is measured (several measurements may be made during one test). When the mud chamber is full, filtration is considerably slowed and the amount of filtrate obtained up to this drop in velocity and the volume of mud in the chamber give α. Worked examples are presented. Resistance of a filter cloth and the resistance in the mud feed and juice discharge channels in a filter-press are not considered.

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Remarks on "Filtration equations" by B. Brukner. A. BRIEGHEL-MÜLLER. *Zucker*, 1965, **18**, 629.—(See abstract above.) The filtration coefficient F_k is defined in terms of certain factors including W_f, and W_s is expressed in terms of factors including F_k. Measurement of W_f is found to give a value not in agreement with that given by extrapolation of the filtration curve (attributed to the non-linearity of the curve at the start of filtration). It is considered essential to change the filter bed frequently; but in the case of the Brukner filter such a change would not allow a precisely defined volume to be obtained up to the first graduation mark. Hence, it is recommended that the time of passage of the filtrate from one graduation mark to another be measured.

[1] *Zeitsch. Zuckerind.*, 1934, **59**, 78.

* Dr. Brukner Kläranlagen K.G., 3146 Grüner Jäger über Lüneburg, Germany.

Separation of simple sugars by cellulose thin-layer chromatography. D. W. VOMHOF and T. C. TUCKER. *J. Chromatog.*, 1965, **17**, 300–306; through *S.I.A.*, 1964, **27**, Abs. 796.—Thin-layer plates were prepared with a slurry of 15 g of cellulose and 90 ml of water-methanol mixture (5:1). Good separation of sugars (especially the mixture sucrose-glucose-fructose) with well-defined spots was obtained with formic acid: methyl ethyl ketone:*tert.*-butanol:water (1·5:3:4:1·5) as solvent. Separation time (3 hr) was longer than with silica gel plates, but the capacity for sugars was higher (~ 50 μg of each component). The sugars were separated into their molecular size classes, trisaccharides remaining near the origin.

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Thin-layer chromatography of carbohydrates in the presence of bisulphite. S. ADACHI. *J. Chromatog.*, 1965, **17**, 295–299; through *S.I.A.*, 1965, **27**, Abs. 797. Thin-layer plates were prepared with a slurry of 40 g of silica gel G in 80 ml of 0·1M $NaHSO_3$. R_f values for sucrose, raffinose, glucose, fructose and other sugars are tabulated for four different solvent mixtures. The best results were obtained with propanol:water (8·5:1·5) for the whole range of sugars, although separation of the above-mentioned sugars was better in methyl ethyl ketone:acetic acid:water (6:1:3). Colours obtained with five different spray reagents are also tabulated. The R_f values indicate complexing between bisulphite and both aldoses and ketoses.

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Polarographic determination of calcium in 2nd carbonatation juice. M. OLARU. *Lucrarile Inst. Certari Alimentare*, 1962–63, **6**, 27–33; through *S.I.A.*, 1965, **27**, Abs. 802.—The method of BURIÁNEK & DURDÍK[1], whereby Zn is displaced from an EDTA complex in the presence of NH_3 and determined by polarography, was investigated. The presence of dissolved O_2 did not interfere with the determination. Results for thin juice containing 0·01–0·02 g of CaO/100 ml generally agreed well with those of direct EDTA titration, although positive deviations of up to 18% occurred in some cases.

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Isomaltose studies. II. R. WEIDENHAGEN and H. GRUSCHKAU. *Zucker*, 1965, **18**, 647–648.—Two enzymatic processes for formation of isomaltose from maltose and palatinose, respectively, are described.

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The sulphur dioxide contents of direct consumption Indian sugars. S. BOSE, K. C. GUPTA and S. MUKHERJEE. *Sharkara*, 1964, **6**, 86–87.—Twelve sulphitation white sugar samples were analysed for total and inorganic SO_2 by an iodometric titration, the total SO_2 being obtained by addition of NaOH to the sample solution before passing a rapid stream of nitrogen through it. The NaOH was omitted in the determination of inorganic SO_2. Total SO_2 varied between 10·6 and 44·22 p.p.m., while inorganic SO_2 varied from 9·6 to 43·52 p.p.m.

Starch content of sugar house products. I. Starch content of different grades of Indian white sugar. J. C. BHARGAVA, S. BOSE, S. MUKHERJEE and A. N. SHRIVASTAVA. *Sharkara*, 1964, **6**, 130–133.—Starch was determined in a number of sugar samples using a slight modification of the BALCH[2] procedure. The values found lay between 8 and 90 p.p.m., the lowest values (8–20 p.p.m.) being in sugars produced by double carbonatation with double sulphitation, and the higher values (14–90 p.p.m.) in sugars produced by double sulphitation alone. Starch contents of larger-grain sugars were generally higher than those of smaller crystals.

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Determination of the undetermined sugar losses in diffusion, evaporation and in the boiling house. A. YA. ZAGORUL'KO, S. A. BOGDANOV and A. K. BURYMA. *Sakhar. Prom.*, 1965, **39**, 906–911.—Details are given of a cation exchange technique for determining the number of acid radicals (by titrating with NaOH) converted from the salts present in factory juices and syrups by passing through a resin in H^+ form. Equation are given for calculating the undetermined sucrose losses from the results, and a worked example is given.

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Standard molasses and temperature of (low-grade) curing. I. F. BUGAENKO and A. MUSTAFA. *Sakhar. Prom.*, 1965, **39**, 912–916.—The method proposed by SILIN for determining molasses saturation coefficients[3] was found to give reliable results with 80–84°Bx samples from three factories after 2–2½ hours' saturation followed by refractometry without dilution. The values obtained agreed closely which those resulting from 3 days' saturation by crystallization of the excess sugar in the molasses. The data were used to construct a graph of saturation coefficient *vs.* non-sugars:water at 40°, 55° and 65°C. This relationship is linear, and hence knowledge of the non-sugars: water ratio and viscosity should permit easy determination of molasses standard purity at different temperatures. However, determinations of the standard purity after low-grade curing at temperatures in the range 30–65°C gave different results for the three groups of samples at one and the same temperature. It is therefore recommended that the optimum curing temperature be determined for each separate case using the Silin method.

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Enzymatic determination of L-lactic acid in sucrose-containing liquids. II. Sugar beet press juice with lactic acid additions. W. MAUCH and S. SCHMIDT-BERG. *Zeitsch. Zuckerind.*, 1965, **90**, 687–689.—The method described previously[4] was applied to determination of the quantity of lactic acid in 15°Bx press juice to which it had previously been added.

[1] *I.S.J.* 1955, **57**, 202.
[2] *Sugar J.* (La.), 1956, **18**, (12), 79–80.
[3] *I.S.J.*, 1963, **65**, 342.
[4] *I.S.J.*, 1966, **68**, 246.

The amount recovered for all concentrations of lactic acid differed from the initial quantity by less than 1%. The standard deviation was 5·4, 2·6 and 1·4% for 18, 36 and 90 μg of lactic acid per 0·1 ml of press juice, respectively.

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Modifications of sucrose crystal habit in the presence of some non-sucrose substances. G. MANTOVANI and F. FAGIOLI. *Zeitsch. Zuckerind.*, 1965, **90**, 690–692. The effect was determined of certain non-sucrose impurities added to sucrose solutions (5 g of impurity per 100 g of water) on the habit of single crystals, mostly weighing 30–40 g, grown from the solution under controlled conditions. The shape factor K and the b:a and c:a ratios were determined. Calcium and potassium chlorides, betaine, carboxymethyl cellulose, an equimolar fructose-glucose mixture and invert sugar had no essential effect on crystal habit. On the other hand, raffinose had a most noticeable effect, by increasing the length of the b axis and causing the disappearance of all but the a, e, p' and p faces. The effect is considered as possibly due to adsorption of the raffinose in the sucrose crystal lattice. This has been confirmed chromatographically.

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Determination of the colour of white sugar and other sugar factory products. G. K. POSESSOR. *Sakhar. Prom.*, 1966, **40**, (1), 53–55.—The possible error in determining white sugar colour with a visual colorimeter and the extent to which values at the sugar factory and the refinery may disagree are discussed. The use of photocolorimeters, as advocated by the author, obviates the need for determinations by a laboratory acting as arbitrator between factory and refinery and the colour is expressed in what is considered a more suitable form than °St. The optimum wavelength with FEK-M and FEK-N-57 photocolorimeters is considered to be 420 mμ. For conversion of optical density to °St a factor of 0·210 should be used, and not 0·160[1], as indicated in the literature.

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Simplified method of determining molasses standard purity. K. WAGNEROWSKI and C. DABROWSKI. *Gaz. Cukr.*, 1965, **73**, 230–235, 257–263.—The device, in which molasses is saturated within 45 min, simply consists of two Dewar flasks placed horizontally back to back and fixed to a rotating frame driven by an electric motor. Each flask is sealed with a bung through which passes a thermometer. The diluted molasses is heated to 90°C and a set amount of sugar that can pass through a 24-mesh screen but not a 50-mesh screen is added, the mixing lasting 3–5 min at 85°C. The sample is then fed into the flasks and saturation carried out at about 81°C. Results of tests were compared with values obtained using the standard method; the proposed method was found to be sufficiently accurate for routine application. The standard purity may be calculated from analytical data or by means of a nomogram which is presented. Worked examples are given.

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Thin-layer chromatography of monosaccharides and oligosaccharides. E. GUILLOUX and S. BEAUGIRAUD. *Bull. Soc. Chim. France*, 1965, 259–262; through *S.I.A.*, 1965, **27**, Abs. 899.—Separation of stachyose, raffinose, sucrose, and fructose/glucose was obtained on a thin layer of Kieselgel G with *n*-butanol:isopropanol:water (5:3:1) as solvent. The separation time was 3–5 hr. Good results were also obtained with *n*-butanol:methanol:water (5:3:1) as solvent, but sucrose and fructose were not separated. Kieselgel G gave better definition of spots than Kieselguhr G. The presence of salts did not influence the form of the spots. The addition of complexing agents to the layer gave negative results. Recent studies in this field are reviewed, with 17 references.

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Chromatography of sugars on plates. M. PERPAR, J. PERKAVAC and P. BANIČ. *Farmacevtski Vestnik*, 1963, **14**, 191–202; through *S.I.A.*, 1965, **27**, Abs. 900. The technique of thin-layer chromatography on silica gel G is summarized. R_f values for the principal mono- and disaccharides are tabulated for 10 solvent systems of the type: primary alcohol (methylethylketone):acetone (methanol, ethylacetate, acetic acid): water. Reactions with 9 spray reagents are tabulated. The use of segmented plates is recommended for clearer resolution of adjacent spots, particularly the removal of a series of triangular portions of the medium to give narrow triangles widening in the direction of solvent movement.

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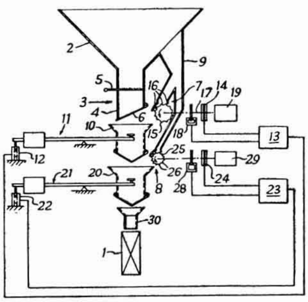
Study of methods for conductimetric determination of ash in beet molasses. R. BRETSCHNEIDER, V. HALADA, A. SVOBODA and P. KADLEC. *Listy Cukr.*, 1965, **81**, 254–260.—Two conductimetric methods of ash determination in molasses were compared with each other and with sulphate ash determination. The two conductimetric methods used (i) a sample of concentration 5 g/100 ml, and (ii) a 28°Bx sample. The average results from 8 determinations were very close, viz. 12·36% on Brix for sulphate ash, 12·33% for method (i) and 12·35% for method (ii). Temperature had a linear effect on conductimetric determination in the range 16–28°C, expressed by $Q_{con.20} = Q_{con.t} - c\ (t - 20)$, where $Q_{con.20}$ is the conductimetric ash at 20°C, $Q_{con.t}$ = conductimetric ash at temperature t, and c is a constant having a value of 0·26 for method (i) and 0·28 for method (ii). It was found that water used for dilution in the conductimetric method should have a conductivity below 10μS.cm^{-1}.

* * *

Sucrose crystallization. H. E. C. POWERS. *Zeitsch. Zuckerind.*, 1966, **91**, 20–27.—See *I.S.J.*, 1964, **66**, 287–290; 1965, **67**, 330–333.

[1] *See also* IVANOV *et al.*: *I.S.J.*, 1964, **66**, 162.

Sugar weigher. Fr. Hesser Maschinenfabrik AG., of Stuttgart-Bad Canstatt, Germany. **1,001,640.** 22nd August 1963; 18th August 1965.—Sugar in supply hopper 2 passes on the one hand to a pre-dispensing device 3 having a hopper 4, slider 5 and bottom flap 6, and on the other hand to a branch pipe 9 feeding two post-dispensing devices 7 and 8.



On each working stroke of slider 5, the device separates a preset volume of sugar which, on operation of flap 6, falls into the pan of weigher 11. The volume is such that the quantity will be the required weight at the highest sugar density likely to be found. With lower density sugar, a further amount must be added, the deficiency being measured by a detector head such as the differential transformer 12. This deficiency is transmitted as a voltage to device 13 which transforms it into a number of impulses whereby the cell wheel 15 is rotated so that a number of cells 16 are filled with sugar and emptied into pan 10. The pan discharges into a second pan 20 where a fine adjustment is made in a similar way to the first coarser adjustment, any deficiency being measured by transformer 22 and converted by device 23 to a number of cells 26 of wheel 25 adding sugar to the pan 20 before it discharges through funnel 30 into package 1.

* * *

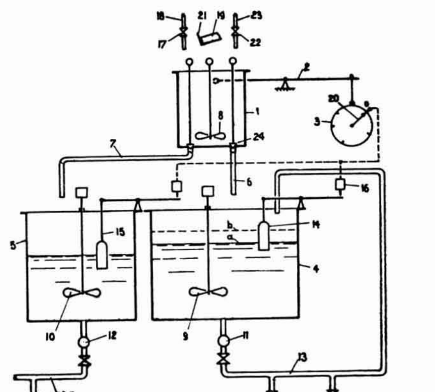
Selective weed control in beet crops. Farbenfabriken Bayer A.G., of Leverkusen, Germany. **1,004,469.** 29th April 1964; 15th September 1965.—The control is achieved by application of 1-methyl-3-(2-benzothiazolyl)-urea alone or with a carrier, pre- or post-emergence.

* * *

Producing L-glutamic acid by fermentation. Asahi Kasei Kogyo K.K., of Osaka, Japan. **1,004,616.** 16th July 1962; 15th September 1965.—Precultures of the micro-organism *Microbacterium ammoniaphilum* on a medium containing an oleic ester of sorbitan, are placed in a fermentation medium which contains no biotin but which contains less than 5000 mg/litre (400–2000 mg/litre) of the oleic ester and a carbohydrate (glucose, fructose, sucrose, molasses or starch hydrolysate).

* * *

Preparing sugar-glucose syrup. Gebr. Ter Braak N.V., of Rotterdam, Holland. **1,008,974.** 2nd September 1963; 3rd November 1965.—Glucose solution, solid sucrose and water are supplied to weighing tank 1 from which the mixture is withdrawn to tanks 4 and 5 and mixed in the cold by stirrers 9 and 10. The homogenized mixture may be sent by pumps 11,12 through pipes 13, 13a to evaporators where the sugar is dissolved and the syrup concentrated as required. As the level falls in tanks 4 and 5, floats 14 and 15 cause a contact to be made, e.g. at switch 16. This, through a contact at the zero of scale 3 closes an electric circuit for opening the water feed valve 17.



When weighing tank 1 has received the required amount of water the pointer 20 of scale 3 has moved to a position where is closes a contact whereby valve 17 is closed and the sugar feed conduit 19 is opened. The pointer continues to move as sugar enters tank 1 until it reaches another set point at which a new contact is made so that the sugar feed is stopped and glucose feed started through valve 22.

Copies of Specifications of United Kingdom Patents can be obtained on application to The Patent Office, Sale Branch, Block C, Station Square House, St. Mary Cray, Orpington, Kent (price 4s 6d. each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. 20231 U.S.A. (price 50 cents each).

When the required proportions are present the mixture is stirred by agitator 8 and after a timed interval is passed through the discharge valve, e.g. 24 to the mixing vessel, e.g. 4. Relative proportions of the mixture can be altered by adjustment of the set points on scale 3.

* * *

Sugar ester borate complexes and sugar esters. ECONOMICS LABORATORY INC., of St. Paul, Minn., U.S.A. **1,009,018.** 31st August 1962; 3rd November 1965. The complexes and esters, useful as surface–active agents and detergents, are prepared by reacting (at 85°–115°C) in the presence of glacial acetic acid as a solvent reaction medium, a sugar (glucose or sucrose) with a boric acid or boron oxide (orthoboric acid) to form a reaction product soluble in glacial acetic acid, reacting a (mixed) fatty acid halide (containing 8–18 carbon atoms) with the reaction product to give an ester, the hydrogen halide formed being remove by distillation as is the acetic acid.

* * *

Sugar cane harvester. J. M. MIZZI, of Braemeadows, Queensland, Australia. **1,010,158.** 23rd December 1963; 17th November 1965.

* * *

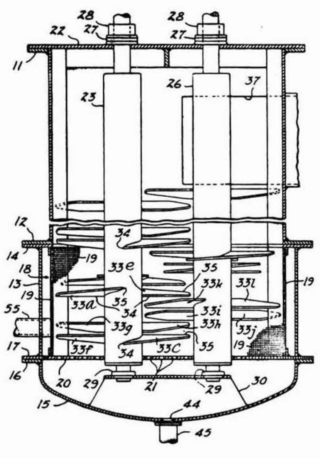
Beet topper. R. E. RICHARD, of Margny-les-Compiègne (Oise), France. **1,010,266.** 25th February 1963; 17th November 1965.

* * *

Beet harvester. C. VAN DER LELY N.V., of Maasland, Holland. **1,011,012.** 17th November 1961; 24th November 1965.

* * *

Vertical cane diffuser. F. C. SCHAFFER and R. W. MCKENZIE, of Baton Rouge, La., U.S.A. **1,011,906.** 7th May 1964; 1st December 1965.—The diffuser comprises a vertical tank holding a number (2–7) of shafts 23, 26, driven from above and journalled in bearings 27, 29, the lower bearings being supported in a spider arrangement 30 fastened to tank bottom 15. The shafts carry flight sectors 33 in a stepped intermeshing arrangement and pitched at a suitable angle, having such a radius and covering such a segment of a circle that, by rotation of adjacent shafts in opposite directions, the cane introduced into the bottom of the tank is lifted against a downflow of extraction liquid. The latter is withdrawn through screen 19 into annular chamber 18 and so out of the unit.



* * *

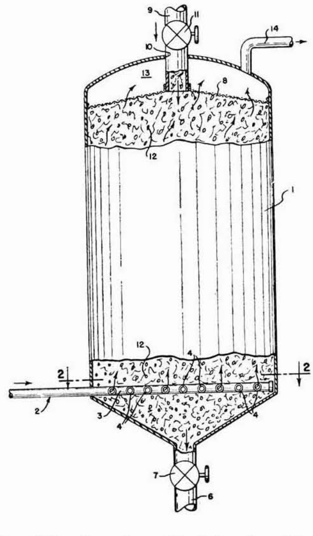
Separation of unreacted sugars from (esterification) reaction mixtures. FARBENFABRIKEN BAYER A.G., of Leverkusen-Bayerwerk, Germany. **1,012,424.** 12th March 1964; 8th December 1965.—Unreacted sugars, e.g. sucrose, in an esterification reaction medium containing dimethyl formamide, dimethyl acetamide, a dialkyl sulphoxide or butyrolactone as a solvent, are separated by addition, at 20°–90°C (40°–60°C), of an aliphatic or aromatic hydrocarbon containing halogen atoms or an unsubstituted aromatic hydrocarbon, whereby the sugar is precipitated and the ester may be recovered from the solution.

* * *

Photo-electrically controlled beet thinner. FRANZ KLEINE MASCHINENFABRIK, of Salzkotten, Germany. **1,012,490.** 24th November 1962; 8th December 1965.

* * *

Decolorizing tank for liquid sugars. UNION TANK CAR COMPANY, of Chicago, Ill., U.S.A. (A) **1,012,506.** (B) **1,012,507.** 16th October 1963; 8th December 1965.

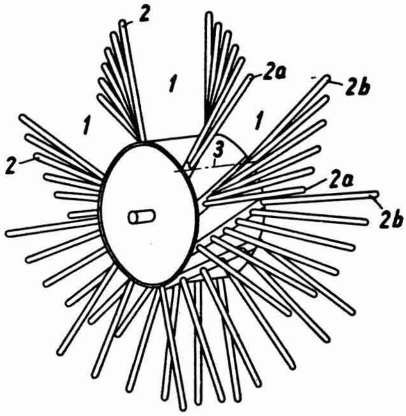


(A) Valve 7 is closed and inlet valve 11 is opened whereby particles 12 of activated carbon are introduced into tank 1 through pipe 9 until it is filled to the level of retaining screen 8, so forming an adsorbent bed. Valve 11 is closed and a liquid sugar fed under pressure into the tank through distributor 2, leaving as a decolorized effluent through screen 8 and chamber 13 into pipe 14. When the bed efficiency is reduced, fresh carbon is added to the top of the bed through pipe 9 and valve 11 while a corresponding amount of spent carbon is withdrawn through valve 7 and pipe 6, the bulk of the bed remaining in a compacted state.

(B) As the carbon is withdrawn from the bed, the volume of liquid sugar entering the tank is automatically increased to compensate for the volume leaving with the spent carbon, so that the outflow of decolorized liquid sugar remains constant.

* * *

Regulation of flow of beet in a flume. ELFA APPARATE-VERTRIEBS-G.M.B.H., of Mülheim/Ruhr, Germany. **1,014,034.** 14th December 1961; 22nd December 1965.—The device consists of a wheel in which cells 1 are formed by partitions in the form of rows of rods 2 projecting radially from the hub.



As the hub revolves beets are passed along the flume, the flow rate depending on the speed of rotation. The beginning of one cell overlaps the end of the previous one so that the beet flow is not discontinuous.

* * *

Beet thinner. R. J. E. BUCKINGHAM, of Bury St. Edmunds, Suffolk. **1,015,703.** 6th December 1962; 5th January 1966.

* * *

Preparation of purified sucrose esters. LEDOGA S.p.A., of Milan, Italy. (A) **1,018,553.** 16th August 1962; 26th January 1966. (B) **1,018,554.** 22nd October 1963; 26th January 1966.

(A) The solvent (dimethyl formamide) for a reaction product in which a sucrose ester (sucrose monolaurare, sucrose mono-undecenoate or sucrose monopalmitate) has been formed by interesterification with a C_1–C_8 alkyl (ethyl or glyceryl) ester of a C_6–C_{30} aliphatic acid, is evaporated to give a residue which is dissolved in an alkyl ester of an aliphatic carboxylic acid containing 2–6 C atoms in all (ethyl acetate) at 60°–90°C. The solution is extracted two or three times with 10–20% by volume of water at 60°–90°C (80°C), separating the organic phase each time, and finally either cooling to 0°–30°C (0°C) whereby the single phase parts into an organic and an aqueous phase, or extracting with water at 20°–25°C and at below room temperature. The aqueous phase is separated and its sucrose ester content recovered by extracting with butanol or cyclohexane, washing this extract with water and brine, and evaporating to dryness.

(B) A mixture of sucrose mono- and di-esters of C_6–C_{30} fatty acids [prepared by reaction of sucrose with a natural glycerol triester (ox tallow, palm oil)] is dissolved in (3 parts by weight of) a lower (C_1–C_6) aliphatic alcohol (95% ethanol) at 40°–80°C and cooled to 0°–35°C whereby the diesters of the C_{16}–C_{30} acids precipitate; the remaining solution is evaporated to dryness and the residue dissolved in (3 parts by weight of) ethyl acetate, with heating. On cooling to 5° to —20°C, the mono-esters are precipitated and collected, while the solution remaining is evaporated to yield the diesters of C_6–C_{15} acids and unsaturated acids.

* * *

Purification of sugars and their ester derivatives. THE COLONIAL SUGAR REFINING CO. LTD., of Sydney, N.S.W., Australia. **1,019,511.** 7th August 1962; 9th February 1966.—A sugar (glucose, fructose or sucrose) or sugar ester may be purified by dissolving, at 100°–200°C, in a substantially anhydrous water-miscible monohydric high-boiling alcohol containing the structural grouping $-O-\overset{|}{\underset{|}{C}}-\overset{|}{\underset{|}{C}}-OH$ in its molecule [a monoalkyl ether or monoester of ethylene glycol or diethyl glycol (ethylene glycol monomethyl ether), furfuryl alcohol, tetrahydrofurfuryl alcohol or 2-hydroxymethyl tetrahydropyran)], and subsequently cooling to about ambient temperature to effect crystallization.

* * *

Process for carrying out reactions involving sugars and their derivatives. THE COLONIAL SUGAR REFINING CO. LTD., of Sydney, N.S.W., Australia. **1,019,512.** 7th August 1962; 9th February 1966.—The sugars (sucrose, glucose or fructose) are dissolved in a solvent (as in the preceding patent) at 50°–200°C and subjected to reaction (dehydration, condensation, reduction, oxidation, etc.) with the appropriate reagents, at 0°–200°C.

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.

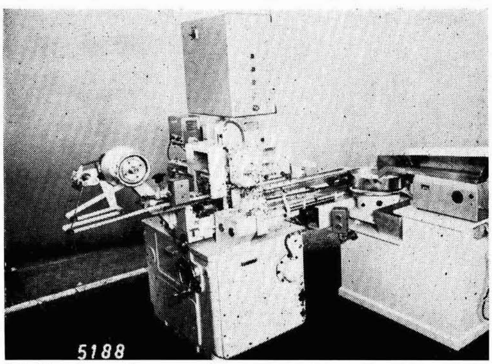
Western States centrifugal baskets. The Western States Machine Co., Hamilton, Ohio, U.S.A.

Two new sizes of basket are now available with Western States machines. The larger has a diameter of 54 inches and is 40 inches deep. Intended for *A*- and *B*-massecuites and white sugar, it has a capacity of 23·9 cu.ft. of massecuite in a 7-inch layer and, depending on the motor fitted, operates at speeds of 900/1050 or 1000/1125 r.p.m., using dual-frequency drives. One machine has been used for crystallizer massecuite, operating at a maximum speed of 1200 r.p.m. The smaller basket has a diameter of 48 inches and a depth of 36 inches. It is suitable for white sugar and operates at 1200 r.p.m. With a 7-inch layer of massecuite, its capacity is 18·8 cu.ft. Insufficient data have been obtained to give any accurate forecast of throughput, although a large number of 54-inch baskets have been in operation for two years and 48-inch baskets have been used for one campaign.

* * *

Sugar wrapping machinery. SAPAL Société Anonyme des Plieuses Automatiques, 1024 Ecublens près Lausanne, Switzerland.

The model B-I wrapping machine illustrated can wrap lump sugar in the size range 12 × 12 × 8 mm to 40 × 35 × 15 mm at a maximum speed of 280 wraps/min. The 1·5 h.p. motor of 250 r.p.m. output handles cut lengths of paper in the range



45–100 mm long and up to 100 mm wide. The machine features push-button starting and stopping, adjustable speed regulation during operation, a totally enclosed casing and automatic lubrication of all drive elements. A vibratory feeder is available if required.

* * *

Diaphragm level transmitter. Taylor Instrument Companies (Europe) Ltd., Gunnels Wood Road, Stevenage, Herts.

A new inexpensive level transmitter for open tank service is announced. Called the 235T, the instrument operates on the force balance principle to derive a 3–15 p.s.i. (0·2–1 kg/sq.cm.) output signal, presenting only a clean stainless steel diaphragm to the process. It is continuously adjustable and is available in a low-range form (20–120 inches w.g.) and a high-range form (60–360 w.g.), being easily convertable from one to the other without the need for extra parts. Basically designed for syrup tank application in the sugar industry, the transmitter incorporates over-range protection facilities to obviate calibration shift after steaming out or hosing down. The diaphragm is completely welded to the body which is finished in epoxy enamel and is suitable for interior or exterior installation. It measures only approx. 4½ × 5 inches max. dia. and can be mounted by a ½-inch flange drilled to European or U.S. standards.

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PUBLICATIONS RECEIVED

pH METERS. Leeds & Northrup Ltd., Wharfdale Road, Tyseley, Birmingham 11.

Details are given of the 7401–A2, 7405–A2 and 7403–A2 pH meters, all of which have a range of pH 0–14. The 7401–A2 is a general-purpose meter with an accuracy of ±0·05 pH, while the 7405–A2 is for more precise work to an accuracy of ±0·01 pH, and the 7403–A2 has a relative accuracy of ±0·005 pH. The Leeds & Northrup measuring electrode used covers the complete pH range and is suitable for application at temperatures in the range 10–90°C. The reference electrodes have a "dual-glass" liquid junction.

* * *

CONTROL EQUIPMENT. Hartmann & Braun A.G., 6 Frankfurt/Main–West 13, Postfach 1361, Germany.

Two publications have been issued, one giving details of electrical and electronic measuring instruments and thermal and process measuring and control devices, while the other gives numerous examples of applications in a range of industries using Hartmann & Braun control gear. This second publication is well illustrated and includes pH indicators on a carbonatation vessel, the control panels of an evaporator station and juice purification station, and furnace control for beet pulp drying.

* * *

TEMPERATURE AND LEVEL MEASUREMENT AND CONTROL. Fielden Electronics Ltd., Wythenshawe, Manchester.

Data sheet Temp.T.1 gives information on the type D.5073 temperature transmitter, in which the element is a resistance bulb consisting of a coil of platinum wire in a stainless steel sheath. The "Telstor" Series 62 level gauge has a simple transmitting circuit housed in the terminating head of the electrode or sensing probe (four main types of electrode are available covering all normal applications) and alarm or control means are available, while the "Aquatrol" NF.2 automatic level control operates on the principle of electrical conductivity. It is fully transistorized and provision is made for high or low sensitivity, according to the resistivity of the liquid.

* * *

MECHANICAL HANDLING. Mechanical Handling Engineers' Association, Glen House, Stag Place, London S.W.1.

The 1966 edition of the Association's catalogue gives an alphabetical list of members and their products and gives numerous illustrations of mechanical handling equipment in various industries covered by eight different sections. The captions are in English, French and Spanish.

STAINLESS STEEL STORAGE VESSELS. The Taylor Rustless Fittings Co. Ltd., Ring Road, Lower Wortley, Leeds 12.

Product Data Bulletin 5 gives general information on stainless steel storage and transit vessels, which are available manufactured to a standard pattern or can be made to customers' specifications. The vessels can be supplied with descaled finish and square corners or with internal polishing and rounded corners.

* * *

OVERHEAD IRRIGATION. Guthrie Allsebrook & Co. Ltd., Crown Street, Reading, Berks.

Guidance on overhead irrigation and its use in fertilizer and herbicide application is given in a booklet published by the company. Information is also given, in leaflet P115/64, on the "Wagtail" irrigation equipment, which consists of aluminium piping fitted with special couplings; these can be joined and dismantled quickly and easily. The rotary rainers are spaced 40 ft apart. When one area has been irrigated, the line can be moved and re-layed in a few minutes.

* * *

DIAPHRAGM-OPERATED VALVES AND TEMPERATURE CONTROLLERS. Drayton Controls Ltd., West Drayton, Middx.

List No. DOV.1/66 gives details of the single-seat on/off diaphragm-operated valves, which are available in various body types, sizes and materials suitable for most control applications and applicable in sequential operation. List No. TC.5/66 provides information on the electronic "Dialset" proportional temperature controller which employs a platinum resistance thermometer. The transistorized printed-circuit amplifier senses resistance changes of 0·1% and produces an output signal capable of operating a Drayton motorized valve or other control element. The controller is available in two temperature ranges: —50 to +50°C and 25–125°C. The latter range can be converted to 100–200°C by cutting the shorting link situated behind the setting dial.

* * *

AUTOMATIC BLENDING. Mimic Diagrams & Electronics Ltd., Maxim Road, Crayford, Kent.

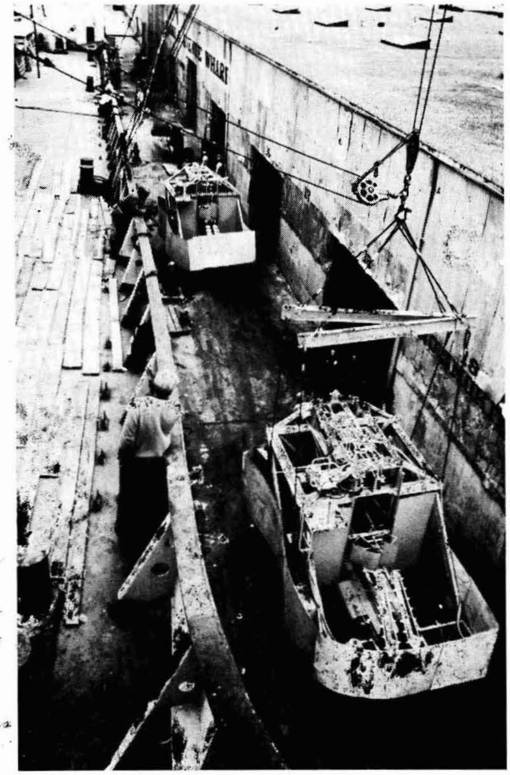
Literature is available on the multi-component "Autoblender", which can be supplied as a packaged unit complete with pumps and drives, meters, valves, piping, control console, etc., and on the master-and-slave "Autoblender", applicable where there are few streams to be blended and where one stream may be allowed to "run wild".

Brevities

New Thames jetty for Tate & Lyle.—The illustration shows a concrete jetty completed for Tate & Lyle Refineries Ltd. by Taylor Woodrow Construction Ltd. The jetty extends 440 ft into the Thames at Silvertown and is designed to facilitate deliveries of bulk raw sugar to the Thames Refinery. The 520 ft long × 42 ft wide pierhead will enable ships to discharge directly onto an elevated conveyor which will transfer the sugar to a 7-storey weigher house. Handling rates of 800 tons/hr are envisaged. The concrete decking is supported on steel box piles and will carry two 12½ ton-capacity unloading cranes.

* * *

Cane harvesters.—The illustration shows a cane harvester, manufactured by Cane Machinery & Engineering Co. Inc., of Thibodaux, La., U.S.A., being lifted aboard a freighter. It and eleven other Cameco harvesters are being delivered to Khashm El Girba sugar factory, Sudan.



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Dicalite filter-aids acquisition.—The Dicalite filter-aid and filler division of Great Lakes Carbon Corp. has been acquired by General Refractories Co. and incorporated into a newly-created subsidiary, Grefco Inc. It will continue to function as the Dicalite Division with headquarters in Los Angeles, Calif., U.S.A.

* * *

East German centrifugals for Cuba[1].—Representatives of the East German export trade concern Chemieanlagen-Export have signed an agreement in Havana, under which the East Germans are to supply Cuba with centrifugals valued at 60,000,000 Marks. The first batteries of machines produced by VEB Maschinenfabrik Sangerhausen are to be installed this year in Rio Cauto factory (Oriente) for operation in the next cane harvest.

[1] *Lebensmittelind.*, 1966, **13**, 162.

Cuban Sugar Statistics[1]

	1965		1964	
	(*metric tons, raw value*)			
Stocks 1st January ..		197,783		185,778
Production		6,082,158		4,589,506
		6,279,941		4,775,284
Exports	5,315,630		4,176,051	
Consumption	492,351	5,807,981	401,450	4,577,501
Stocks 31st December		471,960		197,783

Exports	1965	1964
Albania	11,297	10,810
Algeria	18,291	37,696
Bahrein	4,780	—
Bulgaria............	157,692	87,248
Canada	68,614	3,268
Ceylon	43,443	21,596
Chile	10,210	—
China..............	398,216	386,352
Czechoslovakia	244,618	52,071
Germany, East......	169,878	81,054
Iran	73,466	31,466
Iraq	126,313	—
Israel	9,138	—
Italy	52,533	149,455
Japan	415,215	345,582
Jordan	33,940	—
Korea, North	21,458	21,051
Kuwait	—	10,417
Lebanon	10,459	10,591
Mali	10,546	—
Morocco	182,209	323,259
Netherlands	31,005	10,387
Norway............	5,487	—
Poland	—	32,148
Portugal	41,520	—
Somalia............	—	11,477
Spain	173,771	275,704
Sudan	—	—
Sweden	42,399	10,721
Switzerland	18,818	42,573
Syria	62,167	30,961
U.S.S.R.	2,456,144	1,936,798
U.A.R.	126,168	95,284
United Kingdom	113,237	94,144
Uruguay	—	10,599
Venezuela	31,556	—
Vietnam, North	65,997	10,542
Yugoslavia	85,045	42,797
TOTAL	5,315,630	4,176,051

New Egyptian sugar factories[2].—In the second five-year plan, sugar factories are to be built at El Baharia and Quss. By 1970 the capacity of Edfu sugar factory is to be raised from 45,000 tons to 180,000 tons of sugar, and that of Kom-Ombo from 75,000 tons to 150,000 tons. By 1971 the sugar factory at Deshna will have come into operation, and will produce 40,000 tons of sugar, to be later increased to 100,000 tons. The output of Armant factory is to be raised by 1968 from 75,000 tons to 120,000 tons, and in this year the sugar factory at Baliana should go into production, its output being expected to rise to 150,000 tons by 1974. Egyptian sugar production, which in 1952 totalled only 218,000 tons and in 1964 reached 440,000 tons, should be 700,000 tons/year by the end of the second five-year plan.

* * *

U.K. sugar surcharge.—The world price of raw sugar fell sharply during the first two weeks of June and the Minister of Agriculture, Fisheries and Food accordingly made Orders under the Sugar Act, 1956, adjusting the surcharge in conformity with this price movement. The surcharge was thereby raised as from the 17th June from 3½d per lb (32s 8d per cwt) to 3¾d per lb (35s 0d per cwt).

BREVITIES

Bahamas sugar plans[3].—The study reported earlier[4] on the possibility of a sugar mill on Great Abaco has appently been favourable since it has been officially stated that the Government has reached an agreement with Owens-Illinois Co. which will enable the company to grow sugar on the island. A special sugar quota of 10,000 tons for 1968 has been granted to the Bahamas by the U.S. House Agricultural Committee.

* * *

U.S. sugar cane crop restriction[5].—Despite a substantial cut-back in acreage and the effect of hurricane damage, 1965 crop sugar production amounted to 1,104,292 tons, consisting of 554,131 and 550,161 tons, raw value, from Florida and Louisiana, respectively. Effective stocks as at 1st January 1966 were almost the same as a year earlier, while production from the 1966 crop is conservatively estimated at 1,150,000 tons or 50,000 tons in excess of quota for the Mainland Cane area. With better weather conditions, productions could substantially exceed 1,150,000 tons and it appears necessary that production from the 1967 crop be restricted to avoid a supply of sugar in excess of quota and carryover requirements, according to the U.S. Dept. of Agriculture.

* * *

Antigua Sugar Factory Ltd. 1965 report.—The drought which had hit the Company for several years, of which 1964 was the worst, continued throughout 1965. The crop yielded only 14,040 tons of commercial sugar, equivalent to 14,097 tons 96 pol sugar, made from 136,180 tons of cane crushed. This compares with 21,160 tons of 96 pol sugar made from 191,661 tons of cane in 1964 and 27,958 tons of 96 pol sugar from 255,354 tons of cane in 1963. The poor 1965 crop resulted in a considerable increase in the losses sustained in the year before, and the continuing drought and labour difficulties which delayed the start of the 1966 crop are likely to reduce the production of sugar this year to about 9000 tons, thereby considerably increasing the accumulated loss.

* * *

Hawaiian consultants in Kenya.—Amfac Associates Ltd. have been appointed Managing Agents of the Chemelil Sugar Co. Ltd. which, when developed, will be the largest sugar estate in Kenya. The Chemelil Sugar Company is being developed by a consortium of the Kenya Government and international investors. The new company will produce approximately 60,000 tons of white sugar per year. However, even with the added production, Kenya will still be an importer of sugar. The new sugar estate is located on the shores of Lake Victoria near the town of Kisumu which is 150 miles from Nairobi where the company's main office is located. A limited number of technicians and staff personnel will be employed; however, one of the main objectives of the Kenya Government and Amfac Associates is to train and utilize Kenya citizens in the operation of this estate which will have an area of between 25,000 and 30,000 acres, to include Company and planters' cane. The Kenya Government will construct an all-weather road system of approximately 100 miles to assure transport of sugar cane to the factory which will begin operation in 1967. The two-year cane crop is at an elevation of 4000 feet, in an area which has an annual rainfall of 50 inches. DAVID P. YOUNG, former Assistant Manager of the Oahu Sugar Co. Ltd., is now in Kenya as General Manager for Amfac Associates. He will be in charge of all operations including field and factory, and will report directly to the Board of Directors of the sugar estate.

* * *

New Iraq sugar factory[6].—The Government of Iraq is considering tenders from German, Italian and Japanese firms for the construction of a new sugar factory in Amara, to have a capacity of 4800 tons of cane per day.

1 *I.S.C. Stat. Bull.*, 1966, **25**, (5), 33–34.
2 *Zeitsch. Zuckerind.*, 1966, **91**, 289.
3 *Overseas Review* (Barclays D.C.O.), June 1966, p. 85.
4 *I.S.J.*, 1966, **68**, 192.
5 *Willett & Gray*, 1966, **90**, 221.
6 F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (19), 17.

BREVITIES

Bagasse paper expansion in Cuba[1].—The three existing bagasse paper factories in Cuba are to be expanded to raise their total capacity from 39,000 to 60,000 tons to meet part of the increased demand for paper products which is expected to rise to 242,400 tons by 1970 and to 600,000 tons by 1980. It will also be necessary to install further factories of 282,000 tons additional capacity in order to meet the target of 342,000 tons domestic production by 1980.

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New sugar factory for Algeria[2].—A new sugar factory with a production capacity of 15,000 tons of sugar per year is to be constructed soon at Annaba (formerly Bône).

* * *

New sugar factory for Tanzania[3]. Sugar cane has been grown for some years on the Mtibwa sugar estate, and the acreage is to be increased to 5000 acres. A new sugar factory is to be erected near the plantations and will cost about £1,500,000. It is scheduled to be put into operation in 1970.

* * *

Chile sugar expansion[4].—The Chilean Government has given its agreement to Industria Azucarera Nacional S.A. for expansion of the production capacity of its factory at Linares, 350 km south of Santiago, by 50%. Last year the factory produced 39,370 metric tons of sugar and the expansion will increase this by about 15,000 tons and will permit a saving of $807,000 on foreign exchange. The three factories of IANSA, situated at Linares, Los Angeles and Llanquihue, produce currently 95,000 tons of sugar per year, meeting 40% of domestic requirements.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 18th July*, 1966)	s d
Anglo-Ceylon (5s)	5/–
Antigua Sugar Factory (£1)	9/–
Booker Bros. (10s)	20/9
British Sugar Corp. Ltd. (£1)	23/9
Caroni Ord. (2s)	1/8¼
Caroni 6% Cum. Pref. (£1)	16/–
Demerara Co. (Holdings) Ltd.	2/9
Distillers Co. Ltd. (10s units)	20/7½
Gledhow Chaka's Kraal (R1)	15/6
Hulett & Sons (R1)	15/–
Jamaica Sugar Estates Ltd. (5s units)	3/3
Leach's Argentine (10s units)	8/6
Manbré & Garton Ltd. (10s)	33/3
Reynolds Bros. (R1)	16/6
St. Kitts (London) Ltd. (£1)	15/6
Sena Sugar Estates Ltd. (5s)	10/4½
Tate & Lyle Ltd. (£1)	27/9
Trinidad Sugar (5s stock units)	2/1½
West Indies Sugar Co. Ltd. (£1)	7/–

CLOSING MIDDLE

New York Stocks (*at 16th July*, 1966)	$
American Crystal ($5)	17⅜
Amer. Sugar Ref. Co. ($12.50)	27⅞
Central Aguirre ($5)	31
Great Western Sugar Co.	41
North American Sugar ($10)	13⅛
South P.R. Sugar Co.	23½
United Fruit Co.	35

European Sugar Beet Area Estimates, 1966[5]

	1966 2nd Est.	1966 1st Est.	1965
Western Europe		*hectares*	
Austria	48,454	52,000	38,200
Belgium/Luxembourg	65,000	70,000	65,362
Denmark	53,600	53,500	55,775
Finland	17,000	18,500	18,316
France	259,500	280,000	355,400
Germany, West	294,148	294,000	293,155
Greece	15,906	15,800	15,830
Ireland	22,100	22,300	25,870
Italy	300,000	290,000	275,000
Netherlands	92,500	93,500	91,894
Spain	150,000	150,000	150,000
Sweden	41,100	43,000	41,727
Switzerland	8,374	8,360	8,459
Turkey	153,252	166,600	160,690
U.K.	175,000	177,000	177,285
Yugoslavia	103,000	80,000	82,000
TOTAL	1,798,934	1,814,560	1,854,963
Eastern Europe			
Albania	6,000	6,000	6,000
Bulgaria	70,000	70,000	70,000
Czechoslovakia	220,000	220,000	219,800
Germany, East	218,000	230,000	216,70C
Hungary	110,000	110,000	112,850
Poland	450,000	450,000	476,000
Rumania	190,000	220,000	192,000
U.S.S.R.	4,000,000	4,200,000	4,200,000
TOTAL	5,264,000	5,506,000	5,493,350
Europe excluding U.S.S.R.	3,062,934	3,120,560	3,148,313
Europe including U.S.S.R.	7,062,934	7,320,560	7,348,313

Taiwan sugar equipment for Rwanda[6].—Under the terms of a five-year agreement signed in Taipei recently, Taiwan will assist in the construction of three new sugar mills in Rwanda.

* * *

Rumanian sugar production, 1965[7].—According to official statistics, 402,000 tons of white sugar were produced in 1965 in Rumania, against 349,000 tons in the previous year, i.e. a 15% increase. According to the plans for the years 1966–70, 4 to 4·1 million tons of beets are to be harvested annually[8]. Sugar production is to be increased from 422,000 tons in 1966 to 485,000 tons in 1967, 540,000 tons in 1968, 555,000 tons in 1969 and 600,000 tons in 1970. The beet area will have to be extended; on the basis of the present area of 190,000 hectares, the planned production of 422,000 tons may be reached in 1966.

* * *

Sugar plans for the Cameroon Republic[9].—A sugar cane plantation is to be established at Mbandjock in the Cameroon Republic and a factory with a planned annual output of 12,000 tons of refined sugar for the domestic market is to be constructed. The total cost of the project will be approximately £2·9 million; a loan agreement has recently been concluded by which the European Investment Bank will supply one quarter of this amount.

1 *Cuba Economic News*, 1966, **2**, (10), 3.
2 *Agence France-Presse*, 29th May 1966.
3 F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (17), 17.
4 *Sucr. Belge*, 1966, **85**, 388.
5 F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (19), 1.
6 C. Czarnikow Ltd., *Sugar Review*, 1966, (769), 123.
7 *Zeitsch. Zuckerind.*, 1966, **91**, 348.
8 F. O. Licht, *International Sugar Rpt.*, 1966, **98**, (19), 13.
9 C. Czarnikow Ltd., *Sugar Review*, 1966, (771), 130.