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THE
# INTERNATIONAL SUGAR JOURNAL

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## NOTES AND COMMENTS

**Cuban sugar purchases[1].**

Cuba, historically a seller of sugar, surprised the trade by entering the market as a buyer to fulfil earlier commitments and bought through a London Trade house a cargo of U.K. refined sugar for October shipment to Bulgaria and an "omnibus" cargo of raws from a French house for shipment to Mainland China. It is rumoured that two additional cargoes of raws have been purchased for ultimate delivery to Mainland China, but these have not been confirmed. No prices have been divulged.

Particular surprise was evoked that the refined sugar is required to be shipped during October when European production is normally in full swing but it has since been reported that the Bulgarian harvest is expected to be late this year and the sugar is needed to bridge the gap before domestic production becomes available[2].

* * *

**European beet area estimates.**

First estimates have been published by F. O. Licht K.G.[3] of the area planted to beet for the 1964/65 campaign. The total is put at 7,579,500 hectares, an increase of about 1,300,000 ha over the 1963/64 area. Of this increase, however, no less than one million ha is reckoned as the increase in area for the U.S.S.R., while most Western European countries are shown to have increases of between 5 and 12%. Roumania is expected to increase her beet area by 7% and Poland by 20% but only very small increases are expected in the rest of Eastern Europe with the exception of the U.S.S.R.

Of the last-mentioned country's 1,000,000 ha increase estimate, C. Czarnikow Ltd.[4] write: "The official plan provides for 4·3 million hectares to be sown to beet in the Soviet Union this season, compared with 3·3 million hectares in 1963. We very much doubt whether so large an area will be possible. It is known, of course, that the crop in 1963/64 fell far below expectations and some steps will presumably be taken to attain a higher level of production from the coming campaign. Nevertheless, other crops also suffered considerably in the U.S.S.R. during the past year and it would not be surprising to find that the competing claims of the grain, animal foodstuffs and livestock industries result in a very much smaller area being allocated to the growing of sugar beet than is at present being mentioned."

Details of the estimates appear elsewhere in this issue.

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**Australian sugar crop, 1963[5].**

Outturn of sugar from the 1963 Queensland cane crop of 11,501,807 tons was 1,651,833 tons 94 n.t. sugar and 75,589 tons n.t. sugar was produced from the New South Wales crop of 618,411 tons of cane. Australian sugar production from the 1963 season was therefore 1,727,422 tons, which compares with the record Australian figure of 1,849,261 tons in the 1962 season.

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**Nigeria sugar project[6].**

An integrated sugar plantation and refinery project, with an initial capacity of 60,000 tons, is proposed by the Government of Eastern Nigeria.

A report on this, "Preliminary Study of the Potential for a Sugar Industry in Eastern Nigeria", has been prepared by Arthur D. Little, Inc., as part of a programme of technical assistance sponsored by the U.S. Agency for International Development. The Government of Eastern Nigeria is looking for foreign capital and participation by a reputable, experienced technical partner.

Consumption of imported refined sugar, the report notes, has increased almost 5-fold in the past 10 years. Demand may go as high as 115,000 tons by 1968 and 150,000 tons by 1971. The following shows the rising trend of refined sugar imports for Nigeria (in tons): 1945 2,689; 1947 2,377; 1952 13,551; 1957 32,344; 1962 73,191.

[1] *Willett & Gray*, 1964, **88**, 186.
[2] C. Czarnikow Ltd., *Sugar Review*, 1964, (659), 83.
[3] *International Sugar Rpt.*, 1964, **96**, (11), 1–6.
[4] *Sugar Review*, 1964, (658), 79.
[5] *Australian Sugar J.*, 1964, **55**, 713.
[6] *Willett & Gray*, 1964, **88**, 106.

No white sugar is manufactured in Nigeria. The country's first and only sugar mill is now being built at Bacita, near Jebba, in the Ilorin province of Northern Nigeria. This enterprise is expected to begin harvesting cane from its own plantation and manufacturing white granulated sugar in November 1964. An estate of 6,380 acres is to be planted and the mill is expected to reach its full production capacity of 25,000 to 30,000 tons by 1967.

The operation at Bacita cannot be greatly expanded, however, until the first Niger River dam has been built and associated flood-control measures provide additional land for sugar cane planting. Dam construction will take 6 years and no starting date for the project has been announced. Even assuming that the northern output doubles by 1971, there would still be an unfilled demand for 90,000 to 100,000 tons.

No commercial plantings of sugar cane have existed in Eastern Nigeria. Previous surveys of potential sugar-cane-producing land in the region, however, reveal that an area of roughly 140 square miles, bounded by the Anambra and Do rivers and located just north west of Enugu, is well suited for the crop.

Information on climatic conditions covering temperature, humidity and rainfall are included in the report. Extensive data on soil types and drainage in the area are said to be available. Rough estimates of the amount of water available the year round from the 2 rivers have been made and indicate adequate quantities. These figures would have to be refined by further study.

The area in question is thinly populated and sufficient acreage can be provided with Government assistance by means of a long-term lease, as has been done in the past for other plantation projects.

Data are included in the report on transportation and fuel as well as power and labour costs—all of which seem favourable to a low-cost operation. Fertilizers and other agricultural chemicals for plantation operation, as well as special chemicals required by the refinery, would be imported. Examples of import duties are shown, illustrating the advantages of a local industry.

The report makes no attempt to cost out the project or to estimate its potential profit margin.

Under the terms of their service to the Eastern Region Government, the staff of Arthur D. Little, Inc., are prepared to work with interested investors, free of charge, to obtain additional technical and economic data and to assist in every way possible to accelerate an investment decision.

Firms in the sugar and allied industries, interested in investment in Nigeria, may obtain a copy of the report from the limited number available by writing to: Economic Development Section, Arthur D. Little, Inc., Acorn Park, Cambridge, Mass. 02140, U.S.A.

**Indian sugar situation[7].**

It is an apparent anomaly of the current statistical picture that India, one of the foremost sugar producers, should still have one of the world's lowest levels of domestic consumption. Several countries are now geared to produce more than one million tons each year but only five or six can hope to exceed the two million tons mark. India is well above this figure; by 31st March production from the 1963/64 crop had amounted to 2,331,000 tons, and it is anticipated that by the time the campaign ends this figure will be increased by a further 275,000 tons to achieve a total output in the region of 2·6 million tons.

A shortage of foreign exchange has presented the Indian authorities with a considerable problem, and it has been decided that sugar exports must be maintained, even though this entails restricting domestic consumption. Current expectations are that from the campaign year November/October close on 300,000 tons will be shipped abroad, leaving 2·3 million tons to be disposed of in India. The stock level, which on some occasions in the past rose to very large proportions, has dwindled so that by the commencement of the current campaign only about 150,000 tons remained in existence, which must be fairly close to the minimum quantity to be carried forward if the distributive system is to function effectively, and it would be unwise to reckon on a further reduction.

With India's population now numbering about 450 million, per capita consumption this year will, therefore, average about 11·5 lb. Centrifugal sugar usage in Asiatic countries tends to fall well below the levels obtaining in Western Europe and North America and it is not reasonable to compare their rate of offtake bearing in mind the unrecorded level of consumption of gur and khandsari. Nevertheless, it is quite clear than ample room exists for a marked increase in the tonnage consumed in India and it is salutary to note than an additional one pound per year per head of population will account for a disappearance of 200,000 tons. It is of interest, however, that per capita consumption has increased by less than four pounds over the last forty years.

In an effort to increase production so as to permit greater exports, as well as to allow for an expansion in consumption, licences have recently been issued for the establishment of several new mills, whilst the capacities of many existing ones are to be raised. At the same time it has been announced that higher prices will be paid for cane in the 1964/65 season.

Production targets well in excess of three million tons have recently been mentioned whilst, according to a recent Government commission, consumption might well rise to as much as four million tons by 1970/71. It not infrequently occurs that practice falls some way behind targets; nevertheless, it would not be surprising if an important increase in production were to be effected in India during the next few years, whilst it is hoped that finance considerations will permit the people of India to expand their own consumption at least as fast.

[7] C. Czarnikow Ltd., *Sugar Review*, 1964, (660), 87.

# I.S.S.C.T. CONGRESS IN MAURITIUS

**Proceedings of the Eleventh Congress of the International Society of Sugar Cane Technologists, Mauritius, 1962.**

THIS handsome but weighty volume contains the texts of papers presented to the Eleventh Congress of the International Society of Sugar Cane Technologists held in Mauritius between September 24 and October 5, 1962. Various aspects of the cultivation of sugar cane (agriculture, breeding, entomology, pathology) are dealt with in no less than 105 papers, occupying 770 pages. There are also 35 papers devoted to other matters—factory operations, processing, engineering, chemistry, by-products, etc.

Delegates to the Congress, about 250, included representatives from most cane growing countries. The largest delegation in terms of numbers was that of Mauritius, as might be expected, followed by South Africa, Australia, Puerto Rico, East Africa, Hawaii and the U.S.A. Photographs of the individual delegations are one of the pleasing features of this volume. The presidential address, by P. O. WIEHE, Director of the Sugar Industry Research Institute in Mauritius, dealt with "The rôle of the I.S.S.C.T. in promoting our knowledge of the sugar cane plant". "The rôle of research in the development of modern agriculture" was the title of an address given by F. C. BAWDEN, Director of the Rothamsted Experimental Station, who showed, in a convincing manner, the great value scientific work and research has been to the sister beet sugar industry in recent years. J. M. PATURAU of Mauritius dealt with the sugar industry of that country, including its interesting historical background.

*Agriculture*

In the Agricultural Section the address of the Chairman (H. EVANS, British Guiana) "A review of recent developments and trends in sugar cane agriculture" has already been reprinted in these pages[1]. No one is likely to dispute his closing remarks where he states "Summarizing one may state that future progress from the agricultural side will depend on a steady stream of new and superior varieties, better control of pests and diseases, a better understanding of the sugar cane plant in relation to its environment; the identification and correction of local limiting factors to growth and quality; elimination of competitive weeds and the provision of optimal economically feasible conditions for high productivity; . . . and finally the harvesting of the sugar that is produced in the field by the most economical means and with the smallest possible unavoidable losses."

About 4 dozen papers were given in the Agricultural Section and these occupy nearly 500 pages of the volume. A large proportion of these papers are devoted to nutrition and to fertilizers and their use in many different countries. Naturally nitrogenous fertilizers claim much attention. In a paper on fertilizers in British Guiana it is stated that under prevailing conditions aqueous ammonia has proved to be inferior to sulphate of ammonia unless a subsurface application is made, also that urea is inferior to sulphate of ammonia by almost one ton of cane per acre, surface applied urea suffering considerable loss of nitrogen by volatilization of ammonia.

Foliar analysis and its value or its limitations is the subject of several different papers. "A new approach to the study of cane root systems" is the title of a paper by four Hawaiian workers and provides much food for thought. Two other papers are devoted to studies on sugar cane roots. Modern chemical methods of weed control receive attention from writers from Hawaii and Trinidad while "New aspects in the control of rhizomatous grasses with special reference to *Cynodon dactylon*" is the subject of a paper by E. ROCHECOUSTE of Mauritius.

The deterioration of burned standing cane and burned cut cane is dealt with by H. E. YOUNG of Queensland, this work having been initiated on account of new mechanical harvesting systems. In the field of mechanization "The development of self-loading cane trailers, trans-shipment cranes and gantries" is discussed by G. S. BARTLETT, a delegate from Natal, while R. A. DUNCAN deals with sugar cane harvester developments in Hawaii. Two of the papers on irrigation both deal with heavy clay soil conditions in Jamaica; a third deals with Indian conditions.

*Cane Breeding*

In this section, with 28 papers, covering 179 pages, the chairman, P. G. C. BRETT of the Mount Edgecombe Experiment Station in Natal, chose as the subject of his address "Advances in sugar cane breeding". He pointed out that in recent years advances have been made over a wide front. Methods have been sought to improve upon selection techniques, to induce flowering and to control the time at which it occurs, to increase pollen fertility, to improve crossing techniques, and to breed specifically for parent varieties.

No less than five papers were devoted to the subject of experimental or controlled flowering in sugar cane, which is evidence of the wide interest now taken in this matter, the contributors being from the United States, Puerto Rico, Mauritius and Fiji. Practical methods for the control of flowering enable the breeder to extend the crossing range both by inducing flowering in varieties which do not normally flower and by synchronizing the flowering of different varieties. One of the main objects of the construction of the Colonial Sugar Refining Company's phytotron

[1] *I.S.J.*, 1963, **65**, 163, 191, 223.

at Brisbane[2] is said to be to control flowering by means of photoperiod and temperature treatments and so to make possible specially desired crosses.

Another subject claiming the attention of several contributors is that of seedling selection and the reasons for discarding seedlings. There were papers from cane breeders in Mauritius, Queensland, Natal, Louisiana and Hawaii, and these took the form of a symposium. Reasons for rejection naturally vary considerably from one part of the world to another and these papers, considered together, afford an interesting study.

Bunch-planting, which is a comparatively recent innovation in selection technique and originated in Hawaii, was dealt with in papers by delegates from the United States and India. There is difference of opinion on the value of bunch-planting, but much must depend upon local conditions. It is favoured most in those countries where seedlings are easily raised.

*Diseases*

The Pathology Section consists of about 100 pages with 19 papers. The address of the Chairman (C. G. HUGHES of Queensland) dealt with three decades of sugar cane pathology. He pointed out that during the last 30 years a whole new science of sugar cane pathology had been developed. The fact that pathology had not lagged behind developments in other biological disciplines was a matter for pride and satisfaction for all those engaged in this field. Developments had ranged over the whole gamut of cane diseases and control. He then briefly dealt with them under the heading of bacterial, fungal, viral and phanerogamic parasitic diseases, and mentioned some of the newer aspects of control work.

A symposium was devoted to practical control measures for sugar cane diseases, papers being given by delegates from Australia (two), Louisiana and Mauritius. The following were some of the measures discussed—roguing, disease surveys, certified seed beds, agricultural hygiene, heat therapy and variable disease reaction in varieties. Separate papers dealt with Ratoon Stunting Disease (U.S.A.), Chlorotic Streak (Brazil), Gumming Disease (Mauritius), Red Rot (India), Downy Mildew (Philippines), Eye Spot (Mexico), Mosaic (2 papers: U.S.A.) and Fiji Disease (2 papers: Madagascar). An account of a survey of sugar cane diseases in Ceylon was given by B. T. EGAN (Queensland). The effect of witchweed (*Striga lutea*) on cane varieties in the United States is discussed by E. L. ROBINSON and I. E. STOKES, this Old World weed having been discovered in the western hemisphere as recently as 1956.

An up-to-date list of sugar cane diseases and their world distribution, prepared by the Standing Committee on Sugar Cane Diseases of the I.S.S.C.T., is given. This should prove useful to many. Another useful list is one of the names of sugar cane pathologists, with their addresses, arranged according to countries.

*Pests*

Owing to the absence of the Chairman of the Entomology Section (F. A. BIANCHI of Hawaii) the session was opened by J. R. WILLIAMS of Mauritius, who was himself responsible for two papers in this section. One of these was on the soil-inhabiting nematodes associated with sugar cane in Mauritius and the other on the reproduction and fecundity of the sugar cane stalk borer, *Proceras sacchariphagus* (spotted borer). Incidentally, Mr. WILLIAMS also was responsible for having performed the onerous task of editing the Proceedings for the whole Congress.

No less than six papers were devoted to borers, which is not surprising considering the enormous losses they cause to the sugar cane industry throughout the world. The authors of other papers on borers were from Louisiana, Jamaica and Madagascar, the last of these dealing with a method for mass rearing of the above mentioned borer on *Sorghum*. This permits the production, at will, of all the stages of this borer which may be necessary for laboratory investigations and, in particular, for the breeding of parasites of the borer.

The sugar cane froghopper (*Aeneolamia varia saccharina*) is the most serious pest of sugar cane in Trinidad and its chemical control is the subject of a paper by a worker there. Another paper on froghopper (*Aeneolima postica*) control deals with Mexico, where this insect is considered be to the second worst pest of sugar cane.

Having regard to the importance attached to New Guinea and Papua as the original home of some kinds of sugar cane it is appropriate that the insects of *Saccharum* in those territories should form the subject of a paper. A list of insect pests affecting sugar cane plantations within the Pacific, by a Hawaiian worker, should provide a useful record for other sugar cane entomologists.

Papers on soil arthropods (Louisiana) and on rats and rat control (in Mexico and British Guiana) are included in this section.

F.N.H.

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**Two new cane varieties for 1964 planting.** ANON. *Producers' Rev.*, 1963, **53**, (10), 13.—These will be released by the Bureau of Sugar Experiment Stations for planting in 1964. One is Q78 which it is proposed to put on the approved list for Tully, South Johnstone, Mourilyan and Goondi. The other, Q77, is to appear on the Mossman, Hambledon, and Mulgrave approved lists.

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**Mechanical harvesting demonstrations.** ANON. *Producers' Rev.*, 1963, **53**, (10), 95.—The capabilities of the Toft mechanical harvester, in difficult, badly lodged cane, is described (with two photographs). More than 130 of these cane loading units are now in use in Australia. Some have been ordered for use in Swaziland.

[2] *I.S.J.*, 1962, **64**, 128.

# THE STUDY OF SUGAR CANE DISEASES IN NATAL

AN illustrated article on the work of the Pathology Section of the South African Sugar Association Experiment Station at Mount Edgecombe, near Durban, has recently appeared[1]. This is one of a series of articles or pictorial features dealing with the work of this active research station.

The main functions of the Pathology Section consist of research into various aspects of the major sugar cane diseases that occur in Natal, assistance in the breeding programme in determining disease resistance and in maintaining a constant check on the disease situation as a whole, a situation which is never static. With the main diseases emphasis is on those that have a direct bearing on the production of cane and sucrose. Work on mosaic disease and ratoon stunting disease claims much attention at the present time. Studies on the latter involve work on heat therapy and on diagnosis and transmission.

Studies at present under way include greenhouse experiments on the possible relationship between hot water treatment for ratoon stunting disease and increased susceptibility to mosaic infection. Mosaic research includes studies on the probable existence of more than one strain of the mosaic virus. If this should prove to be so, a survey of the geographical distribution of the strains will be carried out. Mosaic disease and streak disease are studied in a combined trial at the Station at Mount Edgecombe, but gumming disease and red rot reaction have to be studied in most belt areas.

With regard to work on disease resistance with young seedlings this commences at an early stage in the life of the seedling. Inspection of planters' seedcane nurseries is another aspect of the work, as are special disease surveys such as those on gumming disease and smut. Visits to farms to investigate farmers' disease problems are a regular feature of the work of the pathologist.

Another very important function of the Pathology Section is the maintenance of the Sugarcane Quarantine Station at Durban. All sugar cane varieties imported by the Experiment Station have to be grown for a period of up to two years in the quarantine greenhouse to make sure they are disease- and pest-free before being more generally cultivated. Three serious sugar cane diseases, Fiji Disease, Leaf Scald and Downy Mildew, have not yet been recorded for Natal. To allow uncontrolled importation of sugar cane cuttings would be courting disaster.

F.N.H.

# SUGAR CANE BREEDING AT BARBADOS

**Twenty-Ninth Annual Report, B.W.I. Central Sugar Cane Breeding Station and Variety Testing Station, Barbados, 1961-1962.**

THE breeding programme for 1961 was a very successful one and the proportion of crosses carried out in the lantern batteries materially increased.

Some interesting new crosses were made, including a nobilization of the Bornean form of *Saccharum spontaneum*, known as "Moentai". This is a strong growing form with an attractive growth habit. In general the emphasis was on making crosses with the more recent seedlings rather than placing reliance on the older standard breeding canes, whose potentialities have been fairly well explored.

Many crosses were made between the standard commercial varieties of Hawaii, Queensland, Mauritius, Florida and India and the best Barbados breeding canes. Interesting progenies were obtained from several of these crosses, providing some addition to the range of types for selection under Caribbean conditions.

It is estimated that over 54,000 seedlings germinated, of which nearly 41,000 were potted as singles and over 39,000 were planted in the nursery. Tables are given with lists of the crosses made. Tables are also given showing the results of third year seedling trials and other work on variety testing.

Information on varietal trends in contributing territories is provided, the territories being—Jamaica, British Guiana, Trinidad, Barbados, Antigua and St. Kitts. Information is also given on the distribution of varieties to contributing and other countries.

Reference is made to the establishment of the new Cane Breeding Station at Groves and to the advantages likely to accrue from this. The new station will be on a site of approximately 32 acres.

F.N.H.

**Reaction of progenies of certain sugar cane × *Saccharum spontaneum* crosses to two rusts.** K. V. SRINIVASAN and M. C. MUTHAIYAN. *Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 275.—In India sugar cane may be attacked by the rust *Puccinia erianthi*, while *Saccharum spontaneum* may be attacked by another rust, *Puccinia kuehnii*. Among sugar cane × *Saccharum spontaneum* crosses it was observed some seedlings were susceptible to *P. erianthi* and resistant to *P. kuehnii*, while others were susceptible to *P. kuehnii* and resistant to *P. erianthi*. None were susceptible to both.

[1] ANON: *S. African Sugar J.*, 1963, **47**, 470–473.


**On certain genetic factors concerned in the production of viable seed in sugar cane.** B. V. NATARAJAN *et al. Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 270–271. The existence of differential capacities of the pistil parents for viable seed formation is indicated from data gathered on a number of crosses. Reciprocal differences in seed setting and the relatively low contribution of the pollen parent towards the formation of the hybrid seed are discussed.

* * *

**Studies in *Saccharum spontaneum*—periodicity of floral emergence in the case of some progenies.** C. N. BABU. *Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 271–273.—Different clones of *S. spontaneum* show much variation in periodicity of flowering. They also show marked differences in response to photoperiodic treatment. Observations on a number of clones in regard to flowering are recorded.

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**Evolving varieties for resistance to *Pythium* root rot.** K. V. SRINIVASAN and R. NARASIMHAN. *Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 273–275.—This is a study of the reaction of young sugar cane seedlings to root rot by employing a special ("root dip") technique. Some parents (e.g. N:Co 339 and POJ 2878) give rise to a relatively high proportion of seedlings resistant to root rot, while other varieties gave a large proportion of susceptible seedlings.

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**World consumption of nitrogenous fertilizers.** ANON. *International Fertilizer Correspondent*, 1964, **5**, Item 692.—In the fiscal year 1962/63 the world consumption of nitrogenous fertilizers amounted to 15·6 million tons N, 5% more than that of the previous year. The increase was greatest in the U.S.A., in Western Europe, India and China. In the U.S.A. and Europe approximately 4½ million tons N were consumed in each case and in Asia 3 million, the latter a 12% increase on the previous year.

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**New unreleased varieties.** L. L. LAUDEN. *Sugar Bull.*, 1963, **42**, 28–29.—A record number (459) of new unreleased sugar cane varieties has been selected for further trial in the S.E. United States—as against 200 or less in former years. Many appear to have excellent sucrose content. The expanded cane breeding programme was begun in 1957.

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**An efficient drainage system for sugar cane.** I. L. SAVESON. *Sugar Bull.*, 1963, **42**, 30–32.—It is pointed out that the present century-old drainage system in the S.E. United States was designed when hand labour and mules were used in cane production and that a more efficient system is now called for, especially with the use of heavy modern machinery. An experiment at Port Allen, Louisiana, which shows promise, is described. It combines the successful cotton drainage system with precision land forming (land levelling).

* * *

**Know your experiment station—a visit to the Plant Breeding Section.** ANON. *S. African Sugar J.*, 1963, **47**, 576–577, 579.—This is one of a series of pictorial articles dealing with the activities of the South African Sugar Association's Experiment Station at Mount Edgecombe, near Durban. The various aspects of the work of breeding and raising new varieties suited to South African conditions are explained and illustrated with photographs. During recent years five additional environmental stations have been established.

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**Annual mechanization demonstration.** ANON. *S. African Sugar J.*, 1963, **47**, 584–587.—At this demonstration and show, arranged by the South African Sugar Association's Field Mechanization Committee, near Maidstone, Natal, over 27 firms participated and visitors from all parts of the sugar-belt attended. All classes of modern cane equipment for use in the field were on view or demonstrated.

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**What fertilizer should you use?** ANON. *Producers' Rev.*, 1963, **53**, (10), 9.—The pros and cons of the following nitrogenous fertilizers are discussed—aqueous ammonia, urea, sulphate of ammonia and nitrogen in mixed fertilizers. The first widespread use of aqueous ammonia in Australian cane fields was in 1962.

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**Weedicide tests.** ANON. *Victorias Milling Co. Expt. Sta. Bull.*, 1963, **10**, (10), 5.—Large scale tests in cane fields showed that 2,4-D amine applied at the rate of 8 lb/ha gave cheaper and more effective control of weeds than "Gesaprim 50 W" at either 1·5 kilos or 2·0 kilos/ha.

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**Cane disease picture in VMC farms.** ANON. *Victorias Milling Co. Expt. Sta. Bull.*, 1963, **10**, (10), 5.—The 9-monthly survey of leaf diseases, on 8–11 month old cane, showed a further decrease in leaf scorch infection (2·8% to 1·2%), in red spot of leaf sheath and red spot of petiole. But there was increased infection in ring spot (0·89% to 3·01%) and yellow spot (1·19 to 1·22%).

**The evolutionary significance of sugar accumulation in *Saccharum*.** T. A. BULL and K. T. GLASZIOU. *Australian J. Biol. Sci.*, 1963, **16**, 737–742.—Sugar levels in the various species of the *Saccharum* complex suggest an evolutionary increase in sugar content. Under suitable ecological conditions, survival through sucker growth may be dependent on rapid mobilization of stored carbohydrate. Selection pressure for sucrose storage would then occur if sucrose was more readily remobilized than other storage carbohydrates. It is suggested that this ecological situation occurred in New Guinea, and that natural and not human selection led to the evolution of *S. officinarum*. The relationships between total sugars, moisture content, and fibre content indicate that there is an apparent physiological limit to sugar accumulation in the genus *Saccharum* at about 27% of the fresh weight.

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**Sugar beet yellows in Great Britain, 1962.** R. HULL. *Plant Pathology*, 1963, **12**, 155–156.—Sugar beet mild yellowing virus and not sugar beet yellows is now considered to be the prominent cause of loss from sugar beet yellows. A table is given showing estimated yield losses from 1946 to 1962. In 1962 yellows developed late and did not spread extensively. Only in the coastal area of Essex and south-east Suffolk was the disease severe.

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**Field emergence and laboratory germination of sugar beet seed.** W. J. BYFORD. *Plant Pathology*, 1963, **12**, 174–177.—Quality of sugar beet seed in Britain varies from year to year according to weather conditions at harvest and contamination with *Pleospora betae*, the main cause of seedling black-leg. Experiments, with 14 samples of seed, showed the improved germination or emergence to be expected after treatment with an ethyl mercury phosphate steep.

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**Variance of counts from larval suspensions of beet eelworm.** F. MORIARTY. *Plant Pathology*, 1963, **12**, 177–179.—Variances greater than those associated with the Poisson distribution were obtained with counts from larval suspensions of *Heterodera schachtii*. This was caused by clumping in the transfer pipette, and can be avoided by using pipettes with a wide aperture.

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**Insects injurious to sugar cane in Madagascar: practical aspects of the question.** L. CARESCHE and J. BRÉNIÈRE. *Agron. Trop.*, 1962, **17**, (7–8), 608–631; through *Rev. Appl. Ent.*, 1963, **51**, Ser. A, 513–514.—A list is given of the insects that attack sugar cane in Madagascar and the injury caused by the more important is discussed. Notable among these are *Argyroplace schistaceana*, *Sesamia calamistris* and *Proceras sacchariphagus*, the last mentioned borer less important than formerly, probably because of increasing populations of *Trichogramma australicum* which parasitises the eggs.

**Control of first generation sugar cane borer populations in Louisiana.** S. D. HENSLEY *et al. J. Econ. Ent.*, 1963, **56**, 407–409.—The effect of insecticides on first generation *Diatraea saccharalis* on ratoon cane was investigated. Treating areas of 140–200 acres with 8–12 lb 2% "Endrin" granules per acre in May gave 76–79% control of the first generation, but had little effect on the abundance of the second generation, probably owing to migration from nearby fields.

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**The principal pests of sugar cane in Mexico.** S. FLORES CACERES and M. ABARCA RUANO. *Divulg. Inst. Mejor. Prod. Azucar*, 1961, (4), 110 pp; through *Rev. Appl. Ent.*, 1963, **51**, Ser. A, 109.—Notes are given on the distribution, morphology, bionomics, injuriousness, and control of the principal insects and other animal pests of sugar cane in Mexico, arranged under the parts of the plant attacked.

* * *

**Residual effect of sprays of "Ekatin", "Metasystox (1)" and "Metasystox (R)" against *Doralis fabae* and *Myzus persicae* under laboratory conditions.** M. MIKSIEWICZ and L. KLICZA; *Biul. Inst. Ochr. Rosl.* (Poznan), 1962, (14), 203–218; through *Rev. Appl. Ent.*, 1963, **51**, Ser. A, 186.—In greenhouse tests in Poland these insecticides protected beet from aphis attack for up to 8 days.

* * *

**The common beet weevil in the district of Vratsa and its control in 1962.** K. MILKOV. *Rast. Zasht.*, 1963, **11**, (4), 15–18; through *Rev. Appl. Ent.*, 1963, **51**, Ser A, 478.—*Cleonus punctiventris* is by far the most important pest of beet in the district of Vratsa in Bulgaria. Overwintered adults appear on the surface of the soil in early April. A BHC dust applied at 27–36 lb per acre three times (10–15th April; 20–25th April; 1st May) reduced losses to less than 1%. Old beet plantings and waste land should be dusted.

* * *

**Life history of the sugar beet root maggot in southern Alberta.** A. M. HARPER. *Canad. Ent.*, 1962, **94**, 1334–1340; through *Rev. Appl. Ent.*, 1963, **51**, Ser. A, 597.—This constitutes a field and laboratory study of the bionomics of the beet root maggot, *Tetanops myopaeformis*, which has damaged sugar beet in sandy soils in southern Alberta since 1955.

* * *

**Different kinds of injury to leaves of the sugar beet and their effect on yield.** G. MÖLLERSTRÖM. *Medd. Växtskyddsanst*, 1963, **12**, 299–309; through *Rev. Appl. Ent.*, 1963, **51**, Ser. A, 637–638.—In tests on sugar beet in Sweden the effect of leaf damage at different seasons was ascertained, 20, 50, 75 and 100% of the foliage being removed by cutting away pieces of the leaves. Yield decreased with increased defoliation. Sugar content was most affected by defoliation in August and September. Leaving the small central leaves intact reduced losses. The effect of leaf injury by insects depends upon which leaves are attacked.

**Abaca mosaic virus and its relationship to sugar cane mosaic.** A. L. ELOJA and T. W. TINSLEY. *Ann. Appl. Biol.*, 1963, **51**, 253–258.—At Rothamsted no evidence was found to support the view that abaca (*Musa textilis*) mosaic virus is a strain of cucumber mosaic virus. The virus from deceased abaca in the Philippines, which is sap-transmissable between maize seedlings, is probably a strain of sugar cane mosaic virus.

* * *

**Results of variety tests on sugar beet, 1959-62.** W. MEIER. *Mitt. schweiz. Landw.*, 1963, **11**, (5), 74–79; through *Rev. Appl. Mycol.*, 1963, **42**, 641.—Among seven polyploid lines tested during this period Maribo PA1 and PA3 showed the greatest resistance to leaf spot (*Cercospora beticola*).

* * *

**New chemicals give safe and effective control of many aquatic weeds.** L. J. MATTHEWS. *New Zealand J. Agric.*, 1963, **107**, 394–395.—A new era in aquatic weed control has been opened by two new chemicals, "Diquat" and "Paraquat". They are relatively safe to use and control a wide range of water weeds, without adverse effect on associated life.

* * *

**Downy mildew disease of sugar cane in Negros Island, Philippines.** J. R. RIVERA. *Philippines Sugar Inst. Quarterly*, 1963, **42**, 629.—This is a comprehensive report on *Sclerospora sacchari* in the Philippines on hybrid seedlings (75% infected) and *Saccharum spontaneum* hybrids (severe damage) in 1957–58. Commercial varieties were less affected than hybrids. Infections on *Saccharum spontaneum* and sugar cane are compared.

* * *

**Studies on the control of water lettuce.** L. W. WELDON *et al. Proc. 16th Southern Weed Conf.*, 1963, 356; through *Weed Abstracts*, 1963, **12**, 303.—In trials in the U.S.A. (since 1958) on the control of *Pistia stratiotes* in canals and irrigation ditches "Diquat" at 1 to 1·5 lb per acre has given the best results (98–100% control) with the dibromide or dichloride formations appearing equally effective. A wetting agent was not necessary. MCPA at 8 lb per acre in diesel oil at 10 gal/acre was as effective as 2,4-D at twice this rate.

* * *

**The sugar industry in British Guiana.** H. EVANS. *Sugar y Azúcar*, 1963, **58**, (9), 64–66.—All aspects of cane production in British Guiana are briefly discussed, viz. topography, soils, estate layouts, drainage, fresh water supplies, land preparation, planting, irrigation, mineral nutrition, pests and diseases, harvesting, cane quality and yields.

* * *

**Results of phosphate fertilizing trials with sugar beets.** S. GERICKE. *Zucker*, 1963, **16**, 535–539.—With 120 kg/ha $P_2O_5$ applied as slag, the yield increase corresponded to 58 kg beet for each kg of $P_2O_5$. In the present cultivation areas phosphate fertilizing is important in regard to level of yield and quality of beets.

* * *

**The I.I.S.R. deep furrow cum trash vein system of sugar cane culture.** R. R. PANJE. *Indian Sugar*, 1963, **13**, 263–267.—Soil moisture difficulties and irrigation deficiencies in sugar cane cultivation in northern India and the Gangetic plain during the hot dry season are described. The advantages of deeper planting and trash utilization to encourage deeper rooting are emphasized.

* * *

**Studies with chlorotic streak disease of sugar cane. X. Longevity of the pathogen in nutrient gravel culture.** B. T. EGAN. *Tech. Comm. Bureau Sugar Exp. Sta.*, 1963, (4), 29–32.—Experiments in Queensland showed that the chlorotic streak pathogen can retain its infectivity for at least 150 days in nutrient gravel cultures which had previously grown diseased cane. It is thought the longevity of the virus in the soil might be equally great.

* * *

**The trend is upward in mechanical harvesting.** ANON. *Australian Sugar J.*, 1963, **55**, 559–561.—Details are given of the increase and expected further increase in 1964 of mechanical harvesting in different cane districts of Queensland. In one district where 27 machines were in use last season 80 are expected to be in use next season. In other districts the number is expected to double. It is considered that increased mechanical harvesting will lead to a greater permanent population in the sugar districts and will relieve pressure on available hand labour for those cane farmers who must continue with it because of difficult terrain or other reasons.

* * *

**Cane pollen from America.** ANON. *Australian Sugar J.*, 1963, **55**, 563.—Following the success of last year's preliminary experiment, freeze-dried sugar cane pollen has again been flown from the United States and used to pollinate two Queensland varieties, Q 63 and Q 67. The pollen was received in sealed tubes and was allowed to recover in a water-saturated atmosphere for 5 hours before use. Results are awaited with interest.

* * *

**Effect of temperature during anthesis and seed maturation on yield and germinability of sugar beet seed.** F. W. SNYDER and G. J. HOGABOAM. *J. Amer. Soc. Sugar Beet Tech.*, 1963, **12**, 545–563.—This paper records the effects of temperature during anthesis (flower opening) and seed maturation on yield of seed, germination ability, and certain other plant and fruit characters. The yield of seed at the higher temperatures (middle 80's to 90's) was about half that at the lower (65–70°F).

# THE R.T. ROTATING PRE-SCALDER

By G. TIBO and A. SMET
(Tirlemont Refinery, Belgium)

*Paper presented to the 16th Tech. Conf., British Sugar Corporation Ltd.*, 1963.

## PART I

### INTRODUCTION

BEET sugar factories have always been interested in obtaining cold diffusion juice, because this makes possible the recovery of otherwise lost calories. The diffusion batteries of old produced raw juices at a temperature of 35°C or lower, with the result that they could be heated before carbonatation by means of low-pressure steam from the vacuum pans or condensates.

The advent of continuous diffusers (with the exception of the D.d.S. diffuser) and especially the scalding of cossettes before entering the diffuser have made the recovery of low temperature calories more difficult. This could only result in an increase of steam consumption of the factory had there not been a reduction in the juice draught, aided by the smoother working of the continuous diffusers and by the lower heat losses due to better insulation of the apparatus.

The advantages gained from the scalding of the cossettes and from a practically constant temperature all along the drum are so important for microbiological control that it has been for many years standard practice with the R.T. diffuser to run the juice out at a temperature of 70°C. The opportunity to save more steam is thereby missed and several attempts have been made to improve the situation.

*Early Experiments on Cooling R.T. Diffuser Juice*

The first attempts in Tirlemont to cool the raw juice by means of cossettes were made, shortly after the war, on the experimental Bergé drum. The cossettes were fed cold to the diffuser and the heat exchange occurred merely by mixing in the three first compartments of the drum. There was thus no scalding at all. The cossettes reached a temperature of 55°C by the fourth compartment, where they were brought up to 70°C by means of steam injection. The diffusion juice was thus cooled to 30°C with resulting benefit to the heat economy. The practical results were however disastrous since:

the capacity of the diffuser was reduced by 10% because the cold cossettes took up more space than when scalded, and it was necessary to reduce the load per revolution of the drum to avoid complete filling of the head,

the sucrose loss in the pulp was increased, the three first compartments being almost inoperative for diffusion, and

the pH fell and large unknown losses occurred, resulting from the discontinued scalding and from fermentation in the cooling compartments, where the temperature (30 to 55°C) and the retention time (8 to 10 minutes) of the juice and cossettes were highly favourable to the growth of the microbial flora, in spite of the liberal use of formaldehyde.

When, in 1947, the Bergé-drum was converted to a R.T. double-scroll diffuser, the idea of cooling compartments was adandoned and the conventional scalding restored.

A few years later (towards 1952) the idea was taken up again, but with some refinements: the cossettes were conveyed to the head of the diffuser by means of cold juice, they were heated to 55°C in the three first compartments and then to 70°C by means of a process similar to scalding. The diffusion juice was completely removed at 70°C from the fourth compartment and reinjected at 85°C in the third one having passed through a heat exchanger.

N. M. ADAMS and W. R. T. TWAITE proposed a very similar idea in their paper "Proposals for future heat economy" presented at the 14th Technical Conference at London in 1961[1].

This process was tried in Tirlemont towards 1953, but has been discontinued for the same reasons as those stated above.

Once more the conclusion was reached that the conventional scalding process used with the R.T. diffuser was so advantageous that the loss to the heat economy was comparatively unimportant.

However, the question arose once more when the Raffinerie Tirlemontoise decided to erect two new juice-stations (Longchamps and Waremme) equipped with R.T. diffusers from which the raw juice was to be pumped to the central factory at Wanze. Before pumping, the juice should be cooled to avoid any thermal expansion of the pipe-lines which could disrupt the joints or the welds.

The previous experiments made in Tirlemont had shown that to restrain microbial development during the cooling of the juice and to preserve the full capacity of the diffusers:

(1) the heat exchange between the cossettes and the juice should proceed as rapidly as possible, and

(2) the beneficial effect of the scalding of the cossettes prior to their entry into the diffuser should be retained.

Therefore, the construction of a separate prescalder was considered.

Practice had moreover proved that the heat-exchange between juice and cossettes is very fast: it takes only a few seconds to bring the cossettes from 15°C to 70°C in a conventional scalder.

[1] *I.S.J.*, 1961, **63**, 246.

### Scroll Type Prescalder

The pre-scalder designed in 1957 and installed at first in the two said juice-stations and then in three sugar factories is a trough, usually sloping, fitted with a scroll which conveys the cossettes (Fig. 1).

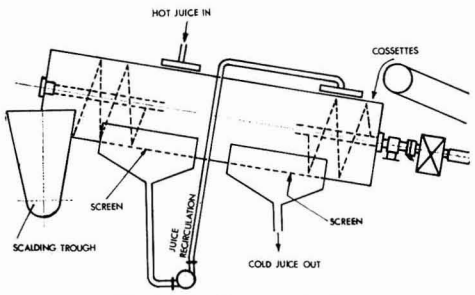


Fig. 1. Scroll type pre-scalder

Characteristics of the apparatus per 100 tons of beet per hr

| | |
|---|---|
| Length of the trough: ..... | 6·7 metres |
| Diameter of the screw: ..... | 1·3 metres |
| Pitch of the helix ..... | 0·4 metres |
| Slope of the trough ..... | 10° |
| Speed of the screw ..... | 12 r.p.m. |
| Power required ..... | 15 h.p. |

The juice to be cooled is poured on the cossettes about half way along the trough; it flows through the cossettes and through the perforated plate of the upper half of the trough. It is pumped again and poured on the cold cossettes entering the bottom of the device; it is collected through the perforated plate of the lower half of the trough.

The juice is thus cooled from 70°C to 54° in the first loop and from 54° to 45° in the second one. The cossettes, heated to about 50°C, are discharged at the end of the scroll into the scalder from which they are conveyed to the diffuser by means of 250% hot recirculated juice at 80–82°C.

The main advantages of the scalding are thus retained, although to a lesser extent, i.e. washing and asepticizing of the cossettes, plasmolysis of the cells and coagulation of protein matter, heating of the cossettes to 70°C prior to their introduction into the diffuser, and decrease of the space occupied by the cossettes.

The slope of the trough is of little importance; it is only useful to raise the cossettes up to the scalder. In one particular design, the trough was made horizontal, without any adverse effect.

The cossettes go through the device in 70 seconds, and the juice does not stay any longer in spite of the double circulation. The danger of microbial infection is thus kept to a minimum, more especially as the scroll and the walls of the trough are constantly cleaned by the rubbing action of the cossettes.

To avoid infection of the juice, it is however advisable to sprinkle formaldehyde continuously on the cossettes at the bottom of the trough at a rate of 8 litres per hour. The use of the pre-scalder does not require any increase of formaldehyde consumption in the diffuser.

This apparatus has thus been satisfactory in industrial practice; however, it has a few shortcomings:

(1) the cossettes are slightly damaged by the scroll,

(2) the cossettes are not evenly distributed in the spirals, which causes severe channelling of the juice and, hence, the need for juice recirculation in order to reach 45°C,

(3) it is impossible to by-pass the device when it is mechanically out of order, and

(4) floor space required is rather great.

We were also puzzled by the lowering of the filtrability of first carbonatation juice, which disappeared when the juice was by-passed away from the pre-scalder. Several factors were suspected: juice emulsion, abrasion of cossettes causing more pectic substances to pass into the juice, fermentation, etc. It seems now that it is only a matter of preliming temperature of the juice. The beet factories equipped with a pre-scalder reheated the cooled juice by means of low-pressure steam or condensates only to 60°C, and the preliming took place at that temperature instead of 70°C when the pre-scalder was not in use. Experience has shown that the filtrability of the first carbonatation juice is better when the raw juice is prelimed at 70°C rather than 60°C, and fitting one additional heater cured the trouble.

### Rotary Pre-Scalder

The few shortcomings of the scroll type pre-scalder mentioned above led Mr. L. Strengnart to consider the problem of the heat-exchange between juice and cossettes, keeping in mind the experience gained previously.

He would have liked to take advantage of the principle outlined earlier by Adams and Twaite, namely, "The really efficient way to cool the raw juice is by using a completely continuous counter-current pre-scalder." Counter-current circulation affords indeed the best guarantee of a perfect exchange.

Unfortunately it was not possible to find a simple way to convey the cossettes without these being damaged, and the idea was abandoned.

It was then considered that if the juice percolated through a thick layer of cossettes, some of the advantages of the counter-current circulation would be retained thanks to the longer contact time (the flow being slowed down by the tighter packing of the cossettes, which moreover avoids channelling), and to the close contact between juice and cossettes.

An efficiency was expected that would approach nearly the theoretical heat exchange curve. The temperature to which the juice could be cooled in such a way is easy to calculate.

A compromise had to be found between maximum efficiency (thickness of cossettes layer) and minimum retention of the juice (duration of the percolation). As a result of a few experiments made during the 1960 campaign, the thickness of the layer of cossettes was set between 60 and 80 cm, while the effective percolating time was kept below 40 seconds; it was agreed that the heat exchange could be done merely by pouring juice through a layer of cossettes travelling on a stationary grating or screen.

In the rotary pre-scalder (Fig. 2) the cossettes are moved along a circular course, which allows an easy by-passing of the device when necessary. The revolving motion around a vertical axis is obtained by means of a rotor made of two rings (a) and (b) coupled with a series of radial partitions (c). The bottom of the tank in which the rotor revolves is made of two distinct parts: the first one (d) located under the screen (f) is used to collect the cooled juice, the second one (e) forms the conventional scalding trough.

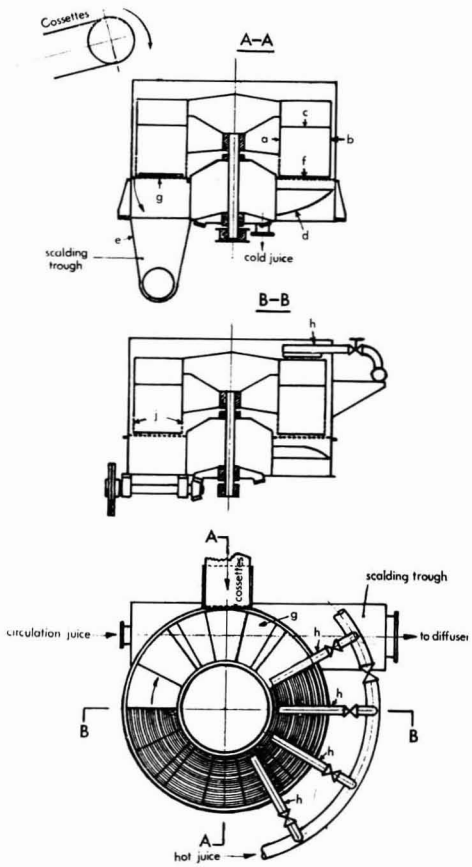


Fig. 2. Rotary pre-scalder with fixed screen

Characteristics of the apparatus per 100 tons/hr of beet

| | |
|---|---|
| Diameter of the cylindrical tank | 2·7 metres |
| Height of the cylindrical tank | 1·9 metres |
| Total height of the apparatus, including scalder | 3·2 metres |
| Outside diameter of rotor | 2·6 metres |
| Inner diameter of rotor | 1·4 metres |
| Height of rotor | 1·2 metres |
| Number of cells | 12 |

Speed of rotation: variable between 0·8 and 1·5 r.p.m. (actually 1·1 r.p.m.)

The bottomless cells formed by the rings and the partitions are loaded with cossettes. During rotation, the load of cossettes are sprayed at several places with the whole extracted juice in only one treatment. The heat exchange occurs by means of downward percolation of the juice through the layer of cossettes. The cooled juice is separated by means of the screen (f) and by side-holes bored in the rings. The screen keeps the cossettes in the cells until they come back above the scalding trough, into which they are discharged by gravity.

The apparatus is fed above the scalding trough. At this point, the cossettes are held up by a flap (g) locked to the tank and located in the same plane as the screen which forms its extension. This flap can be lowered to divert the cossettes to the scalder when so required. Formaldehyde or steam distributors, either stationary or fixed on the rotor, are provided for the disinfection of all parts wetted by low temperature juice. The rotor is driven at variable speed to allow control over the thickness of the layer of cossettes together with the draining time.

A pilot installation treating 100 tons of beets per hour was installed at the Brugelette factory in 1961. Its performance was poor, however, during the first beet season, mainly because the bar-grating rapidly became clogged and, in fact, it had to be by-passed for most of the campaign. The few experiments made after cleaning the grating were, however, very encouraging; the juice of the R.T. diffuser could be cooled from 70°C to 40°C in only one percolation through the cossettes.

Several modifications were made for the 1962 campaign and the bar-grating was substituted by a screen with conical-shaped $\frac{1}{4}$-inch holes. The improved apparatus worked satisfactorily during the 1962 campaign, it never had to be by-passed and the whole of the extracted juice was fed to the pre-scalder. Temperature of the juice at the inlet was 72°C, and after only one percolation through the cossettes the juice was cooled to 40°C.

The cooled juice was then reheated before preliming from 40°C to 50°C by means of low-pressure steam from the vacuum pans, from 50°C to 60°C by means of surplus condensates, and from 60°C to 72°C by means of steam from the fourth effect of the evaporator.

As we were not sure, on account of the troubles experienced during the 1961 campaign, if we would succeed with the pre-scalder fitted at Brugelette, another pre-scalder type was also designed during the off-season. Figure 3 shows this variant.

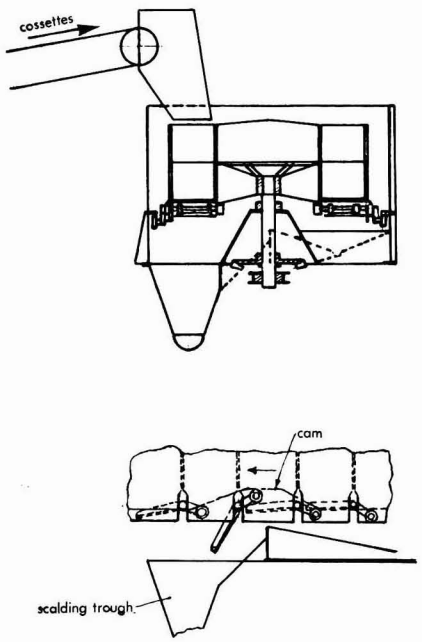


Fig. 3 Rotary pre-scalder with movable screens

As we believed that the rubbing of the cossettes on the screen was the cause of the obstruction, we tried to make it part of the rotor. Each cell is thus provided with a moving screen, which opens when travelling over the scalding trough so as to allow the cossettes to be discharged in it. The opening and the closing of the screens are operated by means of a cam located between the tank and the rotor. The screen was formed with conical shaped holes $\frac{1}{2}$ inch in diameter.

Such a device has been fitted at the Frasnes factory where it has given complete satisfaction during the whole of the 1962 campaign with the same results as at Brugelette; the juice was cooled from 72° to 40°C.

Various speeds have been tried. For an output of 105 tons of cossettes per hour the adequate speed seems to be 1·3 r.p.m., which gives a layer of cossettes of about 80 cm thickness.

The Frasnes pre-scalder, as also the Brugelette one, while dimensioned for only one throughflow of the juice, were designed to allow occasional recirculation of the juice. The hot juice was poured about half-way between the feed and the scalder; after the first percolation it was collected and pumped again on the cossettes immediately after they were loaded in the cells.

Experience has shown that the size of the equipment was too small to allow this method of working, as it was necessary to limit the amount of juice pumped on the cossettes to about half, to prevent it from flowing with the cossettes into the scalding trough.

The Frasnes pre-scalder shows the advantage over the Brugelette installation in that the cossettes do not rub on the screen. It is however more cumbersome (with 300 mm greater diameter), contains a mechanical movement to operate the screens (more maintenance) and requires a 30 minutes interruption before it can be by-passed.

The advantages for the rotatory pre-scalder have thus been achieved:

(1) cooling of the juice from 72°C to 40°C by means of only one percolation through the cossettes, thanks to the high efficiency secured by pouring well-distributed juice on a layer of cossettes of a uniform and sufficient thickness,

(2) the lack of movement of the cossettes, either internal or with respect to the rotor, avoids any damage during their course in the pre-scalder,

(3) elimination of any dead space where the cossettes could remain stagnant,

(4) retention time of the juice and the cossettes in the pre-scalder is kept to a minimum; about 40 seconds,

(5) easy disinfection either by means of steam or formalin,

(6) small size, the apparatus being easily accommodated between the cossettes conveyor and the scalding trough, and

(7) easy by-passing of the device by the cossettes as well as by the juice.

The short beet campaign of 1962/63 did not allow investigation of the cooled and reheated juice from the microbiological and chemical viewpoints; that is to be done in 1963/64.

The experience gained with the scroll-type pre-scalder has taught us that with continuous and adequate addition of formaldehyde (8 litres per hundred tons of beets), it is possible to restrain the growth of the mesophilic bacteria, which are the most dangerous at this temperature.

The new type of pre-scalder will doubtless behave the same way and possibly the rate of formaldehyde could even be reduced.

As has already been said, the amount of formalin required by the R.T. diffuser is not affected by the use of a pre-scalder.

It might be possible in the future to try to cool the juice even more, say down to 25°C, as such a juice is considered stable from a bacteriological point of view. This could be done by designing a larger apparatus and recirculating the juice, but it would require rather cold cossettes.

We believe that the improvement would be only minor although it would allow a further economy of

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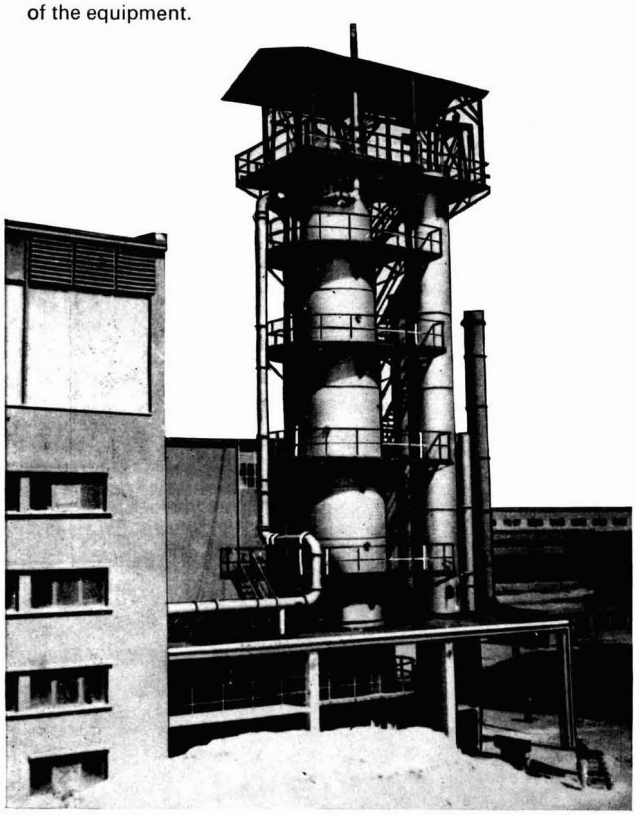

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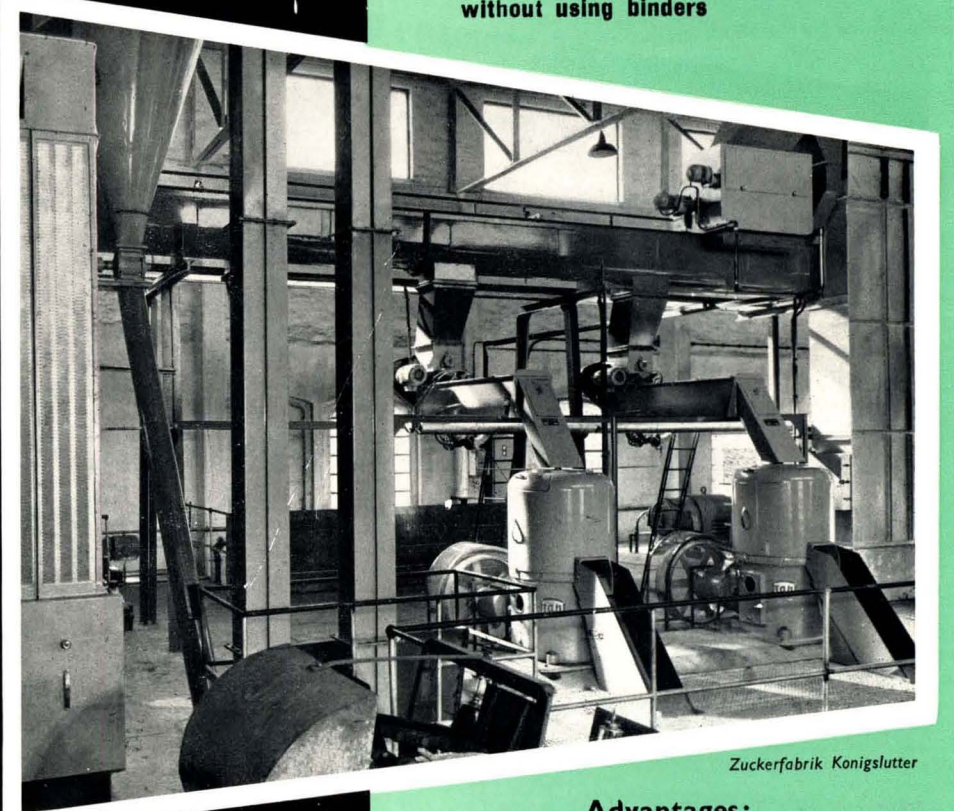

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steam in the factory by reusing more low-temperature calories. However the retention time of the cossettes and of the juice in the pre-scalder would be increased and, in addition, the temperature of the scalding juice would be decreased below 80°C, which cancels the benefit of the scalding of the cossettes.

The rotatory pre-scalder can be built for large outputs, up to 4000 tons/day. For the 1963/64 campaign, an appliance dealing with 150 tons/hour of cossettes is to be erected at Genappe having the following characteristics:

| | |
|---|---|
| Outer diameter of the rotor | 3·1 metres |
| Inner diameter of the rotor | 1·5 metres |
| Height of rotor | 1·2 metres |
| Number of cells | 14 |
| Diameter of cylindrical vessel | 3·26 metres |
| Height of cylindrical vessel | 2·16 metres |
| Total height of the apparatus, including scalder | 3·6 metres |
| Speed of rotation | 0·7 to 1·5 r.p.m. |
| Anticipated power requirement | 7 to 8 h.p. |

*(To be continued)*

# THE ISOLATION OF RAFFINOSE FROM CANE FINAL MOLASSES

By W. W. BINKLEY

**(New York Sugar Trade Laboratory, 37 Warren Street, New York, N.Y., 10007, U.S.A.**

RAFFINOSE, a 6-*O*-D-galactopyranosylsucrose, is probably the most abundant trisaccharide in nature[1]. The producers of sucrose from sugar beets have been keenly aware of this fact from the early days of the industry[2]. Only recently this trisaccharide was detected in raw and refined cane sugars[3]; paper chromatography and electrophoresis made possible this discovery. Utilizing column chromatography in addition to these techniques, we wish to report herein the detection of raffinose in and its isolation from cane final molasses.

## Experimental

*Materials.*—The cane final molasses used in this work has been described[4]. The isolation from this molasses of a fraction (designated B-90R) rich in oligosaccharides other than sucrose has been published[5]. The yields of residual syrup from Cuts 109 and 110 from the column chromatography of 11·60 g of Fraction B-90R (representing 1 kg of molasses) was 478 and 287 mg, respectively. These cuts reacted as follows: Molisch—positive; Benedict, before acid hydrolysis—negative, after acid hydrolysis—positive; paper chromatography of their acid hydrolysates indicated the probable presence of glucose and fructose in nearly equal amounts with significantly smaller quantities of galactose.

### *Exploratory Chromatography and Electrophoresis on Paper of Cuts 109 and 110 from the Column Chromatography of Fraction B-90R*

Portions of the residual syrups from Cuts 109 and 110 were deposited at designated places on a 23 × 52 cm sheet of Whatman No. 1 filter paper. The descending chromatogram was developed at 20°C for 133 hr with 7:1:2 v/v 1-propanol:ethyl acetate: water[6]. α-Naphthol-phosphoric acid spray reagent revealed the probable presence of at least five ketose-bearing oligosaccharides in these cuts (Fig. 1).

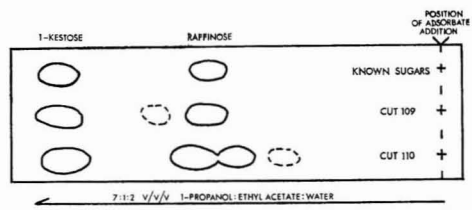



Fig. 1

Portions of the residual syrups from Cuts 109 and 110 were deposited also at a designated starting position of a 23 × 56 cm sheet of Whatman No. 3 filter paper. Tetramethyl-D-glucose was added also at the starting position to establish the distances of

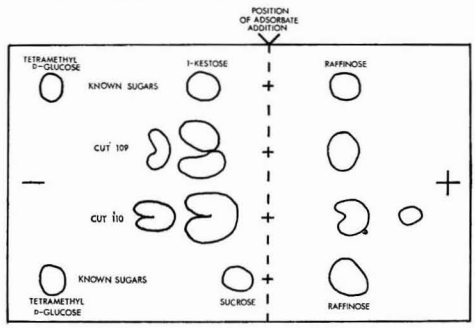



Fig. 2

[1] FRENCH: *Advances in Carbohydrate Chem.*, 1945, **9**, 167.
[2] LOISEAU: *Compt. Rend.*, 1876, **82**, 1058.
[3] GROSS *et al.*: *I.S.J.*, 1962, **64**, 69.
[4] BINKLEY & WOLFROM: *J. Amer. Chem. Soc.*, 1950, **72**, 4778.
[5] BINKLEY: *I.S.J.*, 1964, **66**, 46–50.
[6] ALBON & GROSS: *Analyst*, 1952, **77**, 410.

the migrations. These substances were subjected to paper electrophoresis at 12°C for 4 hr at 2000 V in a 0·05 *M* borate buffer at pH 9·2. *p*-Anisidine phosphate spray reagent indicated the probable presence of a minimum of four oligosaccharides in these cuts (Fig. 2).

*Chromatography on Thick Paper of Cut 109*

(*A*) *Isolation of Raffinose.*—A 52 mg portion of Cut 109 in 1 ml of methanol was deposited with a streak applicator at a designated starting position on a 23 × 45 cm sheet of Whatman No. 17 filter paper. The descending chromatogram was developed at 20°C with 325 ml of 7:1:2 v/v 1-propanol:ethyl acetate:water. Strips cut from the lengthwise edges of the chromatogram and sprayed with α-naphthol-phosphoric acid reagent were used as guides in the dissection of the remainder of the chromatogram. The zones, 19–25 cm (upper), 25–30 cm (middle) and 32–38 cm (lower) from the starting position, were eluted with water; yields after dewatering over calcium chloride under reduced pressure at 25°C were 12·5, 6·4 and 13·3 mg, respectively. A 24 mg lot of the upper zone residual syrup in aqueous ethanol at 4–6°C yielded 5 mg of elongated prisms. These crystals reacted as follows: Molisch—positive; Benedict, before acid hydrolysis—negative, after acid hydrolysis—positive; invertase yielded two substances with the *R* and *M* values of melibiose and D-fructose. Rechromatography on thick paper, in the manner just described, of a 34 mg lot of the upper zone residual syrup afforded 15 mg of well-formed crystal, melting point 77–78°C. Mixed melting point of these crystals with an authentic specimen of raffinose pentahydrate was unaltered; $R_{sucrose}$, 0·37, and $M_{sucrose}$, 1·58 values were in good agreement with those for raffinose. The X-ray powder diffraction diagram of these crystals was identical to that for raffinose pentahydrate[7]. The crystals isolated from Cut 109 were thus properly identified as raffinose pentahydrate.

A methanol-ethanol solution containing 25 mg of the residual syrup from the lower zone of the above thick paper chromatogram yielded 11·6 mg of crystals when seeded with 1-kestose. Recrystallization produced crystals which melted at 200–201°C (decomp.); mixed melting point with an authentic specimen of 1-kestose was unaltered.

(*B*) *Acetylation and Isolation of Raffinose Hendecaacetate.*—Lots of the residual syrups from the upper (30 mg) and lower (29 mg) zones were allowed to react separately with 0·1 g of fused sodium acetate and 5 ml of acetic anhydride for 2 hr at 110–120°C; the yields were 51 and 40 mg, respectively.

The acetylated residual syrup (51 mg) from the above upper zone dissolved in 10 ml of benzene was added at the top of a 20 cm high × 3·5 cm dia. column of 35 g of calcium silicate ("Microcel C", Johns-Manville Co., New York, N.Y., U.S.A.), prewet with 50 ml of benzene. The chromatogram was developed with 350 ml of 400:3 v/v benzene:2-propanol and was operated at 300 mg Hg. The extruded column was streaked with a solution of 1% potassium permanganate in 10% sodium hydroxide. The principal zone was located 57–69 mm from the top of the column; adsorbate recovery was accomplished with acetone (the zone location of 50 mg of raffinose hendecaacetate chromatographed under these conditions was 56–75 mm from the top of the column). Nucleation with raffinose hendecaacetate of the recovered adsorbate in aqueous ethanol at 4–6°C yielded 12 mg of crystals. The crystalline material from the recrystallization of these crystals in the same solvent melted at 99–100°C; mixed melting point with an authentic specimen of raffinose hendecaacetate was unaltered.

The acetylated residual syrup (40 mg) from the above lower zone was chromatographed exactly as described for the upper zone. The principal zone was located 24–34 mm from the top of the column and its mobility was identical to that of acetylated 1-kestose.

*Acetylation and Acetate Chromatography of Cut 110*

A 255 mg portion of Cut 110 was allowed to react with 0·5 g of fused sodium acetate and 5 ml of acetic anhydride for 2 hr at 110°C, yield 359 mg.

The above acetylated residual syrup dissolved in 100 ml of benzene was added at the top of a 20 cm high × 7 cm dia. column of 150 g of calcium silicate ("Microcel C"), prewet with 100 ml of benzene. The chromatogram was developed with 2 litres of 100:1 v/v benzene:*tert*-butyl alcohol and was operated at 300 mm Hg. Zone locations were achieved by streaking the extruded column with alkaline potassium permanganate. Four zones were found: 0–2 (T), 2–14 (C), 31–51 (B) and 67–80 (A) mm from the top of the column. The yields of recovered adsorbate

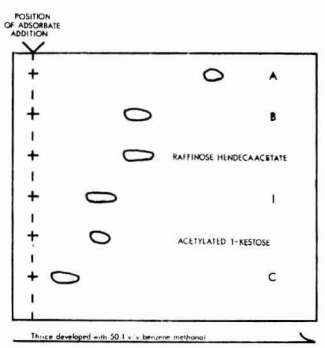



Fig. 3

were as follows: 31 mg (T), 152 mg (C), 66 mg (B), 13 mg (A) and 46 mg (I, adsorbate recovered between zones B and C). Thin layer chromatography on calcium silicate ("Microcel C") of these recovered adsorbates revealed the probable presence of the following: raffinose (B), 1-kestose (I) and oligosaccharides of higher molecular weight (C) (Fig. 3).

[7] FRENCH *et al.*: *J. Amer. Chem. Soc.*, 1953, **75**, 3664.

### Discussion

There is present in the sugar cane and the sugar beet a family of trisaccharides, all of the lineage of sucrose. As these plants approach maturity, these higher oligosaccharides are formed by transglycosylation. Transfructosylases convert sucrose into the kestoses; transgalactosylases produce raffinose. While raffinose was probably the first trisaccharide to be found in nature[8], the kestoses were discovered only a decade ago[9]. The application of selective adsorption[10] and chromatography[11] on fuller's earth clay to cane final molasses yielded two non-sucrose oligosaccharide-containing fractions[5]. 1-Kestose, 6-kestose and neo-kestose were found in the first fraction. Paper chromatography and high voltage paper electrophoresis[12] indicated the probable presence of raffinose, 1-kestose, neo-kestose and a minimum of three other oligosaccharides in the second one (Figs. 1 and 2). The isolation of crystalline raffinose (as its pentahydrate) from this fraction was achieved by thick paper chromatography. Raffinose was also isolated as its crystalline hendecaacetate by acetylation and acetate chromatography. These techniques have led to the first reported isolation of crystalline raffinose from cane final molasses. Its concentration (based on the yield of crystalline material) was estimated to be 0·005%.

The interchange in the order of mobilities of raffinose and 1-kestose in paper chromatography and of their acetates in column or thin layer chromatography is another example of the versatility of this technique in carbohydrate research.

### Summary

The isolation of crystalline raffinose from cane final molasses was achieved with column and paper chromatography. The minimum concentration of this trisaccharide (based on the yield of crystalline material) was estimated to be 0·005%.

### Acknowledgment

A portion of this work was performed under a contract between the Sugar Research Foundation and the Ohio State University Research Foundation (Professor M. L. Wolfrom, supervisor). Certain research samples from this contract were kindly made available by Professor Wolfrom. Thanks are due Mr. E. J. Roberts, Sugar Investigations, United States Department of Agriculture, for his assistance with the paper electrophoresis and Mr. H. Chanzy, State University College of Forestry at Syracuse University, for his assistance with the X-ray diffractograms.

[8] Harding: *Sugar*, 1923, **25**, 308.
[9] Albon *et al.*: *J. Chem. Soc.*, 1953, 24; Gross *et al.*: *ibid.*, 1954, 1727.
[10] Binkley & Wolfrom: *J. Amer. Chem. Soc.*, 1947, **69**, 664.
[11] Lew *et al.*: *ibid.*, 1946, **68**, 1449.
[12] Gross: *Nature*, 1953, **172**, 908; 1954, **173**, 487.

# THE D.d.S. CANE DIFFUSER

By LEIF L. NIELSEN
(Chief Chemist, The Tanganyika Planting Co. Ltd.)

FOR many years the milling process has been the only large scale method used for extraction of sugar from sugar cane. This process is of such importance that it has developed into a science and is the basis of studies at several Research Institutes all over the world. Greatly improved milling efficiency has been achieved as a result of extensive research, and it must be assumed that the extraction obtained by the modern milling-train has reached a limit beyond which it is not economically feasible to go.

Higher extraction by conventional means can be achieved only by further extension of the milling train, or by increasing the application of imbibition water. The former method is unduly expensive both as regards investment and maintenance, and the latter has little effect above a certain quantity and results in higher steam consumption.

Consequently, a different process must be applied if a significant increase in extraction is to be obtained. It would seem that the obvious answer would be to adapt the diffusion or lixiviation process, hitherto used exclusively for the extraction of sugar from beet tissues, to the demand of cane.

In the beet sugar industry the sugar was originally extracted from beet by wet maceration, but the quality of juice and the yield obtained by this method were poor. Diffusion of sliced beet was introduced in 1864 and fast became the predominant method which, until recent decades, was a discontinuous process. However, the need for a continuous process increased and several inventions were made which quickly resulted in the construction of continuous diffusers. These machines are now rapidly replacing the old diffusion batteries in the beet sugar factories.

While this technological development took place in the beet sugar industry, the cane sugar industry was scarcely affected, and although some factories, for instance in Egypt, adopted the discontinuous diffusion process for sugar cane with good results, this method was never extensively adopted.

In the later fifties the continuous diffusion process as used in the beet sugar industry was applied experimentally to sugar cane in many small scale plants, but the trials did not encourage manufacturers to build full scale units, mainly because the physical properties of cane are completely different to those of beet.

Successful trials were carried out in 1959 and 1960 by Silver Engineering Works and The Danish Sugar Corporation at Kekaha Sugar Company, Hawaii, with a Silver-D.d.S. diffuser. Based on the experience gained in Hawaii, the Danish Sugar Corporation continued their own trials in the spring of 1962 with a D.d.S. diffuser at The Tanganyika Planting Company Ltd., Moshi, Tanganyika, and consequent upon the favourable results obtained, the decision was made to construct a diffuser capable of processing 1500 tons of cane per 24 hours. Erection was commenced in June 1962, and the diffuser has been in continuous operation since January 1963, except during the off-crop period June/July 1963.

*Description of the D.d.S. Cane Diffuser*

The diffuser consists of a tilted trough-shaped vessel with a double cylindrical bottom as shown in Fig. 1. Two scroll conveyors (2) are placed lengthwise in the diffuser in such a manner that the scroll-flights of the conveyor partly intermesh.

The prepared cane is fed into the diffuser at its lower end (1) through a hopper and onto the scrolls which convey it up through the diffuser. The speed of the scrolls may be varied between 0·5 and 1·5 r.p.m.

While being conveyed through the diffuser the cane comes into contact with thin juice pumped into the upper end (7, 4) from the last mills of the milling train. At the upper end the exhausted cane is removed by a system of drag conveyors (3). The juice is screened (5) before leaving the diffuser. A predetermined juice level is maintained automatically (6). Steam jackets (8) surround the double cylindrical part of the trough to facilitate heating, thus increasing the rate of lixiviation and preventing bacteriological action.

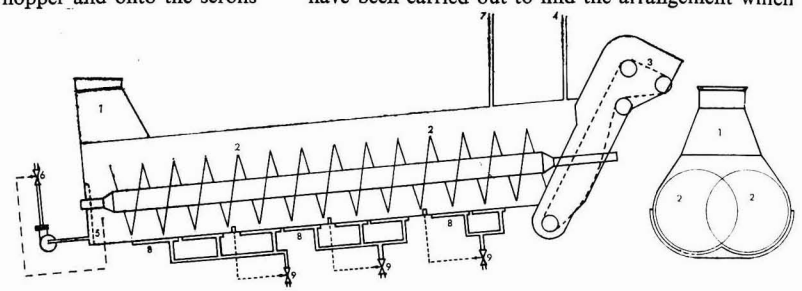


Fig. 1

*The Diffuser and the Milling Train*

The diffuser has been placed alongside the mill-house. Before entering the milling-train which consists of a three-roller crusher and three mills, the cane is prepared by two sets of rotating knives. The cane is then ground in the crusher and the first mill and elevated to a rubber belt conveyor which carries the first mill bagasse to the diffuser as seen in Fig. 2. A continuous belt weigher fitted to this conveyor ensures automatic regulation of the quantity of water supplied to the diffuser, based on the crushing rate.

The exhausted bagasse discharged from the diffuser is returned to the mill-house by means of rubber belt conveyors and is fed to the second mill through a chute which ensures a steady feed.

Imbibition water is applied in front of the third mill in the ordinary manner, except that its application is regulated by the belt-weigher mentioned above.

The juice expressed by the second and third mills is separated and pumped to the diffuser through independent pipelines, and the de-watered bagasse is sent to the boilers.

The juice discharged from the diffuser is mixed with crusher and first mill juice and pumped to the factory as mixed juice.

Application to the diffuser of press water (previously referred to as 2nd and 3rd mill juice) and fresh water can be arranged in various ways, and experiments have been carried out to find the arrangement which gives optimum results; for instance, application of all water close to the discharge elevator and mixing of second and third mill juice, or equal quantities of fresh water applied to the diffuser and in front of the third mill.

However, the lowest pol in bagasse in relation to the lowest draught $\left(\frac{\text{weight of mixed juice}}{\text{weight of cane}} \times 100\right)$ was obtained by application of all fresh water in

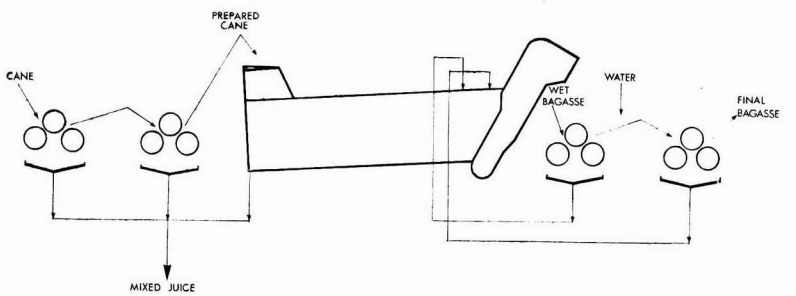



Fig. 2

front of the third mill and separation of the press-water from the second and third mills.

*Operation of the Diffuser*

In the main the operation of the diffuser involves only maintenance of an adequate degree of filling of the trough. This is achieved by regulation of the speed of the scrolls.

Initially some difficulties were experienced in conveying the whole mass of bagasse through the trough at a uniform speed. Chokes developed resulting in damage to the scrolls. This problem was solved by fitting jags to the circumference of the scrolls and by periodic variation of the speed of the rotation of the scroll shafts. This oscillating movement of the scrolls is controlled automatically in such a manner that the speed of one scroll is increased by say 5% until the flights of this scroll almost reach the flights of the other scroll, when the speed of the first scroll reverts to normal and the speed of the other scroll is increased by 5%.

Proper preparation of the cane, in particular by the knives, is a prerequisite of good performance of the diffuser.

The bagasse leaving the diffuser is hot and very wet (weight of bagasse approximately 110% on cane). Nevertheless, the feeding of the second mill has created no problems.

No changes in juice quality resulting from diffusion have been observed.

The power consumption of the diffuser and the belt conveyors is approximately 100 h.p.

*Operational results*

Typical results extracted from the diffuser log sheet are given in Table I.

The imbibition water applied in front of the third mill is hot, and the hot bagasse leaving the diffuser is exposed to the air while being conveyed from the diffuser to the milling train.

As the recorded quantities of imbibition water have not been corrected for evaporation losses, they have been omitted from Table I.

**Table I**

| Date | Tons cane | Draught | 1st mill bagasse % cane | Final bagasse Pol | Final bagasse Moisture |
|---|---|---|---|---|---|
| 11th Nov. 1963 | 1153 | 87 | 34 | 1·73 | 44 |
| 12 | 1542 | 91 | 33 | 1·76 | 44 |
| 13 | 1513 | 90 | 33 | 1·86 | 44 |
| 14 | 1257 | 92 | 36 | 1·52 | 46 |
| 15 | 1270 | 92 | 35 | 1·51 | 48 |
| 16 | 1159 | 94 | 37 | 1·68 | 46 |
| 18 | 1187 | 91 | 33 | 1·55 | 46 |
| 19 | 1310 | 96 | 35 | 1·27 | 47 |
| 20 | 1342 | 96 | 36 | 1·35 | 48 |
| 21 | 1129 | 97 | 34 | 1·41 | 49 |
| 22 | 1297 | 99 | 35 | 1·59 | 46 |
| 23 | 1145 | 98 | 36 | 1·67 | 46 |
| 2nd Dec., 1963 | 1346 | 94 | 33 | 1·52 | 45 |
| 3 | 1301 | 92 | 33 | 1·42 | 44 |
| 4 | 1216 | 99 | 33 | 1·32 | 45 |
| 5 | 1113 | 97 | 33 | 1·35 | 45 |
| 6th Jan., 1964 | 1434 | 96 | 36 | 1·58 | 46 |
| 7 | 1457 | 93 | 35 | 1·51 | 46 |
| 8 | 1326 | 92 | 35 | 1·72 | 46 |
| 9 | 1394 | 90 | 35 | 2·07 | 44 |

Typical juice analyses are given in Table II.

**Table II**

| | Date | Crusher juice | Diffusion juice | Mixed juice | Last expressed juice |
|---|---|---|---|---|---|
| Brix | 2nd Dec., 1963 | 19·87 | 9·16 | 17·23 | 2·28 |
| Purity | | 84·2 | 75·5 | 82·4 | 72·3 |
| Brix | 3rd Dec. 1963 | 19·45 | 9·56 | 16·90 | 2·31 |
| Purity | | 85·0 | 78·2 | 83·6 | 72·7 |
| Brix | 4th Dec. 1963 | 18·68 | 8·68 | 16·04 | 1·84 |
| Purity | | 83·6 | 76·5 | 82·7 | 73·4 |
| Brix | 5th Dec. 1963 | 18·64 | 8·36 | 15·71 | 1·71 |
| Purity | | 83·8 | 76·6 | 82·1 | 77·8 |
| Brix | 6th Jan. 1964 | 18·18 | 9·13 | 14·71 | 2·60 |
| Purity | | 83·6 | 72·9 | 80·2 | 75·8 |
| Brix | 7th Jan. 1964 | 18·82 | 9·14 | 16·00 | 2·54 |
| Purity | | 84·5 | 76·6 | 82·8 | 77·2 |
| Brix | 8th Jan. 1964 | 18·64 | 9·37 | 15·45 | 2·83 |
| Purity | | 84·8 | 76·6 | 82·3 | 74·6 |
| Brix | 9th Jan. 1964 | 18·09 | 10·54 | 15·79 | 3·36 |
| Purity | | 83·3 | 75·4 | 81·2 | 74·4 |

Three sequential juice analyses are given in Table III.

Bagasse and juice temperatures (average of 9 measurements) are given in Table IV.

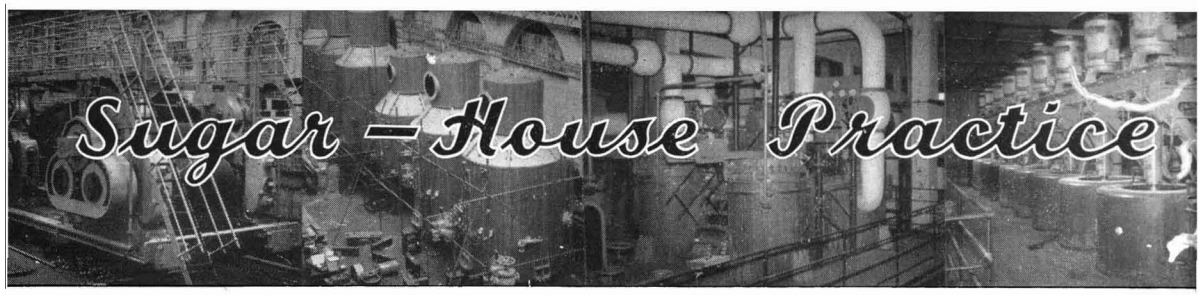
The temperature of the diffuser was maintained at 72°C.

**Table III**

| | Brix | Purity | pH | Brix | Purity | pH | Brix | Purity | pH |
|---|---|---|---|---|---|---|---|---|---|
| Crusher juice ..... | 19·02 | 84·1 | 5·4 | 18·83 | 80·1 | 5·1 | 18·52 | 85·5 | 5·2 |
| Diffusion juice | 8·34 | 80·1 | 5·3 | 9·06 | 71·2 | 5·2 | 8·62 | 73·7 | 5·2 |
| Mixed juice ..... | 15·16 | 81·5 | 5·1 | 16·82 | 79·8 | 5·1 | 12·72 | 82·2 | 5·2 |
| 2nd mill juice ..... | 3·24 | 77·8 | 5·4 | 4·89 | 70·1 | 5·3 | 4·64 | 76·5 | 5·4 |
| 3rd mill juice ..... | 1·85 | 75·7 | 5·8 | 2·92 | 67·5 | 5·6 | 2·58 | 72·1 | 5·7 |
| *Diffuser:* | | | | | | | | | |
| 1st hatch ..... | 7·41 | 78·9 | 5·3 | 8·24 | 71·8 | 5·2 | 7·15 | 75·4 | 5·2 |
| 2nd hatch ..... | 6·04 | 73·7 | 5·4 | 7·76 | 71·3 | 5·2 | 7·55 | 75·9 | 5·2 |
| 3rd hatch ..... | 4·92 | 77·6 | 5·4 | 6·76 | 69·7 | 5·3 | 7·21 | 76·1 | 5·3 |
| 4th hatch ..... | 4·00 | 75·8 | 5·5 | 5·79 | 67·7 | 5·3 | 5·34 | 76·0 | 5·4 |
| 5th hatch ..... | 3·24 | 77·8 | 5·5 | 4·70 | 72·1 | 5·4 | 4·84 | 74·8 | 5·4 |

**Table IV**

| Crusher juice | Diffusion juice | Mixed juice | 2nd mill juice | 3rd mill juice | Imbibition water | Diffuser bagasse | Final bagasse | Diffuser steam consumption |
|---|---|---|---|---|---|---|---|---|
| 28°C | 66°C | 42°C | 54°C | 58°C | 72°C | 55°C | 50°C | 4900 lb/hr |




**Notes on the installation and maintenance of pH controllers.** F. LE GUEN. *Ann. Rpt. Mauritius Sugar Ind. Res. Inst.*, 1962, 99–102.—The factors discussed in this article are: mixing of lime and juice (this is best effected by a submerged inverted cone with a propeller beneath it); variations in juice flow (surge tanks are needed to maintain an even flow from the juice weighers to the liming tanks, one being used for preliming, two methods of which are described); milk-of-lime density (usually 2–3°Baumé for accurate automatic control) and hydrostatic pressure of lime on the valve supplying the control valve (the pressure head should be constant). A scheme is presented of a liming station with automatic pH control. The electrode assembly, self-balancing electronic potentiometer and final control element are also discussed.

* * *

**Pressure and vacuum filtration of sugar liquors.** L. T. JENSEN and W. NEWTON. *Proc. 22nd Ann. Meeting Sugar Ind. Tech.*, 1963, 25–33.—The whys and wherefores of filter selection are discussed, in particular the advantages and disadvantages of the rotary vacuum filter, plate-and-frame filters and pressure filters. The use of cloths and pre-coat elements is also dealt with and a table is given of filter-cloths of various materials used in filtration tests.

* * *

**An evaluation of the phosphoric acid-lime treatment of raw liquor at Victorias.** J. P. STO. DOMINGO. *Proc. 22nd Ann. Meeting Sugar Ind. Tech.*, 1963, 65–74.—At Victorias refinery, about 85% of the total raw sugar melt at 62–65°Bx is clarified by adding an average of 0·021% phosphoric acid (on Brix solids) and then liming to pH 7·6–7·8. The melt is then pumped to a constant head tank whence it flows by gravity to Jacobs clarifiers. As much of the clarified liquor as possible (an average of 15–25%) is then polish filtered in Sweetland filters, to which the balance of the unclarified melt is sent direct. This procedure is dictated by limited clarifier and filter throughput. The clarifier muds are diluted to 40–50°Bx, limed to pH 7·2–7·4, re-heated to 170–180°F and filtered in a larger Sweetland filter, the effluent then being combined with the filtered liquor from the other filters and transferred to the char filter supply tank. Since only a portion of the clarified liquor is polish filtered, clogging of the surface of the char filters with a hard mat of scum occurs; this may be removed by scraping, but the greater part is removable only by means of air blown through some of the char. A 3-boiling system is used to make two grades of refined sugar. Over a 17-week period, the phosphate-lime method removed 36% of the colour compared with 11% by pressure filtration, and resulted in a refined sugar yield of 45·99 lb/cu.ft. of massecuite compared with 44·20 lb/cu.ft. formerly. Melt requirements have fallen by 4% while daily production has increased by 8%. The one major defect in the clarification system is the incomplete removal of turbidity and the resultant clogging of the char filters.

* * *

**Double purging of remelt sugars.** H. SCHENKER. *Proc. 22nd Ann. Meeting Sugar Ind. Tech.*, 1963, 137–145.—At Refined Syrups & Sugars Inc. the raw sugar is affined in two stages, the run-off from the second stage being used as affination syrup for the first stage. The process is continuous and automatic. Results of tests show that a better remelt sugar results, with a lower invert and ash content and a colour only slightly higher. Less molasses is produced. A decrease in affination syrup purity is acceptable if the run-off from the double-purged sugar is sent to boiling and not mixed with affination syrup from the wash station. Disadvantages include the need for greater centrifugal capacity and the amount of extra affination syrup produced.

* * *

**Continuous automated production of tablet sugar with dielectric drying.** B. B. JONES. *Proc. 22nd Ann. Meeting Sugar Ind. Tech.*, 1963, 146–154.—The theory of dielectric heating is explained and details are given of the dielectric oven used at Savannah Sugar Refining Corp. to dry tablet sugar. The basic effect is absorption of the electric energy of a dielectric field to produce a temperature rise in the sugar. This is caused by alternate high frequency and high potential stressing of the atomic structure. The rectifier circuit potential at Savannah is approximately 17,500 V and the frequency rating 13·6 m/c. The average moisture content of the tablets on packaging is 0·45%, and in the ovens about 1·21% by weight is removed at a throughput of 21 lb/min.

* * *

**Regeneration of bone char in a Nichols-Herreshoff kiln.** A. BOBADILLA G. *Bol. Azuc. Mex.*, 1963, (168), 41–46, 48.—An account is given of the refining process used at El Potrero, together with a summary of the properties of bone char, and a description of the techniques for filling the cisterns, decolorizing syrup, sweetening-off, etc. The kiln itself is described from two aspects—char flow and gas flow—as well as the control instrumentation. Heat usage by the kiln is 130,000 B.Th.U./ton of refined sugar compared with 190,000 for the previous retorts, i.e. a reduction of 31·6%. Operation and control are easier, maintenance and repairs have been reduced, and it has become possible to work at higher Brix values. Char usage has fallen, while in spite of certain mechanical problems, the equipment has been satisfactory.

**Processing cane raw sugar.** A. I. SHAPIRO. *Sakhar. Prom.*, 1963, (8), 35–39.—A flow-sheet is given of a 5-boiling scheme in which melt raw sugar is affined and the affination 2nd run-off returned to the mingler. After carbonatation, filtration and sulphitation, the liquor is used as feed for *A*-massecuite. Green syrup from the *A* centrifugals is used for *B*-massecuite together with *B* sugar washings. *C*-massecuite is boiled on affination 1st run-off, part of the *C* washings and *B* green syrup. *D*-massecuite is boiled on *C* green syrup and *C* and *D* sugar mixed with the raw sugar. *E*-massecuite is boiled on *D* green syrup and *D* and *E* washings and the *E* sugar affined with the rest of the washings before being mixed with the raw sugar. At least 93% (on weight of raw sugar) white sugar is obtainable at 99·8 purity. A sample balance is given, although this assumes only 0·06% losses in filter muds (on weight of raw sugar).

* * *

**The installation of plan sifters for white sugar classification.** R. SCHULZE. *Zucker*, 1963, **16**, 354-360, 376-383. Sugar sifting equipment is discussed with reference to the information required by customers on the hourly capacity, numbers of sugar types that can be separated, capabilities of handling separate crystal products as a result of deliberate changes in pan boiling techniques to suit consumer requirements, and crystal finenesses that can be handled. The various locations and arrangements possible in a sugar factory are considered. Particular mention is made of schemes in which the plan sifters are suspended from the roof and various factors to be considered in these circumstances are discussed. Numerous diagrams accompany the article.

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**Noxious sulphur in active carbon.** K. ŽERT. *Listy Cukr.*, 1963, **79**, 170–171.—When hot sugar juices in alkaline media are treated by active carbon, they may release sulphur compounds (sulphides) which are then absorbed by the carbon. As a result, hydrogen sulphide may be formed and, depending on the decolorizing capacity of the carbon, iron sulphide may be formed in the juices. A qualitative method of determining the noxious sulphur in the carbon is described; in this the carbon is boiled in alkali and treated with a solution of caramel colouring substances, when hydrogen sulphide is liberated. Quantitatively, the sulphur can be determined by sweeping-out the $H_2S$ in a $CO_2$ stream and collecting it, followed by iodometric titration.

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**Development and operation of the ring-type pan.** E. G. CLARKE. *Sugar y Azúcar*, 1963, **58**, (8), 24–26. Details are given of a fully-automatic ring-type vacuum pan installed at Savannah refinery for white sugar boiling. The control scheme, designed jointly by Bailey Meter Co. and Savannah Sugar Refining Corp., includes 25 relays, 12 solenoid valves, 5 timers and one programme controller. The pan is controlled from one room, which will be used ultimately to regulate 4 pans. An overhead diagram panel above the control console indicates the positions of the air cylinder valves. Primary control is of the sequence type, while secondary control is of the cascade type. At a pre-set supersaturation, seed is fed for a controlled period of time, the absolute pressure programme interrupted, and circulating steam fed for a pre-set time. The absolute pressure is then raised to boiling level, and when the mobility of the mass reaches a set point, syrup feed starts. As the pan level rises, the tonnage meter raises the set point of the steam pressure and mobility controllers. At a pre-set tonnage, syrup feed is stopped, and as the massecuite gets stiffer, steam flow decreases to a set point at which the steam, vacuum and condenser water valves are closed and the dropping sequences are started. After a set dropping period (5 min is considered ideal) a timed amount of lubrication syrup (No. 1 syrup from previous strikes) is sprayed into the pan from the top to flush it out, the foot valve is closed and locked, and the pan is ready for the next cycle. The valves are provided with microswitches to indicate that they are in a required position or to interrupt the sequence if they are not. The boiling time can be adjusted from 70 to 120 min. The pan has operated for one year and is used for high density strikes.

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**Automatic sugar detection in boiler feed water.** J. BRUIJN. *Proc. 36th Congr. S. African Sugar Tech. Assoc.*, 1962, 49–51, 55.—Details are given of an automatic sugar detector based on that described by PARKER[1]. Some modifications to the original are described. The instrument has proved satisfactory in refinery tests at a sensitivity of about 10 p.p.m. sucrose. An instrument using the same chemical principle is produced by William Boby & Co. Ltd., Rickmansworth, Herts., England.

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**The conservation of condensate.** J. M. CARGILL. *Proc. 36th Congr. S. African Sugar Tech. Assoc.*, 1962, 52, 55.—The amount of heat lost when condensate is discarded for fear of sugar contamination in the boiler feed tank is calculated and shown to be sufficiently high for the author's firm to introduce a strip chart controller for measuring the conductivity of condensate. The instrument used is a Leeds & Northrup "Speedomax" Type G. It has a range of 0–40 micromhos and is set at 9 micromhos, above which value sugar is shown by the α-naphthol test to be present in the condensate. When this occurs, the condensate is automatically rejected by means of pneumatically controlled flap boxes, which return to the "accept" position once the conductivity of the condensate falls below 9. The instrument controls twelve points, checking each one at 4 second intervals. When vapour at 1 p.s.i. is used in the four refinery vacuum pans, the condensate conductivity registers high even though no sugar is detected. The advantages gained from this scheme are mentioned.

[1] *I.S.J.*, 1958, **60**, 71–75.

**Some notes on observed influence of water cooling of "B" massecuites on the Boiling House Recovery.** T. COVAS. *Proc. 36th Congr. S. African Sugar Tech. Assoc.*, 1962, 44–48.—At the author's factory (Luabo, Mozambique) the Boiling House Recovery was increased from 85·3 in 1958 to 89·8 in 1961 by water-cooling *B*-massecuite for 12 hr when the purity dropped to 48, compared with 54 when uncooled, the temperature being 43°C and 58°C, respectively. A *C*-massecuite of 54–56 purity was boiled from the water-cooled *B*-molasses, yielding a final molasses of 34–36 purity. The total quantity of *B*-molasses has fallen sharply, thus reducing the frequency of *C* boiling. Other advantages include higher quality *B* sugar, increased crystallizer capacity, a saving in fuel, and a reduction in sucrose losses to final molasses.

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**Application of an old principle in the control of sugar-contaminated condensates.** W. E. DOUGLAS. *Proc. 36th Congr. S. African Sugar Tech. Assoc.*, 1962, 53–55.—Details are given of a conductivity instrument developed at the author's factory for detection of sugar in condensate which is automatically rejected when the level exceeds a set point. A diagram is given of the control circuit. The system uses a white signal light (normal) and a red warning light, and incorporates a pair of electrodes with an adjustable resistance and pneumatically controlled valves. A temperature-compensating circuit is proposed, since the conductivity rises by about 1¼%/°F.

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**Improved under-feed rollers.** D. HULETT. *Proc. 36th Congr. S. African Sugar Tech. Assoc.*, 1962, 61–64. Details are given of a modified under-feed roller, the installation of which in all the mills of the tandem at Darnall resulted in approximately 1% increase in extraction at an imbibition rate of 56% water (on weight of cane). The extraction of No. 1 mill, receiving shredded cane without imbibition water added, increased by about 4%. The average speed of the No. 4 mill engine was reduced from 375 r.p.m. (the maximum permissible speed) to 275 r.p.m. when the roller was installed in this unit. The roller, which permits drainage, comprises a 24-inch dia. roller on which 26-inch dia. hoops of 1-inch square bar, have been shrunk (at 1¼-inch centres) and ½-inch cube studs welded every 3 inches along the periphery of the hoops. Scraper blades keep the grooves clean.

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**Automatic milling control.** G. G. ASHE. *Proc. 36th Congr. S. African Sugar Tech. Assoc.*, 1962, 65–68. Information is given on the controls adopted at Umfolozi for a milling tandem comprising two sets of knives, a 2-roller crusher and six 3-roller 66 × 36 inch mills. The speed of the main carrier is controlled by a killer plate in the feed chute to the crusher. The killer plate, hanging vertically in the chute, is attached to a shaft provided with a pulley which is indirectly connected to the spindle of the valve controlling the steam feed to the carrier engine. With excessive feed in the chute, the killer plate rises and so causes the steam valve to close, thereby slowing the engine. Conversely, with insufficient cane the killer plate drops and the engine is speeded up. A solenoid-operated steam valve in the steam line to the carrier engine closes if the solenoid becomes de-energized by tripping-out of the cane knives, and thereby shuts off the steam feed to the engine and stops the carrier. The relationship between the killer plate and the steam valve opening is adjustable manually to allow for variations in the thickness of the cane blanket with different types of cane. The feed to each mill is regulated by a killer plate placed across the intermediate carrier and indirectly connected to the mill engine governor. If the killer plate rises with excessive blanket thickness, the governor arm lifts and the engine is accelerated. The servo motor of the governor regulating the steam turbine driving the last two mills operates from the No. 5 mill killer plate by means of two limit switches on the killer plate shaft. Apart from labour reductions, the factory has effected a reduction in lost time due to chokes and cane knife trips.

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**The inter-coupling of electrically driven cane knives.** D. L. HUGHES. *Proc. 36th Congr. S. African Sugar Tech. Assoc.*, 1962, 69–71.—While inter-coupling of two sets of electrically driven cane knife sets helps to reduce trip-outs and iron out peak loads, it presents a number of electrical problems, which are listed. The coupling of motors of identical h.p. and of unequal h.p. is considered. It is suggested that the simplest method of obtaining trip-free operation cane knives would be to allow the knives to over-ride the main carrier drive.

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**Separate clarification of vacuum-filter filtrate by using "Separan AP-30" at Umfolozi.** G. H. CONIJN. *Proc. 36th Congr. S. African Sugar Tech. Assoc.*, 1962, 72–76.—After favourable laboratory tests, a factory-scale trial was carried out for two weeks to investigate the clarification with "Separan AP-30" of vacuum filter filtrate using a Bach subsider. Mixed juice was heated to 175°F, limed to pH 7·8, heated to 220°F and settled, the clear juice going to the evaporators and the muds to the filters. The filtrate, of average pH 7·6, was treated with 10 p.p.m. of "Separan AP-30" and sent to the subsider. The non-sugars content of the filtrate was reduced by 60% and, although the juice was hazy, it was still suitable to be sent directly to the evaporators. Its sucrose content was raised from 6·75 to 7·26 and the purity from 70·7 to 81·1, while the reducing sugars percentage fell from 0·337 to 0·240. A "compound clarification" scheme is suggested in which clarified filtrate would be sent to the mixed juice liming station; a diagram is presented of this scheme. The quantity of "Separan AP-30" used (0·04 lb/ton of sugar) can be reduced, it is considered, by improving the method of handling and dosing of the polyelectrolyte.

**The problem of additional fuel.** W. BUCK. *Proc. 36th Congr. S. African Sugar Tech. Assoc.*, 1962, 77–91. South African mill data show that most of the factories regularly use additional fuel to supplement bagasse supplies, the amount of additional fuel increasing yearly. Reasons for low boiler efficiencies and steam losses are considered. Low cane fibre is rejected as a cause of the heavy increase in additional fuel. Natal factory performances are compared with data from other countries, including Swedish and British beet factories. The Natal fuel data are analysed and remedies are suggested. Factory data are tabulated for two Jamaican factories operating with a surplus of bagasse in spite of their lower cane fibre content.

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**The occurrence of inversion.** A. VAN HENGEL. *Proc. 36th Congr. S. African Sugar Tech. Assoc.*, 1962, 92–96.—Liming mixed juice to a pH greater than 7·0 to prevent inversion in the clarifier is considered unnecessary; juice of pH 6·8 will not suffer from a detectable rate of inversion even during many hours' retention, and the lower pH does have a number of advantages, apart from lower lime consumption. No serious inversion occurs in evaporation, any drop in pH being accompanied by a drop in temperature. Inversion will occur as a result of enzyme action in scale-tanks, too low a flow rate in old heaters, excessive mud retention periods in clarifiers, addition of sour bagacillo to poorly designed heater-mixers without proper adjustment to the pH, blowing up by means of steam coils in molasses tanks, whereby inversion will occur in the viscous, stagnant layer in immediate contact with the steam pipe, and low pan circulation of massecuite at high temperatures and low pH. Since the effect of temperature on pH is not yet fully known, pH should be measured at process temperature and compared with that of buffers also at process temperature.

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**Deionization of cane juice—rise in juice purity and extra sugar recovery obtainable from it.** B. B. GAIROLA. *Indian Sugar*, 1963, **13**, 115–119.—Results obtained from the treatment of juice in a pilot-scale ion-exchange scheme installed by the National Sugar Institute show, on the basis of a 10 unit rise in the gravity purity of the juice (equivalent to 0·95% on cane), that the process is economical. It has been calculated that recovery of 0·75% sugar on cane will meet the costs of the process. However, it is shown in the present article, by means of various balances and calculation of the extra sugar recovered using the *s-j-m* formula, that the true purity rise is about 3 units lower than the gravity purity rise, and that the corresponding recovery of sugar on cane is not 0·95% on cane but 0·686%, making the process uneconomical. Since the process may also necessitate replacing a 3-boiling system with a 4-boiling scheme, leading to a rise in the viscosity of the final molasses, ion-exchange treatment is not recommended.

**Some practical aspects of raw sugar manufacture in India.** D. R. PARASHAR. *Indian Sugar*, 1963, **13**, 121–125.—Information is given on the various processes adopted by Indian sulphitation factories on conversion to the production of raw sugar for export. While modifications to the processes normally used for direct consumption white sugar enabled the manufacturers to conform to the specifications laid down for pol, moisture content, reducing sugars and grain size, the requirements regarding ash content could not be met. It is recommended that a detailed investigation be made of the factors affecting the ash content rather than a tolerance be set arbitrarily. Mention is also made of wide differences between the analyses of the raw sugar at the factories, despite the fact that the procedures were standardized.

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**Fuel and heat conservation project, 1963/4 season.** W. BUCK. *S. African Sugar J.*, 1963, **47**, 501–504. Details are given of a project which has been launched to collect information from seven Natal factories (and possibly a further three) on their heat balances. This scheme is intended to help in a study of the problem of excessive fuel usage in Natal factories. The four main factors contributing to the unsatisfactory situation are given as: low boiler efficiencies, inefficient utilization of live steam, lack of bagasse furnaces, and a high moisture content in bagasse used as fuel. Calculations show that the moisture content of bagasse should be not more than 49·9% in order that the factory can satisfy its heat requirements from bagasse alone.

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**Using exhaust steam for the centrifugal machines.** C. G. M. PERK. *S. African Sugar J.*, 1963, **47**, 504–505.—Where a factory has an excess of exhaust steam, this can replace live steam in (i) vacuum pan cleaning, in which application it is faster and more efficient than live steam, (ii) boiler feed de-aeration, (iii) molasses blow-up tanks (vacuum breakers must be fitted to prevent molasses being drawn into the exhaust steam main), and (iv) centrifugals for sugar steaming. For the last application, the exhaust steam must be de-superheated to improve heat transmission, when it will raise the temperature of the sugar to a required level for drying much faster than will live steam. Details are given of the additional equipment and modifications required for use in centrifugals.

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**Progress in the West Indies.** R. NORRIS. *Sugar y Azúcar*, 1963, **58**, (9), 47–48, 80.—A brief, general survey is given of the cane sugar industry of the West Indies with mention of bulk handling of export sugar and developments in cane agriculture.

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**Trinidad.** P. E. V. DE-CARTERET. *Sugar y Azúcar*, 1963, **58**, (9), 49–51.—A general survey is presented of the sugar industry in Trinidad & Tobago with mention of the problems facing it at present.

# BEET FACTORY NOTES

**Beet storage in piles.** N. TAYGUN. *Seker*, 1963, **12**, (47), 21–29.—Results of beet storage tests over 96 days showed that the daily sugar losses were lowest in a beet pile 1·5 m high without ventilation (0·128 kg/ton of beet). In two piles of the same length and breadth as the first but with a height of 3 m the daily losses were 0·210 kg/ton of beet and 0·262 kg/ton of beet, respectively, with and without natural ventilation through ducts.

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**Test of a raw juice purification scheme proposed by A. F. Yakimov.** A. K. KARTASHOV, YU. D. GOLOVNYAK, R. G. ZHIZHINA and N. A. MAKSIMOVA. *Trudy Tsentr. Nauch.-Issled. Inst. Sakhar. Prom.*, 1963, **11**, 57–75.—Laboratory and factory tests of three variants of a carbonatation scheme proposed by YAKIMOV are described. In the first, raw juice is treated in "pre-liming" with recycled unfiltered 1st carbonatation juice (180–200% on volume of juice) at 0·06–0·08% CaO alkalinity instead of with milk-of-lime and the juice is then clarified before defeco-saturation. In the second variant, thickened mud from the 1st carbonatation juice clarifier is returned to pre-liming (25–30% on raw juice volume) instead of 1st carbonatation juice. In both variants the purities of the 2nd carbonatation juice and of thick juice were only very slightly higher than with conventional carbonatation, while the colour of both juices rose quite considerably in both schemes. In the third variant, already described[1], the juice from both defeco-saturation and carbonatation had good filtration and settling properties, but the juice purity rose by less than 1 unit compared with a conventional scheme, although the colour of the thick juice was noticeably lower. No difficulty in increasing juice purity compared with normal systems could be ascribed to non-sugars from the pre-defecation muds out of which only a negligible proportion of the colloids could be peptized even after 3 hours' heating. Although the scheme requires more equipment than a conventional one it is suggested that the process be tested over a complete campaign to obtain representative data.

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**Test of counter-current pre-liming in a laboratory column apparatus.** A. K. KARTASHOV, YU. D. GOLOVNYAK, R. G. ZHIZHINA and N. A. MAKSIMOVA. *Trudy Tsentr. Nauch.-Issled. Inst. Sakhar. Prom.*, 1963, **11**, 75–84.—A laboratory model of the defecation vessel described earlier[2] was tested by adding NaOH and milk-of-lime, respectively, at the top of the tower and determining the alkalinity of water taken from each of the seven compartments. The alkalinity was found to increase gradually towards the top of the vessel. Subsequent tests with raw juice gave better filtration properties and considerably higher settling rates for 1st carbonatation juice than did Brieghel-Müller step-wise pre-liming. Return of 1st carbonatation mud suspension gave a considerably higher filtration rate with 1st carbonatation juice in the case of progressive pre-liming, while the settling rate was unchanged. Return of unfiltered 1st carbonatation juice (200% on raw juice volume) resulted in only negligible increase in the settling rate while the filtrability of the 1st carbonatation juice remained unchanged. The colour of 2nd carbonatation juice was lower than with the conventional scheme. The temperature during progressive pre-liming was 50–55°C, compared with 80–85°C in the step-wise scheme. In all tests the average purity of 2nd carbonatation juice was somewhat lower when the counter-current system was used. The system is recommended for large-scale tests.

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**Test of a BMA continuous tower diffuser with a throughput of 1500 metric tons of beet per day.** E. T. KOVAL', A. YA. ZAGORUL'KO, A. K. BURYMA, V. G. YARMILKO and V. YA. VAILOV. *Trudy Tsentr. Nauch.-Issled. Inst. Sakhar. Prom.*, 1963, **11**, 84–104.—Operation of a BMA tower diffuser (described in detail with diagrams) at Leningrad sugar factory showed that the technically optimum cossette length is 12–14 m/100 g, but at this length the scroll motor power must be increased to maintain a speed of 0·38 r.p.m. (the optimum being 0·38–0·51 r.p.m. with fresh beet). Hence a more powerful motor is recommended. With fresh beet, the optimum temperature of pre-scalded cossettes is 78°C. The temperature of the circulation juice returned (300% on beet weight) to the pre-scalder should be 90–94°C, or 80°C at 400% return. A steam jacket for the pre-scalder is also recommended. The temperature of the fresh water fed to the column should be 67–70°C. With sub-standard beet the circulation and fresh water temperatures should be, respectively, 72–75°C and 60–65°C. At a throughput of 1500 metric tons of beet per day, retention time is 77 min including 7 min for pre-scalding. The factors affecting the specific loading of the diffuser are discussed, and the optimum found to be 60–65 kg/hl. The scroll maintained uniform distribution of cossettes and specific loading throughout the diffuser, without any compression. No dead spaces occurred, although the true sugar extraction curve differed from the ideal as a result of over-mixing of cossettes and juice, irregular cossette feeding and low flow rate of the extraction liquid. Remedies including installing a special type of distributor as used in a Soviet KDA-58 tower diffuser and a special regulator connected to the band weigher. Pulp yield is 70% on weight of beet. Marked breakage of the cossettes occurred, being greater than in other diffuser types. Formalin proved necessary to prevent bacterial

[1] *I.S.J.*, 1960, **62**, 356.
[2] TIBENSKÝ *et al.*: *I.S.J.*, 1959, **61**, 373; 1960, **62**, 257.

activity ; without it anaerobic fermentation took place with the release of hot gases (methane-hydrogen mixture). Even at 51–66°C formalin is effective in diffusion. Sugar losses in pulp were 0·54% on weight of beet at a juice draught of 116·1% using a throughput of 91% of the rated value and a cossette length of 10 m/100 g; these figures were obtained while operation of the new factory was subject to interruptions. With improved conditions and return of press water to diffusion, it is considered possible to halve the losses. The exhausted cossettes should be discharged through 5–6 ports onto an endless conveyor, thus preventing stoppages of the present conveyors caused by cossette compression. Generally, performance of the diffuser is considered highly satisfactory.

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**Test of an Olier continuous diffuser at Sambor sugar factory.** E. T. KOVAL', A. YA. ZAGORUL'KO, V. G. YARMILKO and V. YA. VAILOV. *Trudy Tsentr. Nauch.-Issled. Inst. Sakhar. Prom.*, 1963, **11**, 105–121.—The Olier continuous diffuser, fully described with details of the processing stages, has been found to be highly sensitive to beet cossette quality and particularly to cossette permeability. The mash content should be no more than 2% and the Swedish number (weight ratio of cossettes longer than 5 cm to those shorter than 1 cm) should be 15–20 at an optimum length of 18–20 m/100 g. Steam at 7–8 atm pressure used to clean beet knives enabled high quality cossettes to be obtained with minimum mash content. The optimum temperature conditions were found to be: 60°C in the 1st column with vertical screens (above this temperature the elasticity of the cossette tissue falls sharply), 70–80°C in the next two column, and 70–72°C in the last three columns. Optimum juice draught is 130–140% at an average temperature of 66°C and without press water recycling. The optimum speed of the endless conveyor chain was found to be 0·8 m/min under the conditions existing at Sambor. Slight over-mixing of juice and cossettes occurred. Deviation of the actual diffusion conditions from the ideal is attributed to: irregular cossette feeding, juice turbulence, which was particularly marked in the 1st column where steam is used to heat the contents, and irregular movement of cossettes in inter-screen areas. Pulp yield was calculated at 80% on weight of beet. There was only very slight tearing of the cossettes. While formalin dosage is recommended, little bacterial activity was found even at relatively low temperatures. At 138·2% juice draught, sugar losses in pulp were 0·52% on weight of beet at 66°C average temperature and cossette length of 17 m/100 g. The diffuser is suitable only for good quality beet and is considered extremely complex. However, the mechanical performance was faultless, although lack of centralized lubrication is criticized.

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**Reducing the bacterial population (in raw juice) with sterilization chemicals. II.** TÓTH-ZSIGA. *Cukoripar*, 1963, **16**, 236–239.—Adding disinfectants to raw juice can reduce sugar losses by at least 0·1% on beet, while heating of the juice alone has no sterilizing effect. Graphs demonstrate the sterilizing effects of sodium hypochlorite and formalin.

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**Examination of the process of scale formation in circulation evaporators.** I. N. ZASYAD'KO and N. YU. TOBILEVICH. *Trudy Tsentr. Nauch.-Issled. Inst. Sakhar. Prom.*, 1963, **11**, 157–171.—See *I.S.J.*, 1961, **63**, 275; 1963, **65**, 273.

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**Influence of the silo (pile) microflora on the quality of stored material (beet).** J. ORLOWSKA. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963.—Storage of beet has been studied since 1949 in Poland, tests in 1960–62 involving the comparison of the effects on beet quality of vertical plus horizontal ventilation, and sprinkling with 0·2% of lime on beet and additionally covering the pile with earth, separation and additional cleaning of the roots. Samples were withdrawn from the piles both in string nets containing 25 roots and also as 1000-kg samples from three different locations. Examination showed that the most common fungus in Poland is *Botrytis cinerea* Pers which was found on more than 70% of the samples, while *Penicillium* species were found on 21·2–56·8% and *Fusarium* species on 6·8–20% and other fungi on 0·8–11·3%. The fungus infection is concentrated mostly on the crowns of the beets. The lowest degree of contamination in 1960 was found where the beet was ventilated, sprinkled with lime, and covered with earth. There was a certain relationship between the manner of preservation, the extent of contamination and the temperature inside the mass of roots.

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**Use of ion exchangers for the regulation of pH of various sugar factory products.** P. DEVILLERS and M. LOILIER. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963.—Ammonia released from amides on making juice alkaline is partly released in the evaporators, reducing the alkalinity of the thick juice and increasing the alkalinity of the condensates. If these are returned to diffusion, the ammonia is usually neutralized with acid but continues in process and is again liberated during evaporation after liming. It thus tends to accumulate, increasing the consumption of acid and causing instability of pH in the evaporator. By treatment of the condensate with a weak exchanger on the $H^+$ cycle the ammonia may be removed, bringing the condensate to an optimum pH for return to diffusion and avoiding the addition to the juice of acid which ends up as melassigenic salts. If the thick juice is of too low a pH, involving inversion and colour formation, this can be avoided by treating the juice with a strong anion exchanger

before evaporation; this will reduce soda alkalinity which also contributes to molasses formation. In some circumstances, where little ammonia is available in the juice for liberation during evaporation, the thick juice may be of sufficiently high alkalinity to hinder crystallization; this can then be reduced by treatment of the thick juice after evaporation by means of a weak cation exchanger.

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**Combined actions of sucrose and lime on the solubilization of calcium oxalate and carbonate flocculates in sugar factory juice.** J. DUBOURG, P. DEVILLERS and P. NAFFA. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963.—The quantity of flocculate produced on liming diffusion juice rises to a maximum at about 4 g of lime per litre, thereafter decreasing as more lime is added. The re-dissolved flocculate may be re-precipitated on filtering the juice and bringing back to pH 11·2, and is partly composed of calcium oxalate and carbonate. These compounds form soluble complexes with sucrose and a hypothetical structure for the $CaCO_3$-sucrose complex is proposed. This solubilization of calcium oxalate and carbonate explains the presence of appreciable amounts of these compounds in the purified juice, which form scale in the evaporators if the juice is not softened using a cation exchanger.

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**Influence of foaming of low-grade massecuite on the viscosity and exhaustibility of molasses.** K. WAGNEROWSKI, D. DABROWSKA and C. DABROWSKI. *Paper presented to the 12th General Assembly, C.I.T.S.*, 1963.—Causes of foaming of low-grade massecuite in crystallizers are given and tests described in which samples of de-aerated and concentrated molasses (82·8–86·3°Bx) were emulsified with "Pragomix-Univeral" and the air bubble content determined pycnometrically. The prepared foam was then mixed with known quantities of each molasses sample of known Brix. Viscosity was found to increase considerably with increase in the air bubble content at "standard" Brix. Thus, while pronounced molasses foaming considerably prolongs the low-grade massecuite curing time, the increased viscosity and lower s.g. of the mother liquor will have an adverse effect on the low-grade sugar. A linear relationship was established between molasses Brix and temperature at constant air bubble content and a viscosity of 44 poises. A graph is presented showing the relationship between sugar losses and air bubble content at standard purity. The additional sugar losses resulting from foaming were found to be 0·01% on weight of beet per c.c. of air in 100 g molasses.

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**Investigations of heat economy systems in sugar factories.** S. ZAGRODZKI. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963.—The hourly steam consumptions of four different evaporator schemes were compared at an hourly beet slice of 100 tons. The four systems in decreasing order of steam consumption per 1000 tons of beet were: (1) vacuum evaporator with pre-evaporator and steam engines—69 tons; (2) triple-effect evaporator with concentrator —53 tons; (3) pressure evaporator using condensate heat—50 tons; and (4) triple-effect pressure evaporator with thermo-compressors—45 tons. The effect of boiler-house efficiency on the total coal consumption as dependent on its calorific value was demonstrated, as was the influence of juice draught on steam consumption. The reduction in steam consumption in the vacuum pans and juice heaters with various juice draughts is discussed and limits in the application of thermo-compressors are shown. Partial or complete closing of the ammonia valves in an evaporator, especially with the 1st and 2nd effects, will help save about 2 tons of steam per 100 tons of beet.

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**Condensate economy in the sugar industry.** E. EISENHARDT. *Cukoripar*, 1963, **16**, 231–235.—A survey is presented of methods used to remove large quantities of condensate from steam. The choice of suitable equipment is governed particularly by the factor of mechanical wear. Multi-nozzle drains are recommended.

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**Recent data on microbiological studies of finished sugar.** O. VAJDA. *Cukoripar*, 1963, 16, 254–258. Studies of the bacteria in sugar from a number of Hungarian factories over a number of years have shown that the numbers of spore-forming thermophiles in sugar from one factory vary only very slightly and the national average is almost unchanged from year to year. A culture medium was used for the studies consisting of 100 g yeast, 20 g sucrose, 20 g agar, 5 g peptone and 1000 ml water. The results given by the method, which is cheap and simple, agree closely with conventional methods. The thermophile counts remained almost constant throughout storage under laboratory and factory conditions, and a considerable number of them are included in sugar crystals. Examination of samples from 16 other countries showed that the counts were of the same order as in Hungary. A relationship has been established between the hygiene level in diffusion and the bacterial counts in the sugar.

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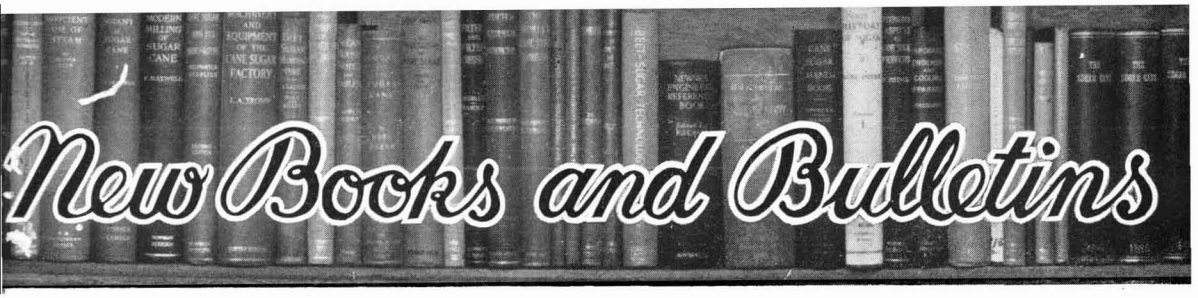
**The "J-VII-M" diffuser at Mezohegyes sugar factory.** Z. NACSA and O. TISZAVÁRY. *Cukoripar*, 1963, **16**, 266–271.—Performance data are given for the diffuser at Mezohegyes which at a throughput of 1460 metric tons of beet per day and a juice draught of 128–131% has sustained sugar losses of 0·38–0·39% on beet, as opposed to 0·47–0·54% on beet with a Robert battery diffuser. A scheme for rinsing of the screens when poor quality beet are being processed has proved effective.




**The Australian Sugar Year Book. Vol. 23, 1964.** 416 pp.; 7¼ × 10 in. (The Strand Press Pty. Ltd., 236 Elizabeth St., Brisbane, Queensland, Australia.) 1964. Price: £A1 10s.

The 1964 Year Book is presented with the same layout as previous editions and contains the usual comprehensive picture of the Australian sugar industry. Its sections comprise a Sugar Industry Directory (officers of cane and sugar organizations, cane prices boards, firms and factories); a collection of articles and reports, mainly on the agricultural aspects of the industry and including abstracts of the agricultural papers read at the 30th Annual Conference of the Queensland Society of Sugar Cane Technologists; and a Sugar Statistics section, which provides data on cane and sugar production in Queensland. The bulk of the book is devoted to the Australian mills and districts, giving mill production data, maps, general information for tourists, etc. and including a large number of illustrations. It concludes with an index to advertisers and contents.

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**Memoria de la V Conferencia Internacional de Técnicos y Consultores del Instituto Tecnológico Azucarero Veracruzano, 1961.** 490 pp.; 7 × 9½ in. (I.T.A.V., Cosamaloapan, Ver., Mexico.) 1964.

This book is the record of a conference held during the 3rd–13th July 1961 at the Cosamaloapan Institute. As with the previous proceedings[1], a description of the Ingenio San Cristóbal y Anexas S.A., the patron company of the Institute, is reprinted from the Mexican Sugar Manual. Following this is an account of the inaugural session of the Conference, and then the texts of the papers presented by technologists from Puerto Rico, Louisiana, Hawaii, the B.W.I., etc. as well as Mexico. Abstracts and discussion of these papers are expected to appear in this Journal in due course. The volume ends with the speech closing the Conference made by Sr. ROBERTO GARCÍA MORA, Director-General of Ingenio San Cristóbal S.A. and President of the Governing Body of the I.T.A.V.

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**Sugar.** ANON. 64 pp.; 5 × 7 in. (Tate & Lyle Ltd., 21 Mincing Lane, London E.C.3.) 1964.

This new and attractive booklet is intended as an introductory guide for laymen with little or no knowledge of the sugar industry; it explains the importance of sugar in the diet and then gives a brief account of the hisory of sugar up to the 19th century. There follow some details on the principal countries producing sugar, and short descriptions of the manufacture of sugar from cane and from beet. Following chapters deal with the Commonwealth Sugar Agreement and sugar marketing, sugar ships, and the refining and packing of sugar, distribution and utilization in jams, confectionery, cake, etc. The various sorts of sugar produced by Tate & Lyle Ltd. are described, as is the research establishment at Ravensbourne, and rum, the product of Tate & Lyle companies in the West Indies. The book closes with an account of the history of "Mr. Cube", the main trade mark of the Company. Interspersed are small snippets of information, and the book is plentifully illustrated with colour photographs.

* * *

**Sugar Cane Diseases of the World Vol. II.** C. G. HUGHES, E. V. ABBOTT and C. A. WISMER. 354 pp; 6 × 8¾ in. (Elsevier Publishing Co., Amsterdam, Holland.) 1964. Price 120s 0d.

Many will welcome the second volume of this work. The first volume appeared in 1961 and was reviewed in these pages[2]. This second volume is well produced and authoritative, and is on the same general lines as its predecessor. The authors or editorial committee are all well known authorities on sugar cane deseases, working in Queensland, Louisiana and Hawaii respectively. Some twenty other authorities on sugar cane diseases in different parts of the world have contributed to this really international project, carried out under the auspices of the International Society of Sugar Cane Technologists.

Fungus diseases are described in three chapters according to whether it is the leaf, stalk or flowering parts that are attacked. Virus and bacterial diseases each claim a chapter. Other chapters are devoted to nutritional deficiencies, environmental effects, genetical effects, miscellaneous non-transmissible effects and to nematodes in sugar cane. A list of all the nematodes known to attack sugar cane is given. From this it is obvious how much work has been done in this field during the last decade for, of the 60-odd nematodes listed, about two-thirds have been recorded or described during the last ten years.

A feature of the book is the number of good photographs and coloured illustrations that are included, most of the diseases described being accompanied by a photograph. Another useful feature is the Spanish summaries that are given at the end of each chapter. These are given in quite considerable detail and will be appreciated by many readers in Latin-American countries.

F.N.H.

[1] *I.S.J.*, 1963, **65**, 120.
[2] *I.S.J.*, 1962, **64**, 85.

# LABORATORY METHODS AND CHEMICAL REPORTS

**Standardization of Peruvian raw sugars.** P. HONIG and J. C. P. CHEN. *Proc. 22nd Ann. Meeting Sugar Ind. Tech.*, 1963, 54–64.—A procedure is described for determining the affinability of Peruvian raw sugar and some test results are given. The standard requirements of 97–98 pol raw sugar with respect to ash, reducing sugars, colour, CaO and $SO_3$ are given as are standards for accuracy and reproducibility of tests. The non-sugars composition of Peruvian raw sugar is discussed. Since Peruvian cane is grown exclusively under irrigation and is harvested at a minimum age of 18 months, the ash fraction of the non-sugars is high and the reducing sugars fraction low. Determination of the various ash components and of reducing sugars is discussed, and the importance of determining both total ash and the organic non-sugars excluding reducing sugars is emphasized.

* * *

**Mechanical arrangements for evaluating the decolorizing power of solids adsorbents.** F. M. CHAPMAN. *Proc. 22nd Ann. Meeting Sugar Ind. Tech.*, 1963, 101–105.—Details and diagrams are given of the assemblies used at Plaistow Wharf refinery to evaluate adsorbents. Each unit comprises a liquor supply tank, a tank equipped with water circulating pump and immersion heater, twenty-four 3 × 24 in tubes, and a platform weigher on which is mounted a compartmented collecting tank receiving the effluents. The three assemblies are filled with a slurry of adsorbent and decolorized liquor and can be coupled as desired, so that two or three adsorbents can be evaluated simultaneously. Each compartment in the collector is water-cooled to minimize colour formation.

* * *

**A further study of sulphate in the refinery.** R. J. TYMANN and J. VLADYKA. *Proc. 22nd Ann. Meeting Sugar Ind. Tech.*, 1963, 106–136.—Results of laboratory char tests showed that a better evaluation of char performance can be obtained from a complete analysis of the input and output impurities rather than by determining the colour and polarimetric purity, since colour removal far outlasts ash removal and considerable recirculation of impurities may result with consequent scaling of evaporators and deterioration in pan boiling. Thus when a char became saturated with sulphate, the colour removal was still approximately 60% of the input colour. When further saturated with anions other than sulphate and chloride the colour removal was only about 40% of the input colour. Underburnt or poorly burnt char is even worse, since the lower pH yields apparently good colour removal while the char removes even less ash. This emphasizes the need for more uniform char burning. The sulphate removal capacity of all the chars tested was lower than their Ca + Mg removal. The total capacity to remove Ca + Mg was apparently well related to the char bulk density. Most of the chars tested achieved 100% sulphate adsorption, but certain ones subsequently released some of the adsorbed sulphate. The behaviour with respect to total ions was broadly the same as with the Ca + Mg. "Excess polyvalent anions" (EPA) stayed essentially constant throughout all tests irrespective of the char used and differences in removal of various ions. Two cation exchange resins ("Amberlite IR-120" and "Amberlite 200") were tested ; they gave practically identical results in all respects, the main difference being in their durability in service. The effluent pH remained fairly constant at 7·5.

* * *

**Coloration of juice during diffusion and its inhibition.** J. HENRY, O. LAZAR and R. PIECK. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963.—In a study on colour formation or darkening of diffusion juices, the action of tyrosinase enzyme on "dopa" (dihydroxyphenyl alanine), an intermediate in melanine formation, was studied, varied factors including aeration and operation *in vacuo*, pH, temperature and the presence of sulphite, iron and copper ions. Further studies were also made on the effect of the enzyme, auto-oxidation, etc. on pyrocatechol and tyrosine. It was concluded that the "dopa" is the main colour-forming agent, pyrocatechol and tyrosine having little effect. The enzyme is destroyed by heating and strongly inhibited by $SO_2$; however, auto-oxidation occurs at higher temperatures, colour formation being strongly influenced by aeration, pH above 6·0 and the presence of $Fe^{++}$, $Fe^{+++}$ and $Cu^{+}$ ions. Optimal $SO_2$ dosage is 8 kg/100 tons of beet and will normally result in white pulp; in the presence of Fe ions some colour will form, and it is considered that the action of Fe and Cu cation-complexing agents should be studied.

* * *

**Thermal destruction of glucose and sucrose in alkaline solution.** J. DUBOURG and A. LEMAITRE. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963. Glucose and sucrose solutions, covered with a layer of silicone oil to obviate aeration effects, were maintained at a temperature of 95°C and at constant pH values of 8, 9, 10 and 11. The acid was neutralized by an automatic titration device and samples were withdrawn for examination at intervals. The reducing power of 0·1% glucose solutions fell in accordance with a 1st order reaction. The extinction curves reached maxima quickly and then fell slowly and regularly. Acid formation was greater with higher pH values and lower concentration, and fell as colour formation increased. It is concluded that the glucose produces two types of coloured compound by a 1st order change, one type then decomposing further to

produce acid while losing its colour strength. The sucrose solutions behaved similarly so far as the extinction curves are concerned, but the acidity curves behaved differently, doubtless because of the simultaneous alkaline hydrolysis of sucrose and the decomposition of the resulting hexoses.

* * *

**Colour formation in the sugar factory.** R. PIECK. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963.—The formation of colour in beet juices is classified into types—caramelization, alkaline decomposition of invert sugar, polyphenol complex formation, etc.—and the literature summarized and discussed. The processes involved are tabulated, indicating the stages of their occurrence during sugar manufacture and their minimization by control of governing factors, e.g. invert content, residence time in evaporators, etc. The relative importance of the types of colouring matter as affecting crystal colour is discussed with reference to the literature.

* * *

**Influence of the presence of $SO_2$ on the alkaline degradation of glucose.** R. PIECK and J. HENRY. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963. Addition of 0–67 meq/litre of $Na_2SO_3$ to glucose solutions (10–40 millimoles/litre) held at 80°C and pH 9·5 (by addition of NaOH) was found not to affect the rate of glucose decomposition but reduced colour formation considerably. It is concluded that the glucose produces two types of coloured compound, one type (about a quarter of the total absorbance) remaining unchanged in the presence of $SO_2$. The other type may be formed via a leuco-compound which reacts with $SO_2$ and remains colourless; this reaction was found to consume up to 0·9–1·0 meq $SO_2$/millimole of decomposed glucose. When oxygen or air is passed through the solution heated in the presence of $SO_2$, considerable colour formation occurs; if $O_2$ is introduced at the start of heating, practically no colour is formed. The presence of $SO_2$ is also found to reduce formation of acidic substances.

* * *

**Coloration of sugar solutions heated between 95°C and 135°C, and the kinetics of the degradation of sucrose.** R. PIECK and J. HENRY. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963.—Sucrose solutions were heated in an autoclave, maintaining the pH with buffers, and the formation of colour (increase in optical density at 420 mμ), invert sugar and lactic acid measured as a function of time. The first was linear, and was affected by temperature, particularly at the lower pH levels. Addition of nitrogenous substances, such as salts or glutamate, did not affect colour formation, indicating that the Maillard reaction played no appreciable part in colour formation under the experimental conditions. Formation of invert sugar is followed by its decomposition and both the reaction constants have been measured for temperatures between 110° and 135°C and pH from 8 to 10. The invert content thus reaches a constant level depending on the pH and temperature and may be quite low although an appreciable amount of sucrose disappears. Lactic acid analyses of the final products yielded no information on the actual sugar losses.

* * *

**Aspects of beet sugar factory molasses supersaturation.** F. HEITZ. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963.—The partition coefficient concept was applied to molasses compositions, the coefficient being the rate of solubility of sucrose in water to its "solubility" in non-sugars. A statistical examination of data from molasses of a number of French sugar factories has been carried out in order to identify the factors having the greatest effect on achievement of minimum purity. The minimum purity falls with the low grade crystallizer temperature but its absolute value will vary with the year, beet variety, manufacturing technique, etc.

* * *

**Laboratory experiments on molasses exhaustion.** R. CAROLAN. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963.—Factory molasses samples of 60 average apparent purity were kept at 40°C in a laboratory crystallizer in the presence of 20% of sugar seed. The average purity fell to 54·4 after one day and to 53·2 after one week. The ratio of sucrose: [K + Na + Ca] fell from the initial average of 1·37 moles/atom to 1·03 after one week; the departure from unity might, apart from experimental error, be attributed to the effects of raffinose or other non-sucrose present, or to the non-melassigenic effect of salts of strong acids. The value of sucrose: [K + Na + Ca] is indicated as a useful guide to the degree of exhaustion, unlike the purity. Aside from the validity of the hypothesis of sucrose combination with the cations, the results of crystallization indicate the appreciable proportion of the molasses sugar which *could* be crystallized given sufficient time, and, since certain samples were reduced to purities below 52, it is seen that a low purity may not necessarily mean good exhaustion but simply a high ratio of organic to inorganic non-sugars in the beet juice.

* * *

**The chemical composition of sugar beets and the effective alkalinity and the sugar loss in molasses.** E. ANDERSEN and E. SMED. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963.—Raw juice samples from a number of sugar beet varieties were analysed for pol, refractometric Brix, K, Na and amino-N. They were processed to the second carbonatation stage and the effective alkalinity measured. A linear relationship was found between the effective alkalinity and the value of (K + Na — amino-N) and it is thus possible to predict effective alkalinity from the raw juice analysis. Investigations have also been made on the effect on sugar crystallization of adding known quantities of certain non-sugars to molasses, using Grut's technique[1] of maintaining

[1] *Zeitsch. Zuckerind.*, 1962, **87**, 492–494; *I.S.J.*, 1963, **65**, 88.

at 40°C in the presence of icing sugar. The results showed that lower molasses purities were achieved with lower K and Na contents and with higher N content. A table gives the calculated pol change per meq of non-sugar added. An increase in (K + Na — amino-N) will generally increase the molasses purity. Monosaccharides added were found to decrease the purity as if replacing the sucrose in the molasses.

* * *

**Isolation and separation of molasses colouring substances.** F. SCHNEIDER. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963.—The colouring matter was adsorbed from molasses on an "IRA-401 S" anion exchange resin ($Cl^-$ form) and eluted with NaCl solution. In addition to a decolorizing effect, the resin also had an ion exchange effect, so that there was a slight purity rise. Only the first four fractions of the eluted colouring matter were used, constituting (with 12% NaCl solution) about 20% of the original colouring matter in the molasses. The colouring matter was separated from the salt on a "Sephadex" column. It was found possible to increase the separation effect by removing most of the salt from the colouring matter by dialysis before passing through the "Sephadex" column. By this means fractions were obtained which showed sharp differences in their U.V. spectra, thus permitting precise control of fractionation by measurements of light adsorption. Extinction curves show a maximum at 260 mμ connected with a reduction in M.W. of the dissolved substances. This phenomenon was found in the first fraction passed through the anion exchanger and in the last eluate fraction passed through the "Sephadex" column, and the cause has still to be found. To effect better removal of salt from the colouring matter, it is recommended that the dry dialysate be extracted with methyl alcohol; an acid-precipitable ash-free substance is obtained from the aqueous extract solution.

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**Physical and chemical properties of a colour body acid isolated from the regeneration effluents from a decolorizing unit for remelt liquor.** H. SCHIWEK. *Zucker*, 1963, **16**, 555–562.—After regeneration with a solution of 7·2% NaCl and 0·2% NaOH of the anion exchange resins ($Cl^-$ form) in a two-stage unit used to decolorize remelt liquor, the effluent was collected and neutralized using a weakly acid cation exchanger ($H^+$ form) on which no colour was adsorbed. After concentrating to crystallize the NaCl, the mother liquor was dialysed, re-concentrated and again dialysed. The residual solution was evaporated to dryness under vacuum to yield an amorphous, brownish-black, chloride-free solid. Sodium ions were eliminated from a solution of this with a strongly acid cation exchanger ($H^+$ form) and a powder obtained by concentrating and vacuum-drying. Paper and thin layer chromatography showed it to be free from carbohydrate monomers, amino acids and aliphatic acids. Alkaline earth and lead salts of the acid were slightly soluble in water, while alkali and ammonium salts were highly soluble. The acid was almost completely insoluble in alcohol. Absorption spectra were measured at different pH values and the elementary analysis of the acid given as: C 47·25%, H 5·09%, N 6·76%, S 5·01%, inorganic residue 1·13%, corresponding to an empirical formula $C_{25}H_{33}O_{14}N_3S$ with a mol. wt. of 631. Analysis and properties of the acid are similar to those of the "fuschazin" acid isolated by STANĚK from molasses[1], and is a Maillard reaction product. Hydrogenation and hydrolysis of a solution of the product yielded 14 amino acids. No explanation has been found of the presence of the majority of the sulphur in the compound (some is produced from the amino acids).

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**Rapid method for the determination of invert sugar in the presence of large amounts of sucrose.** M. W. HWANG. *J. Chinese Chem. Soc. Taiwan*, 1962, **9**, 298–307; through *Anal. Abs.*, 1963, **10**, 4726.—The Lane & Eynon method for determining reducing sugars in samples of high sucrose content is unsatisfactory because of the high alkalinity of the Fehling solution used. A modified Fehling solution of pH 10·7 is prepared by mixing 15 ml of 4% aqueous $CuSO_4,5H_2O$ (Fe-free) with 10 ml of a solution obtained by dissolving K Na tartrate (194 g), $K_2CO_3$ (92 g) and $Na_2HPO_4,12H_2O$ (80 g) in water and diluting to 1 litre. With use of this solution, 0·03 to 1·4% of reducing sugar can be determined in the presence of 5 to 20 g of sucrose per 100 ml.

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**Sucrose decomposition in alkaline solution under conditions of juice purification and evaporation in a sugar factory.** M. ATHENSTEDT. *Zeitsch. Zuckerind.*, 1963, **88**, 563–565.—The results obtained in a study of sucrose decomposition in alkaline media[2] have been related to actual factory data to determine the sugar losses in carbonatation and evaporation. The total loss figure obtained (0·032% on beet) is regarded as the lowest value obtainable under optimum conditions, the upper limit (under unfavourable circumstances) being the value of 0·2% obtained by WALLENSTEIN & BOHN[3]. The main cause of sugar loss in carbonatation is high juice pH and excessive retention times in the clarifiers, while in evaporation the main cause is too high a temperature.

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**Sampling of factory products for analysis.** F. O. BRIEGER. *Brasil Açuc.*, 1963, **61**, 196–197.—An account is given of the frequency and, in some cases, methods of sampling of cane, bagasse, juices, molasses and filter-cake, for analysis. They are based on Hawaiian practices, modified to suit Brazilian conditions.

[1] *Zeitsch. Zuckerind. Bohmen*, 1916/17, **41**, 298, 607.
[2] *I.S.J.*, 1962, **64**, 149.
[3] *I.S.J.*, 1963, **65**, 278.

# BY-PRODUCTS

**Bagasse briquetting plant.** B. PULIDO R. *Bol. Azuc. Mex.*, 1963, (170), 14–15.—Advantages of briquetted bagasse as regards reduced volume for storage and transport are described and an account is given of the plant at Central Igualdad, Puerto Rico, and its operations. Further information is provided on the manufacture of bagasse boards in the Dominican Republic and the advantages of combining two such plants.

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**Sucrochemical applications.** J. L. HICKSON. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963.—The sugar industry, through the Sugar Research Foundation Inc., has carried out a 20-year programme of research into utilization of sugar and its by-products. Achievements during this period are reviewed and likely targets for sucrochemical research are indicated. The initial emphasis was on public health aspects of sugar usage; later this changed to sucrochemical applications. Currently, emphasis is on food uses of sugar.

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**Linkage of sugars with long-chain compounds via amino groups.** F. SCHNEIDER. *Paper presented to the 12th General Assemby C.I.T.S.*, 1963.—A number of mainly unknown compounds of the S-N-L- type (S = monosaccharide, N = nitrogen and L = long-chain lipophilic radical) have been synthesized. Surface tension measurements of the compounds are tabulated and demonstrated in graph form. These show that all have tenside properties with an optimum effect mostly with compounds containing 10-14 $CH_2$ groups. The minimum depressions occur at less than 30–35 dynes/cm for 0·001M solutions.

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**The partial acetylation of sugars.** E. REINEFELD. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963.—In connexion with the partial esterification of sugars, the selectivity of acetylation agents was examined with glucose and glucose derivatives subjected to trans-esterification with methyl laurate and with concentrated glucose solution (in water and dimethylsulphoxide) heated in the presence of acids. In both cases 6-esters of glucose were obtained as main product. The methods used are described in detail and are suitable also for sucrose and non-reducing glucose derivatives. Glucose diethylmercaptan gave a better yield of 6-esters than glucose and reasons for this are given.

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**Protecting sugar beet and other agricultural products with chalk from V-K muds.** J. VAŠÁTKO and A. LUKAČOVIČ. *Paper presented to the 12th General Assembly C.I.T.S.*, 1963.—The value of V-K carbonatation chalk[1] as insecticide, bactericide, fungicide and fertilizer in various preparations has been demonstrated by various tests on growing and stored beet. Twenty-one references to the literature on the uses of V-K chalk are given, which also covers the application of the chalk to other products such as grain, potatoes, maize, vegetables, etc. The sugar losses in V-K chalk-treated beet stored for 50 days were a third lower than in the control pile

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**Sucrose-modified phenolic resins as plywood adhesives.** C. D. CHANG and O. K. KONONENKO. *Adhesives Age*, 1962, **5**, (7), 36–40; through *S.I.A.*, 1963, **25**, Abs. 839.—The optimum composition of a phenol-formaldehyde-sucrose resin (for maximum wet strip-shear tensile strength of the plywood) was determined in sequential experiments by the statistical technique of "steepest ascent". The optimum mole ratio is 1·0 sucrose: 3·5 phenol: 9 formaldehyde, corresponding to 33% of sucrose in the resin. The preparation of the resin is described.

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**Acetylation of non-reducing oligosaccharides.** J. STANĚK and J. ČERNÁ. *Monatsh. Chem.*, 1963, **94**, 329; through *S.I.A.*, 1963, **25**, Abs. 973.—Sucrose was fully acetylated in 20 min by suspending 20 g in a mixture of 25 ml of pyridine and 100 ml of acetic anhydride, and boiling under reflux. The yield of octa-*O*-acetylsucrose was 93·4% of the theoretical.

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**Viscose rayon from bagasse pulp by the prehydrolysis soda process.** S. R. D. GUHA, M. M. SINGH and V. B. SOXENA. *Bol. Azuc. Mex.*, 1963, (172), 15–17. High purity α-cellulose pulps were prepared from bagasse by the prehydrolysis soda process followed by bleaching. The filtrability of the viscose from these pulps was determined and, if the clogging constant is within acceptable limits, the pulp may be considered suitable for viscose rayon manufacture. The prehydrolysis is carried out for 2½ hr with water at 162°C using 6 parts per part of bagasse dry weight, during which a final pH of 3·4 is reached and a yield of 74·7%. The digestion with soda occupies 6 hr at 153°C and reduces the yield to 37·5% of a pulp with 6·8 permanganate index before bleaching. The best conditions for bleaching, to give a product acceptable for viscose rayon manufacture, is treatment with 1% sodium hypochlorite (1% available Cl on dry pulp) at a consistency of 5% for 4 hr at 25°C followed by 1 hr at 60°C in the presence of NaOH (2% on dry pulp), again at 5% consistency, followed by two treatments of 3 hr at 80° in the presence of chlorine dioxide (2% available Cl on pulp) at 8% consistency. Final yield is 33·8% of bleached pulp analysing 92·3% α-cellulose, 6·9% β-cellulose and 3·6% γ-cellulose, 2·5% pentosans, 2·6% methanol-soluble resins and 0·12% ash.

[1] *See I.S.J.*, 1959, **61**, 59.

# PATENTS

**Evaporation of (sugar) solutions.** CUKORIPARI KUTATÓ-INTÉZET, of Budapest, Hundafy. **942,846.** 5th June 1961; 27th November 1963.—The evaporator is a single-pass device in which preheated juice is admitted through pipe 10 to the header tank 9. Flash escapes into the chamber above from which it is withdrawn through valve 11. The juice follows the path indicated by the arrow entering the bottom of the heating chamber 1 and rising up the tubes 2. Steam is admitted to the chamber through duct 19 and condensate withdrawn through duct 20. The thickened juice and vapour enter the vapour chamber 15, the vapour being withdrawn (with flash vapour admitted through valve 11) through valve 8, while the thickened juice is withdrawn through the valve 7 to process. Each tube 2 is provided with an internal tapered shaft

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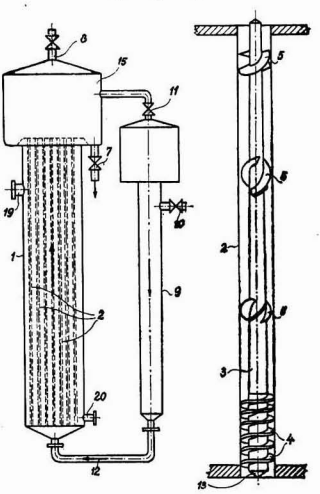

3 so that the annular space occupied by juice and vapour becomes larger with the distance it passes up the tube; this ensures that there is no back pressure created by the increased volume of the vapour. A short section of low-pitch helix 4 is fastened to the shaft 3 and this induces a strong spiral motion in the rising column of juice which continues with turbulence as the juice rises up the tube, assisted at intervals by additional helix sections 5. The spiral movement of the juice-vapour mixture ensures that the juice, being heavier, is maintained in contact with the heat transfer surface while the linear speed of the juice is several times that in a normal evaporator so leading to less overheating and decomposition.

In another form of the evaporator, the juice is pumped to the top of chamber 1 and led downwards to a vapour chamber at the bottom, the low-pitch helix being located at the top of the tube. This is most suited to the evaporation of solutions of labile materials. Such an evaporator can be used for the evaporation of sugar juices using steam at 130°C.

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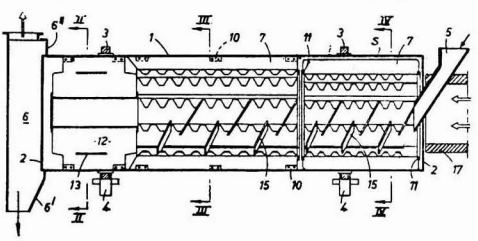
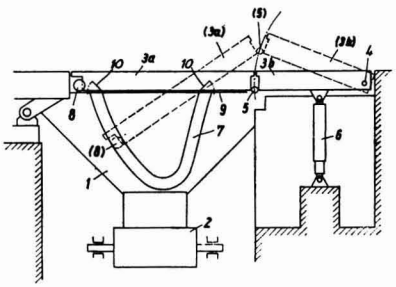
**Rotary drums for drying or heat treating or cooling materials.** G. BOJNER and G. BOJNER, of Stockholm, Sweden. **942,918.** 18th July 1962; 27th November 1963.—The drum 1 is rotated by means of rings 3 on rollers 4 while the material (moist sugar, etc.) is admitted from stationary hopper 5 through the annular wall 2 at the feed end, passing through the drum and being discharged through the other end wall 2 into the outlet 6. A stream of gas (hot air, flue gases, cooling air) is sent through the drum either countercurrent or co-current as shown, entering the stationary chamber 17 and leaving through the duct at the top of outlet 6. Inside the drum are two sections, that near the exit being a heat exchange and dust collecting unit. The other section includes a set of longitudinal lifting bars 7 held firmly against the



inside of the drum by right-angle pieces 10. These bars have front edges formed with tongue-like projections at an included angle of 90–130° to the continuous portion of the bars. These are so shaped that as the drum rotates, the sugar lifted by the bars is allowed to fall in portions—first that on the section of continuous bar opposite the spaces between the tongues, then the material on the tongues and finally that on the continuous bar opposite the tongues. This ensures that the entire quantity of material cannot fall all at once but over a longer part of the period of rotation; the part of the drum filled with falling material is thus increased and drying efficiency raised. Obliquely facing sections 15 transfer the material along the drum towards the discharge end as it rotates. Instead of being fixed to the inside of the drum, the lifter bars 7 may be attached at each end to a ring 11 so that the outer diameter is slightly smaller than the inside diameter of the drum; this means that the bars operate as a freely-rotating cage inside the drum, when the uniform distribution of falling sugar becomes more pronounced and sticky material does not adhere to the tongues and spaces of the lifting bars 7. The illustration shows both the fixed bars and cage form of the mechanism.

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

**Top covers for (beet) hoppers.** ELFA-APPARATE-VERTRIEBS-G.m.b.H., of Mülheim/Ruhr, Germany. **943,581.** 3rd April 1962; 4th December 1963.—The hopper 1 is mounted over conveyor 2 and has a top charging entrance comprising a folding cover 3a, 3b hinged at 4 and 5 which opens and closes under the action of hydraulic cylinder 6. The free end of door part 3a has followers 8 guided in a downward and then



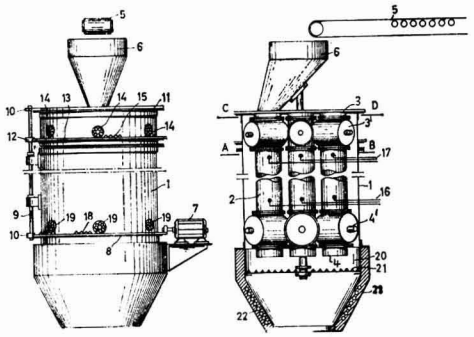
upward curve by guides 7. Thus in its parly open position the part 3a covers much of the hopper entrance; beet unloaded from a truck has a check instead of a lengthy damaging fall to the bottom of the hopper. The door is not opened fully until there is sufficient beet in the hopper to act as such a check; in this way the beet is delivered to the conveyor and to process in a less damaged state.

* * *

**Production of itaconic acid.** MILES LABORATORIES INC., of Elkhart, Indiana, U.S.A. **943,655.** 30th June 1961; 4th December 1963.—Itaconic acid is produced by submerged aerobic fermentation during 160–200 hours of 10–25% sucrose solution (e.g. high-test molasses, syrup) with *Aspergillus terreus*, the solution containing 350-3500 p.p.m. of an alkaline earth metal cation ($Ca^{++}$), 0·5–200 (1–50) p.p.m. of $Cu^{++}$ ions and/or 0·5–200 (1–50) p.p.m. of $Zn^{++}$ ions, and having a pH of 3·0–4·0, the $Cu^{++}$ and/or $Zn^{++}$ ion content being maintained throughout the fermentation, after which the itaconic acid is recovered.

* * *

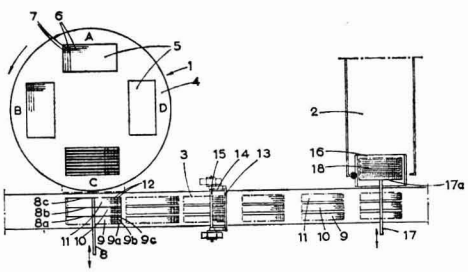
**Crushing cellular materials.** S. LEVINTON, K. J. KOEHLER, E. P. G. HARSANYI, H. SCHROPPE-ARNDT and F. G. LIPPE. **945,127.** 12th September 1962; 23rd December 1963.—An apparatus, suitable e.g. for the "explosion process" of beet sugar extraction, comprises a vessel 1 containing six vertical pressure cylinders 2 in a circular arrangement, each cylinder being provided at the upper and lower ends 3, 4, with quick-acting valves 3′, 4′. Each charge is accurately weighed by belt-weigher 5 into hopper 6 and thence into the cylinder 2. The vessel 1 turns around a central axis under the action of a motor 7 driving an annular gearwheel 8 surrounding and attached to the vessel. Cogs 14, 19 on the ends of the shafts of valves 3′, 4′ projecting through the vessel wall engage with short gear sections 15, 18 on a fixed ring surrounding the vessel; these are arranged



to open the valves briefly at the appropriate moment to admit and discharge their charges in sequence. After the charge has been fed into the cylinder and valve 3′ closed, compressed gas (air, steam) is admitted through pipeline 16 and then further pressure through line 17, the pressure in the cylinder being increased in six stages and then released suddenly by operation of valve 4′. The material is discharged explosively onto the grid 21 in receiver 20 which is surrounded by piping 23 for heating or cooling the product as required.

* * *

**Lump or cube sugar manufacture.** AB. SVENSKA FLÄKTFABRIKEN and AB. LANDSVERK, of Sweden. **947,600.** 1st December 1960; 22nd January 1964. Sugar cubes or lumps are brought to dryer 2 along a conveyor 3 which moves intermittently in synchronization with the press 1. This has a rotatable table with four moulds 5 divided by partitions 6 into chambers 7, the volume of each chamber being that of the uncompressed cube. In position A granulated sugar is poured into the mould; the table then rotates through 90° when the mould is in position B. Here



the cubes are pressed, followed by further rotation of the table to bring the mould to position C. The shaped cubes are here ejected by pistons and transferred by rake 8 with pulling plates 8a, 8b, 8c to the conveyor 3. The mould is then brought to position D where it is cleaned for the next cycle. The cubes on the conveyor are carried along towards the dryer

2 into which they are transferred eventually by the rake 17. Operation of the rakes is by electromagnetic devices under photoelectric control.

* * *

**Cleaning hydraulic beet conveying equipment.** SUCRERIES ET DISTILLERIES DU SOISSONAIS, of Soissons, Aisne, France. **947,554.** 1st June 1962; 22nd January 1964.—Beets are moved along a flume under the influence of water supplied through jets either in the form of nozzles dipping into the flume from above or covered and protected by an overlapping section of the flume bottom, the nozzles being directed along the bottom of the subsequent flume section in the latter case. The nozzles are supplied from a pressure water line through valves controlled by actuators which are connected to a suitable remote control system which governs the sequence and time of nozzle operation so as to keep the flume clean and clear of beet.

* * *

**Refining of sugar solutions.** SUGAR CHEMICAL CO. ETBT., of Vaduz, Liechtenstein. **947,940.** 10th November 1961; 29th January 1964.—A "pre-treated" sugar solution, i.e. partially purified by carbonatation or other means, is passed (at 80°–100°C) through (approximately equal amounts of) a cation exchanger in the Na-form and an anion exchanger in the Cl-form (in a mixed bed) interrupting the contact when 60–75% of the $Cl^-$ ions of the anion exchanger have been transferred to the sugar solution. The partially exhausted ion exchange materials are regenerated by treatment with a (25%) aqueous NaCl solution (at 90°–100°C).

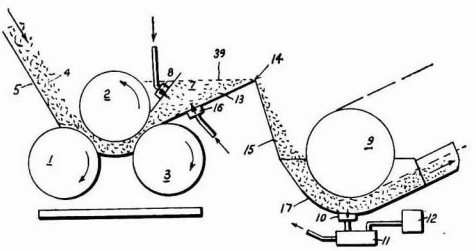
* * *

## UNITED STATES

**Extracting sugar from cane.** B. I. ALDRICH, R. FREW, J. R. MILLER and P. C. RAYNER, *assrs.* THE COLONIAL SUGAR REFINING CO. LTD., of Sydney, N.S.W., Australia. **3,107,605.** 12th September 1961; 22nd October 1963.

The efficiency of maceration or imbibition is reduced by the inability of the water or juice to displace air from the broken cells of cane or bagasse once it has expanded after leaving the zone of compression in a cane mill. To ensure that air does not enter these cells, the output side of the mill is provided with a trough 13 which is funnel-shaped with vertical sides and a bottom plate fitted with a rubber edge held against the bottom roller 3 by spring pressure. Two inlets 8,16 are provided for the maceration liquid and maintain a liquid seal at the discharge opening; that this seal is intact may be seen by allowing the liquid to fill the space between the top plate of the trough and roller 2 as indicated by dotted line 39.

Surplus liquid plus the bagasse overflows at the edge 14 and into receptacle 17 from which the bagasse is lifted by suitable elevator and taken to the next mill while liquid draining through outlet 10 is sent,

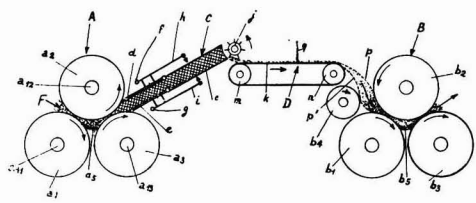



together with additional water required from tank 12, by pump 11 to the inlets 8, 16.

* * *

**Feed systems for sugar cane mills.** M. RIVIERE, of Cambuston, Réunion. **3,113,507.** 10th November 1960; 10th December 1963.

Cane fed to the three-roll crusher or mill A is discharged from the gap between rollers $a_2$ and $a_3$ into the stationary chute $c$ which it enters through the space between sprung flaps $d$ and $e$. It is carried upwards at a rate dependent on the size of the chute and crushing rate (but generally 8–12 m/min) and emerges as a blanket several decimeters thick. It is then broken up by the high-speed delivery device $j$ which consists of a clawed roller applying a downwardly-directed raking action at the outlet of trough $c$. The thick blanket is projected at high speed onto the belt $k$ of carrier D which itself moves at high



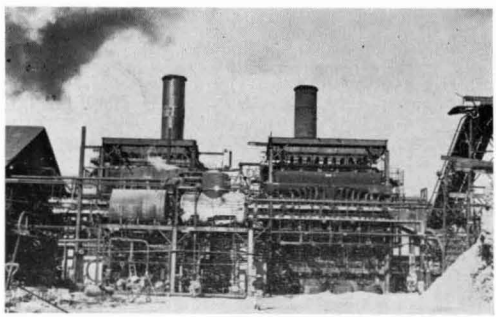

speed (about 100 m/min) so that the thick slow blanket is transformed into a fast thin blanket. It passes under the transverse sheet of imbibition liquid $q$ (achieving a much better imbibition efficiency than usual, so that the quantity of imbibition liquid may be reduced with consequent benefits) and is then discharged over roller $n$ into the gap between the top roller $b_2$ of the second mill $B$ and the feed roller $b_4$. Because of the kinetic energy it possesses, the bagasse has a self-ramming action which aids feeding of the second mill B, and the speed, location of feed roller $b_2$, etc. are so arranged that the blanket surfaces $p$, $p'$ are substantially tangential to the rollers $b_2$ and $b_4$. The device increases mill capacity by about 20%, raising extraction from e.g. 95% to 97%, and lowering imbibition usage from 30/40% to 20%. Its simplicity and lightness make it cheaper than conventional carriers and cleanliness is improved while maintenance and power consumption are reduced.

# TRADE NOTICES

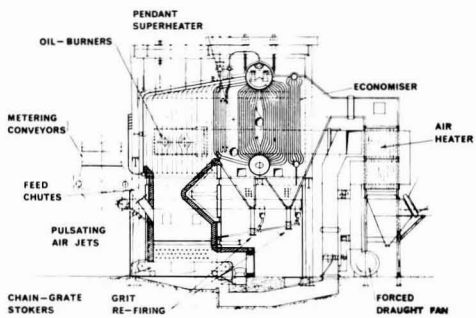
*Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.*

**Babcock bagasse-fired boilers in Mexico.** Babcock & Wilcox Ltd., 209 Euston Road, London N.W.1.

To obtain a reasonably high rate of combustion and also to obviate the manual removal of ash from a bagasse furnace of the Ward pattern, chain-grate stokers have been successfully applied as a means of ash conveying. Such an arrangement was used for two boilers supplied to the Los Mochis plant of the National Sugar Company in Mexico. These units developed jointly between Babcock & Wilcox Ltd., and Babcock & Wilcox de Mexico S.A. de C.V., incorporate a number of special Ward hearths each with its own chain-grate stoker which operates as



mechanical ash-conveyor, effecting continuous discharge of ash. In this design, water-walls commence above the refractory to form the furnace of a Bi-drum boiler. Each unit has auxiliary oil-firing, the burners firing from both sides of the furnace. Refiring of grits collected from the boiler hoppers is effected pneumatically.




Fuel is introduced into the modified Ward furnace via feed chutes located in the front arch or wall, the fuel being spread over the extended hearth by pulsating air-jets. Steam conditions are 250 p.s.i. and 650°F.

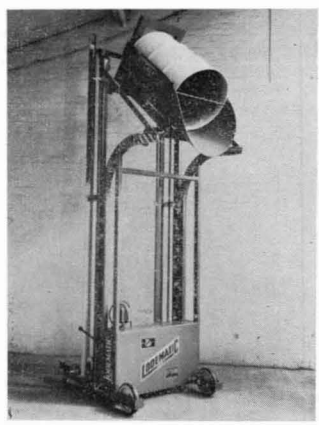
These two boilers, each rated at 125,000 lb/hr, are now in commission and recently four more boilers of basically similar design were ordered for this mill. Two are repeats of the units already at work; the others will each be for 165,000 lb/hr. A further three boilers of this type have also been ordered for two other factories in Mexico. Variations will be, principally, in furnace width (side to side), depending upon the number of Ward-type hearths to be accommodated.

The present design capacity of the Los Mochis plant of 8000 short tons of cane per day will be doubled by the extensions for which the four new Babcock boilers have been ordered. During the 1962/63 season, 716,000 tons of cane were crushed, with a corresponding sugar production of 64,800 tons.

* * *

**Automatic sack and drum tippler.** Lodematic Ltd., Clitheroe, Lancs.

The new automatic tippler is for lifting and discharging sacks and drums into mixers and process plant. It tips with an up-and-over action, reaching



over the hopper to discharge the contents, under the control of a single lever—a fully automatic model is also available. The tippler may be mobile or static.

* * *

**"ElectroMatic" vibrating screen.** Link-Belt Company, Prudential Plaza, Chicago **1**, Ill., U.S.A.

This new screen is designed for efficient low-cost screening of dry materials finer than 30-mesh, including powdered sugar. It consists of a compact electromagnetic vibrator mounted above a screen box and connected directly to a screen cloth. The cloth is connected to the box in a way which permits

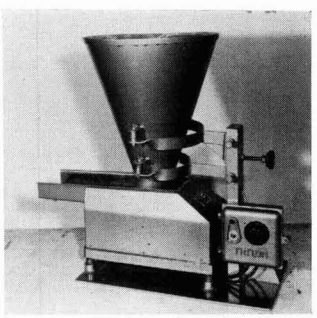
it to pulsate while the box itself remains perfectly at rest. The screen is made with one or two decks in sections 5 ft long by 3 or 4 ft wide; sections can be bolted end to end to produce 10, 15 or 20 ft units.

The vibrations (up to 3600 per minute) are produced from alternating current, remote controls being standard equipment, and the intensity of the pulsations can be varied instantaneously by setting a dial. A chief advantage of the screen is its ability to free itself of fine jagged materials which would cling to a mechanical vibrating screen.

* * *

**Vibrating feeder and hopper.** The Triton Engineering Co. (Sales) Ltd., Kingsnorth Industrial Estate, Wotton Road, Ashford, Kent.

Material storage and instantly variable feed rates are joint features of the new Triton self-contained vibrating feeder and hopper. The feeder unit comprises an electromagnetic vibrating trough feeder and controller with adjustable hopper and base plate. Coarse feed adjustment is obtained by raising or lowering the hopper using the hand-screw provided. Fine adjustment is obtained by means of a separate electrical controller bolted to the hopper support bracket. Both lumpy and fine materials can be handled by using a combination of the coarse and fine feed adjustments. The hopper has a capacity of 1 cubic foot when full and the vibrating feeder will deliver at a maximum feed rate of 5 tons per hour of material having a bulk density of 100 lb per cubic foot.



For remote control of fine feed rate the hopper adjustment is pre-set in situ and the separate controller removed from the bracket and re-mounted at the point required. The controller is also suitable for recessing into a control cabinet and the front of the unit forms a hinged lid for easy access to the internal components. As well as a graduated fine feed control knob, an on/off switch and neon mains indicator lamp are also provided as standard equipment on each controller. The feeder unit is wound for 230 V single-phase 50 c/s A.C. supply and can be supplied either with mild steel or stainless steel hopper and feeder trough.

## PUBLICATIONS RECEIVED

**"SYNTRON" ELECTRIC VIBRATORY EQUIPMENT.** Riley (IC) Products Ltd., 19 Woburn Place, London W.C.1.

The vibrators are simple electromagnetic units which set up a frequency of 3000 vibrations per minute using 110, 230 or 400V 50 c/s current. They are provided with a controller containing a switch, power control rheostat and rectifier; amplitude may be adjusted from full vibration to a fine tremor. The units may be applied to various types of hoppers and chutes or used for packers, feeders, and elevators. Specifications of the units are provided, as are illustrations of many of the applications.

* * *

**DUST CONTROL.** Dust Control Equipment Ltd., Thurmaston, Leicester.

Illustrations and brief descriptions are given of the "Unimaster" and "Drytex" dust control units, "Drytube" dust filters, "Dalamatic" automatic fabric filters and "Multiswirl" wet dedusters of the DCE (formerly Dallow Lambert Ltd.) range, together with a number of installations.

* * *

**DEWRANCE FORGED STEEL STOP VALVE.** Dewrance & Co. Ltd., Great Dover Street, London S.E.1.

Publication No. 749 is a leaflet describing this new valve range which is intended to standardize the types usually employed for ancillary services in high pressure steam installations, permitting the rationalization of high-pressure small-bore pipework and attendant valve installation with consequent reduced maintenance and a small spares inventory.

* * *

**"MULTI-LEAF" FILTER LEAVES.** Multi-Metal Wire Cloth Co. Inc., 1350 Garrison Ave., Bronx, N.Y. 10474, U.S.A.

A new leaflet announces new low prices for the "Multi-Leaf" filter leaves made by Multi-Metal Wire Cloth Co. Inc. for Sweetland stationary pressure filters, which feature lighter leaf construction without loss of strength, deeper chambers for improved flow, a new outlet case in one piece for greater strength, and welded leakproof closure. The leaves are available bare for use with textile covers or fitted with covers of wire cloth, filter cloth, etc.

* * *

**"FREE SPACE" HYDRAULIC COUPLINGS AND DRIVES.** Crofts (Engineers) Ltd., Thornbury, Bradford 3, Yorkshire.

A new booklet, DM/12/64, illustrates, describes and gives dimensions of free space FSP-type hydraulic pulley drives and FSC-type hydraulic couplings. Also provided are selection tables of stock "Supror-Sure-Grip" V-rope drives, stock bores, and instructions for easy conversion to either coupling or pulley type units.

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**Western States centrifugals for Pakistan.**—Crescent Sugar Mills and Distillery Ltd. has selected 8 Western States 48 × 30 in semi-automatic batch-type centrifugals for installation at their Lyallpur plant. Four 1000 r.p.m. electrically driven machines with automatic washing and braking will be used for A- and B-sugars and two similar machines for refined sugar. Two 1500 r.p.m. electric drive machines with automatic braking will also process refined sugar.

* * *

**Massey-Ferguson cane harvesters for Madagascar.**—Three new Massey-Ferguson 515 sugar cane harvesters will work on two estates in Madagascar in the harvest starting in June 1964. A M-F machine operated in Madagascar on a trial basis during 1963 and harvested 7000 tons, a highly satisfactory performance in view of the fact that mechanical harvesting had not previously been attempted and field conditions were not completely suitable for machine operation. Massey-Ferguson (Australia) Ltd., who manufacture the harvester, claim that 1963 and 1964 production of the MF 515 for the Queensland and world markets makes the Company the world's largest producer of cane cutters or harvesters. Altogether, the MF harvester is now working in eleven countries outside Australia.

# INTERNATIONAL SOCIETY OF SUGAR CANE TECHNOLOGISTS

## XII CONGRESS, San Juan, Puerto Rico

The XII Congress will convene on Monday, 29th March and close Friday, 9th April 1965.

Headquarters will be the Hotel Americana in the outskirts of San Juan, near the International Airport. This is a first class hotel, on the sea shore.

Jorge Bird Travel Service Inc., Box 962, Río Piedras, Puerto Rico, is in charge of all arrangements and accommodations. For $450.00 (U.S. Currency) per delegate they will provide 14 days room per person in double rooms, 14 breakfasts, 7 dinners, two banquets, one night accommodation at the Ponce Intercontinental Hotel, transportation within Puerto Rico to and from the airport, to the several island tours, and to local parties and receptions. They will handle baggage, take care of tips, etc. A brochure is being prepared to inform delegates in detail.

An invitation has recently been received to visit the neighbouring island of Santo Domingo (about an hour away by plane) in connexion with the possible arrangement of a two-day—one-night sojourn in the Dominican Republic, which now produces around 1,000,000 short tons of sugar. This visit will be optional.

A post-Congress visit to Florida is also being organized, with the aid and cooperation of the United States Sugar Corporation, for those delegates wishing to make this trip at the conclusion of the Congress.

It is important that Regional Vice-Chairmen accelerate their membership campaigns. It is expected to add at least three new regional sections to membership during the coming year.

Circular letters of instructions will follow. In the meantime all Vice-Chairmen are asked to urge possible contributors to work on the papers to be presented, so that they may be finished at the earliest possible date.

### Instructions for the Preparation of Papers to be Submitted for the Congress

All correspondence in connexion with papers to be submitted to the Editor, Dr. JAIME BAGUÉ, 18 Carrion's Court, Santurce, Puerto Rico.

All manuscripts must be in the hands of the Editor on or before 15th August, 1964.

If accepted for publication by the Publications Committee, papers will be available in the form of preprints at the Congress.

Manuscripts *must:*

(*a*) be written in the English language.

(*b*) be typewritten on one side of the page only, double-spaced, and with a 1 inch margin on all four borders.

(*c*) be clearly divided into separate paragraphs headed by titles as: Introduction, Methods, Materials, Experimental Results, Discussion, Acknowledgments, References, etc.

(*d*) have pages numbered throughout in right-hand upper corner.

(*e*) include a summary of about 250 words.

(*f*) be sent in triplicate (original and two carbons). All photographs must also be in triplicate, but charts and drawings may consist of original and two photostat copies.

Illustrations, Charts and Tables must:

(*a*) be non-coloured (black and white).

(*b*) be not larger than 9 × 12 inches.

(*c*) be supplied separately from the text, and neither stuck nor pasted to the manuscripts, nor folded.

(*d*) have a number and, if necessary, a legend in which symbols are clearly explained. Legend must be typewritten, double spaced in a separate sheet of paper, and properly identified with the same number as the illustration.

Original photographs must be submitted in the form of sharp, non-folded, glossy prints. Line drawings should be in waterproof, black drawing ink. Photographs and drawings must have an identification number, and the text of the explanation and all units and scales should be typewritten in a separate sheet bearing the same identification number.

Literature references should be listed at the end of the paper. In this list (supplied on a separate sheet) references should be in alphabetical order in accordance with the authors' surnames. Each reference should bear a number and this number should appear in the text at the place where the reference is made. Every reference in the text must appear in the list and vice versa.

Each reference to an article published in a periodical must contain the author's name, followed by the title of the article, the title of the periodical (abbreviated according to the system used in Chemical Abstracts), the volume number, year of publication (between brackets) and the page number.

Each reference to a book must contain the author's or editor's name or names followed by the title of the book, the publisher's name, the publisher's city, the year of publication and the page number.

It is strongly advised that one of the Proceedings of previous I.S.S.C.T. Congresses be consulted while preparing the manuscript.

Before April 1965 authors will receive proofs of their papers for correction which, when carried out, should not involve more than 10% of the cost of the original typesetting. Corrected proofs must be in the hands of the Editor before the end of the Congress.

Authors are entitled to order reprints of their papers at prices quoted on the order form that they will receive with the proofs.

Authors are to obtain the usual permission from authors and publishers to quote or copy parts from other copyrighted publications. Authors will protect the publishers of the Proceedings against any claim by a third party in connexion with infringement of copyright caused by the publication of these Proceedings.

Papers submitted for publication must be scientific papers of the highest possible calibre. Papers which are primarily meant to enhance or advance any particular brand or make of machinery or product, will be considered commercial in nature and will be rejected by the Publications Committee.

The deadline of 15th August 1964 is the latest date which will assure that the paper will appear printed in the Proceedings. Every effort of authors, however, to send their manuscript at the earliest possible date before 15th August will be appreciated since it will lessen the burden of a peak load on the publishers.

In order to avoid delays which might not allow your manuscript to reach the Editor before the deadline-date, make sure that you send it by air mail.

# European Beet Area Estimates[1]

| | 1964/65 | 1963/64 | 1962/63 |
|---|---|---|---|
| *Western Europe* | | *Hectares* | |
| Western Germany .. | 322,800 | 303,081 | 297,766 |
| Austria ..... | 52,500 | 48,225 | 47,900 |
| France ..... | 365,000 | 338,548 | 305,000 |
| Belgium ..... | 62,000 | 57,000 | 62,000 |
| Netherlands ..... | 77,500 | 69,138 | 77,439 |
| Denmark ..... | 73,300 | 59,275 | 39,494 |
| Sweden ..... | 43,500 | 40,380 | 46,762 |
| Italy ..... | 245,000 | 224,000 | 217,900 |
| Spain ..... | 150,000 | 110,200 | 170,000 |
| Yugoslavia ..... | 105,000 | 95,000 | 75,000 |
| Greece ..... | 11,800 | 8,975 | 6,300 |
| Switzerland ..... | 7,400 | 6,916 | 4,861 |
| Great Britain ..... | 175,500 | 165,303 | 165,456 |
| Ireland ..... | 33,000 | 35,604 | 31,418 |
| Finland ..... | 20,000 | 16,460 | 18,995 |
| Turkey ..... | 182,700 | 136,634 | 127,939 |
| Total ..... | 1,927,000 | 1,714,739 | 1,694,230 |
| *Eastern Europe* | | | |
| Eastern Germany .. | 235,000 | 232,000 | 232,432 |
| Czechoslovakia .... | 285,000 | 283,000 | 260,200 |
| Hungary ..... | 120,000 | 118,379 | 125,040 |
| Poland ..... | 445,000 | 372,000 | 430,000 |
| Albania ..... | 5,500 | 5,500 | 5,500 |
| Roumania ..... | 190,000 | 177,300 | 154,800 |
| Bulgaria ..... | 72,000 | 72,000 | 70,000 |
| Soviet Union ..... | 4,300,000 | 3,300,000 | 3,170,000 |
| Total ..... | 5,652,500 | 4.560,179 | 4,447,972 |
| Total Europe ..... | 7,579,500 | 6,274,918 | 6,142,202 |

# Stock Exchange Quotations

## CLOSING MIDDLE

| **London Stocks** (*at 15th May* 1964) | s d |
|---|---|
| Anglo-Ceylon (5s) .. .. .. .. .. .. | 9/3 |
| Antigua Sugar Factory (£1) .. .. .. | 14/– |
| Booker Bros. (10s)* .. .. .. .. .. | 21/4½ |
| British Sugar Corp. Ltd. (£1) .. .. .. | 28/9 |
| Caroni Ord. (2s) .. .. .. .. .. .. | 4/– |
| Caroni 6% Cum. Pref. (£1) .. .. .. | 15/9 |
| Demerara Co. (Holdings) Ltd. .. .. .. | 7/9 |
| Distillers Co. Ltd. (10s units) .. .. .. | 25/1½ |
| Gledhow Chaka's Kraal (R1) .. .. .. | 31/– |
| Hulett & Sons (R1) .. .. .. .. .. | 45/– |
| Jamaica Sugar Estates Ltd. (5s units) .. | 5/9 |
| Leach's Argentine (10s units) .. .. .. | 17/6 |
| Manbré & Garton Ltd. (10s) .. .. .. | 37/– |
| Reynolds Bros. (R1) .. .. .. .. .. | 32/– |
| St. Kitts (London) Ltd. (£1) .. .. .. | 21/– |
| Sena Sugar Estates Ltd. (10s) .. .. .. | 7/9 |
| Tate & Lyle Ltd. (£1) .. .. .. .. .. | 37 – |
| Trinidad Sugar (5s stock units) .. .. | 3/6 |
| United Molasses (10s stock units) .. .. | 35/9 |
| West Indies Sugar Co. Ltd. (£1) .. .. | 19/3 |

## CLOSING MIDDLE

| **New York Stocks** (*at 14th May* 1964) | $ |
|---|---|
| American Crystal ($10) .. .. .. .. | 60¾ |
| Amer. Sugar Ref. Co. ($12.50) .. .. .. | 22½ |
| Central Aguirre ($5) .. .. .. .. .. | 27¼ |
| North American Ind. ($10) .. .. .. | 40 |
| Great Western Sugar Co. .. .. .. .. | 15½ |
| South P.R. Sugar Co. .. .. .. .. .. | 33¼ |
| United Fruit Co. .. .. .. .. .. .. | 20¾ |

* *Ex-dividend*

# Brevities

**Nitrogen fertilization of tropical crops.**—Louisiana State University is sponsoring a short course on this theme which is to be held on the LSU campus during the 19th–31st July 1964. Major aspects of the nitrogen fertilization of sugar cane, rice and cotton will be covered in this short course, emphasis being placed on the handling and application of anhydrous ammonia, nitrogen solutions and solid nitrogen fertilizer. The course will consist of lectures and practical field work, with an agronomy phase and an engineering phase. It will be conducted by faculty members of the Agronomy and Agricultural Engineering Departments of LSU who have research and teaching experience in the production and management of tropical crops. The course fee is $200 and enrolment is limited to 15 participants. Applications must be received by 30th June and should be addressed to Dr. W. H. PATRICK, Dept. of Agronomy, Louisiana State University, Baton Rouge, La., U.S.A.

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**U.S. beet sugar expansion[2].**—On the 17th April the U.S. Secretary of Agriculture announced the commitment of 33,000 acres from the National Sugar Beet Acreage Reserve to farms in Maine and 20,000 acres to farms in Arizona, to be effective for the 1966 crop. They are the final commitments under the Acreage Reserve provisions of the Sugar Act. Maine's beet production will centre on Aroostook County and will go to a factory to be built by the Greater Presque Isle Development Corporation and to be operated by the Great Western Sugar Company. The Arizona beet will be near Phoenix, where a factory is to be built by the Spreckels Sugar Co. Each factory is expected to produce about 50,000 tons of sugar, raw value, per year.

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**George Clark & Son Ltd. sale[3].**—Brown & Polson Ltd. are to sell that part of their sugar business situated at Millwall—the George Clark refinery—to Tate & Lyle Ltd. Brown & Polson's industrial division, Corn Products (Sales) Ltd., will continue to market on behalf of Tate and Lyle all the Millwall products.

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**British Guiana disturbances[4].**—The labour situation at sugar estates throughout the country deteriorated in February and March. A strike was called by a union which is seeking recognition but some workers which are members of another union, currently recognized by the sugar industry, have been going to work. In some cases this has led to clashes between rival factions with serious injuries and loss of life. Further fires have been reported in the canefields and bombs have been exploded against various properties. The result of these occurrences has been a decrease in sugar production; e.g. in the week ended 7th March, only 3,769 tons of sugar were produced in comparison with 23,877 tons for the same period in 1963[5]. Press reports indicate that the once-for-all bonus discussions in respect of the 1963 crop have been discontinued until the present situation is resolved. A state of emergency was declared in May.

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**New sugar factory for Uruguay[6].**—British business interests are reported to have offered to assist the Instituto Nacional de Colonización in installing a sugar mill.

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**U.S. beet area, 1964[7].**—The Crop Reporting Board of the U.S. Dept. of Agriculture has announced that this year's prospective plantings are 1,401,000 acres—9% more than the 1963 figure of 1,285,000 acres and 35% more than the 1958–62 average.

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[1] F. O. Licht, *International Sugar Rpt.*, 1964, **96**, (11), 1–6.
[2] *Lamborn*, 1964, **42**, 70.
[3] *The Times*, 4th May 1964.
[4] *Overseas Review* (Barclays D.C.O.), April, 1964 p. 80.
[5] *Daily Chronicle* (British Guiana), 17th March 1964.
[6] *Fortnightly Review* (Bank of London & S. America Ltd.), 1964, **29**, 213.
[7] *Lamborn*, 1964, **62**, 51.