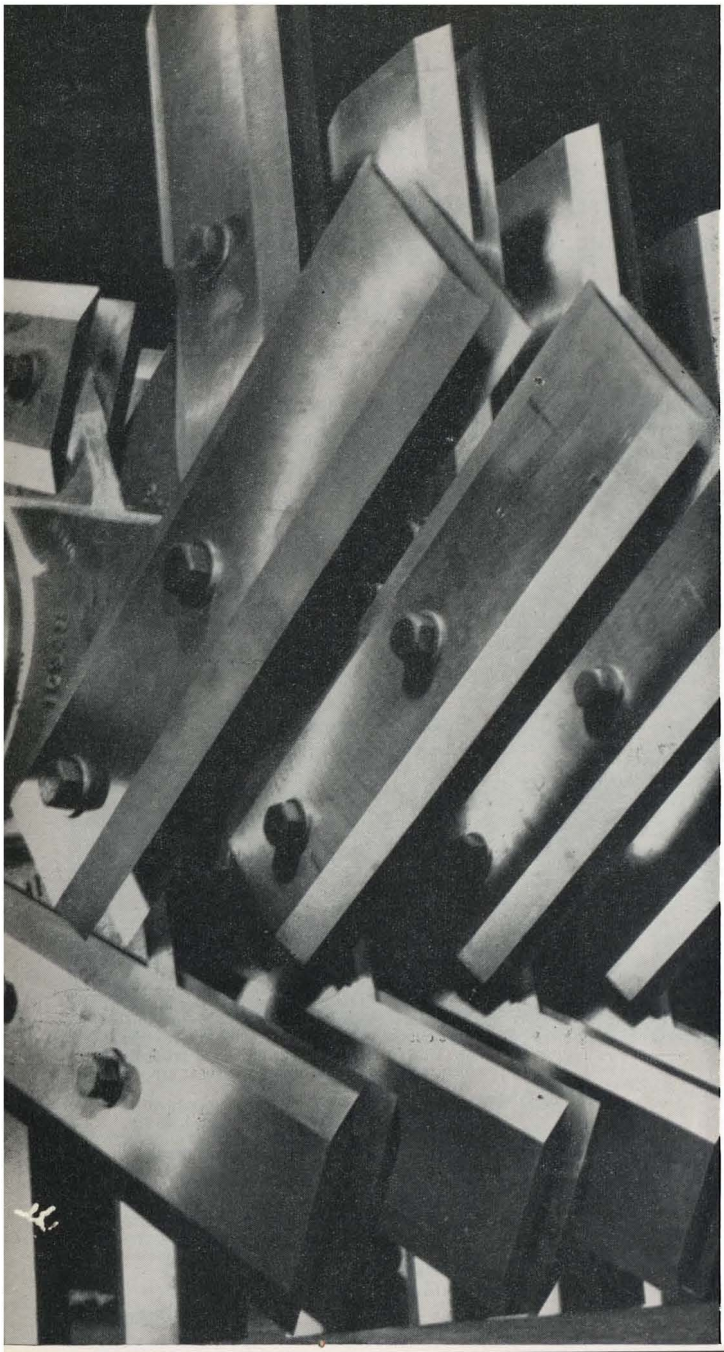
International Sugar Journal

VOL. 66 *May 1964* No. 785

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

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



FLETCHER AND STEWART

for
cane
knives

FLETCHER AND STEWART LIMITED

INCORPORATING

GEORGE FLETCHER & CO., LTD.,
LITCHURCH LANE, DERBY, U.K.
TELEGRAMS: "AMARILLA DERBY TELEX"
TELEX No. 37514

DUNCAN STEWART & CO. LTD.,
6 PARK TERRACE, GLASGOW, C3. U.K.
TELEGRAMS: "STEWART GLASGOW TELEX"
TELEX No. 77607

MEMBERS OF THE BOOKER GROUP

THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXVI MAY 1964 No. 785

NOTES AND COMMENTS

E.E.C. sugar policy proposals.

The Commission of the European Economic Community has put forward proposals for a common sugar policy to the Council of Ministers of the community. According to Comtel-Reuter, the proposed policy provides for a system of prices, the level of which will be assured by levies on imports or exports as well as export rebates or import subsidies. The Commission proposes that the price system should come into effect on 1st July next for Italy and on 1st October for other member states. The trading system should also come into operation on 1st October 1964. The regulations will be applicable to raw sugar and refined beet and cane sugar, beet sugar molasses and certain derived products.

The price system includes a target price, a threshold price, a reference price and an intervention price. Each year before 15th November member states would fix a target price for refined sugar at the "ex-factory" stage for a quality standard which would be identical throughout the Community. The Council would fix before 1st October 1964 the limits of the target price for the 1965/66 trading year.

The difference between target prices in the various member states would be gradually reduced until a single common price is applied, which at the latest would be at the end of the Common Market's transitional period on December 31st, 1969. Member states would also fix each year an intervention price for refined sugar. This price would be equal to the target price reduced by a certain fixed proportion between 5 and 6%.

Holders of home-produced sugar would be able to sell their stock to an intervention body throughout the season. This body would also be able to conclude storage contracts in order to avoid being forced to buy refined sugar. Member states would also fix a minimum price for sugar beet for a common standard of product. Manufacturers would be obliged to buy beet used in sugar factories at this minimum price, account being taken of transport rebates and other special costs. The minimum price for sugar beet would be derived from the intervention price according to criteria to be fixed by the Council of Ministers.

A system of compensation for storage costs for refined sugar would be established in each member state. Storage costs for the last nine months of the year would be reimbursed. The financing of these reimbursements would be through subscriptions paid proportionally by manufacturers, refiners, and importers.

Levies would be charged on imports to compensate for the difference between prices in the importing and exporting nations. The levy would be equal to the difference between the threshold price of the importing country and the c.i.f. price in the case of the non-member exporting country, or the threshold price and the frontier price in the case of a member exporting country.

Intra-community levies would be reduced progressively in relation to the gradual harmonization of sugar and molasses prices. For trade with non-member countries different levies would be applied for raw and refined sugar.

In order to take account of regional trade, a levy on sugar beet would also be applied.

The member states would fix annually separate threshold prices for raw and refined sugar. The latter would be fixed for the same quality standard as for the target price.

The c.i.f. prices would be determined daily by the E.E.C Commission for raw and refined sugar. The price would be determined for a standard variety, in relation to which the prices of other varieties could be freely established. The free-frontier price of refined sugar, one of the elements for calculating intra-community levies, would be determined on the basis of : (1)—The intervention price when the c.i.f. price was lower or equal to the intervention price of the exporting member state. (2)—The c.i.f. price when this lay between the intervention price and the target price. (3)—The target price when the c.i.f. price was equal to or higher than the target price of the exporting member country.

If as a result of big fluctuations on the world sugar market, c.i.f. prices were higher than the threshold prices of importing member states, the latter could grant subsidies calculated on the same principle as

third country levies. These subsidies would enable sugar imported from both another member country or a third country to be sold at the internal market price of the importing member state. In order to prevent exports which would endanger the supplies of a member state, export levies could be applied which would raise the sugar price to the world price.

All imports and exports, except for processed products, should be accompanied by a certificate valid until the 45th day after its issue for imports, and for three months in the case of exports. If the internal price of a member state was lower than a reference price for a given sugar product, the member state in question should suspend the issue of certificates for imports from third countries. This measure is considered necessary to avoid a rapid fall in prices and too frequent recourse to interventions on the internal market. The reference price is fixed annually by the member states for raw and refined sugar.

In order to help refined sugar exports, export rebates are provided for in the proposals. In the case of exports to third countries the export rebate would be equal to the difference between the world price and the intervention price of the exporting member state. For exports to other member states, the same rebate could be granted when the free-frontier price was higher than the threshold price of the importing member state. In such a case the importing state would apply the "third country" levy reduced by a fixed lump sum.

Customs duties, taxes with equivalent effect, quantitative restrictions and minimum prices would be incompatible with the new regulation.

Other measures include a safeguard clause, identical to the one in the common cereal policy, the application of the regulation covering the Common Agricultural Fund and the creation of a Sugar Management Committee.

The Commission will present proposals for regulations governing sugar imports from the associated African states and overseas territories at a later date.

* * *

Mauritius sugar in 1963[1].

The 1963 crop started on the 14th June and ended on the 19th December. The 23 mills together crushed 5,656,173 long tons of cane, i.e. about 800,000 tons more than the record cane crop achieved in 1959. The average sugar recovery was only 11·93% as against 12·57% for the period 1956–59. On the other hand, the average cane yield reached the unprecedented figure of 28·1 tons per acre, which is 1·9 tons in excess of the record of ten years ago. As a result, the yield of sugar per acre (on a cultivated area of 201,469 acres compared with 202,104 acres in 1962) amounted to 3·35 tons, while the previous record, in 1956, was 3·22 tons.

The influence of climatic conditions on the results of the crop are worth mentioning. The normal conditions which prevailed throughout the growth period accounted for the very satisfactory results achieved in the fields; during the maturation period, conditions were somewhat better than normal both as regards rainfall deficits and temperature variations. However, the need to start the campaign at an early date in order to finish crushing before the end of the year explains why the sucrose content of the canes did not benefit to a greater extent from the prevailing favourable conditions.

Exports in 1963 totalled 571,227 tons, including 447,222 tons to the U.K., 56,866 tons to the U.S.A., 56,800 tons to Canada, 10,089 tons to Italy and 250 tons to Nyasaland. This compares with a total of 506,623 tons exported in 1962. Local sales in Mauritius and the Seychelles totalled 26,569 tons compared with 26,792 tons in 1962.

* * *

Sugar production in South Africa.

The South African Sugar Association has announced that all mills have completed their crushing campaigns for 1963/64 season. The final production was 1,264,704 short tons of sugar, made from 10,956,451 short tons of cane. The two Swaziland mills were still crushing and their final production for the season was assessed at 94,400 tons, which gives a total production for the combined industries of 1,359,104 short tons. This is far ahead of the previous best performance achieved in the 1962/63 season of 1,273,549 short tons.

February was an extremely dry month and the average rainfall for the sugar belt of 2·69 inches compares with the computed mean of 4·71 inches. This, however, by no means fully reflects the seriousness of the drought experienced in the industry, as the bulk of the rain fell in the first few days of February and only negligible amounts were recorded for the rest of the month. February is usually one of the wettest months of the year, and is in addition the month with the highest prevailing temperatures, with the result that it is regarded as the optimum month for cane growth.

* * *

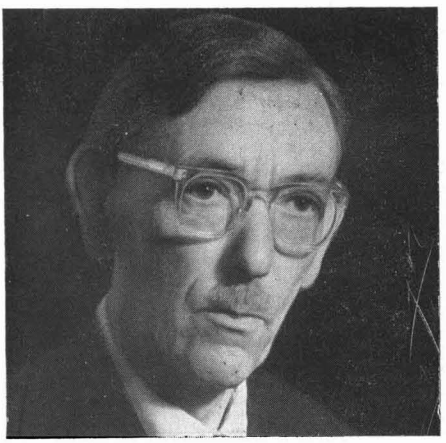
West Indies Sugar Co. Ltd., 1963 Report.

Sugar production at Frome in 1963 was 101,178 tons and at Monymusk was 78,699 tons, giving a total of 179,877 tons which compares with 149,806 tons in 1962 and a five-year average (1958–62) of 145,669 tons. Better cane yields, higher juice quality, smooth operations and a dramatic rise in world sugar prices contributed, however, to a rise in net profit from £58,175 in 1962 to £908,975 in 1963. Of the total 1963 outturn, 14% was sold locally in Jamaica, 73% went to the U.K. and Canada, and the remaining 13% to the U.S.A. The average price realized was £52·90 per ton compared with £41·00 in 1962.

[1] *Mauritius Sugar News Bulletin*, 1963, (12).

Hubert Charles Siegfried de Whalley

H C. SIEGFRIED DE WHALLEY was born at Greenwich, London, on 21st October 1892 and died suddenly on 20th March 1964. He was educated at Aske's Hatcham School and Goldsmith's College, University of London. He became an Associate of the Institute of Chemistry by examination in 1920, and was elected a Fellow in 1923. In 1924 he became an Associate Member of the Institution of Chemical Engineers and a full Member in 1935. In 1953 he was elected a Member of the Institute of Biology.



His long professional career included work during World War I as Chemist at Micanite & Insulators Ltd., as Chemist and later Chief Chemist at Molassine Co. Ltd. until 1922, and from then until 1946 as Chief Chemist, taking over from his father L. J. DE WHALLEY, at the Plaistow Wharf Refinery of Tate & Lyle Ltd., where he also directed the Research Laboratory from its beginning in 1937 until 1947. On its move to Keston, Kent, he became Director of Research with greatly enlarged facilities and responsibilities for the whole Company's research until his retirement in 1957. He was then retained as Consultant to the Company until 1962.

It would be futile to try to enumerate the many investigations on which he was engaged during his 40 years in the sugar industry. His research interests covered a very wide field and ranged from technical questions, such as continuous carbonatation, battery sweetening off and washing of bone char, kinetics of decolorization by bone char and the effects of its particle size, heavy boiling, refinery sugar losses, metal corrosion, enzymic inversion of sugar on a technical scale, to the introduction of modern microbiological control methods adapted for refinery use, and of improved analytical methods for stricter quality control, including methods based on most recent techniques such as chromatography and electrophoresis to help with obstinate problems in research and refinery practice. The latter techniques facilitated the discovery of raffinose and a family of hitherto unknown sugars, the kestoses, in many beet and cane sugar products.

It was natural for him to take a lively interest in the activities of many scientific and professional societies. His contributions were duly rewarded by the honour of being elected a member of the Council of the Royal Institute of Chemistry, of the Council of the Society for Analtyical Chemistry, of the Committee of the London Section of the Society of Chemical Industry, of the Scientific Committee of the Commission Internationale Technique de Sucrerie, of the Industry Advisory Committee of the Sugar Research Foundation and of several others.

Although he served loyally and efficiently all the organizations mentioned above, his heart belonged, one can truly say, to one in particular, viz. the International Commission for Uniform Methods of Sugar Analysis (ICUMSA). He was a Referee on various subjects from 1936 onwards, served as Secretary and Treasurer of the British National Committee from 1948 until 1954, and was elected President of ICUMSA at the Paris Session in 1954, re-elected at the Washington Session in 1958 and served until failing health forced him to retire at the Hamburg Session in 1962. He was then promptly and unanimously elected Life Honorary President, an honour bestowed only once before during the 60 years of ICUMSA history.

Whoever was in close contact with H. C. S. DE WHALLEY during the Hamburg Session could not fail to notice the grave strain and lack of physical strength under which he laboured, and could not but admire the immense courage and sense of duty that enabled him to preside during the five gruelling working days of the session, in addition to social functions and a visit to the Berlin Sugar Institute. A fitting finale to a great career in the Commission of a man whose frail body and gentle manners concealed great drive, ingenuity and devotion to duty.

Although in precarious health, he did not remain idle after the Hamburg Session. He took on the editorship of a new book entitled "ICUMSA Methods of Sugar Analysis", which he strongly felt was an absolute necessity. He just managed to complete the task a few days before his sudden death. May this volume become a lasting memento to his long and universally respected career in the sugar industry.

D. GROSS.

SUGAR CANE AGRICULTURE IN SOUTH AFRICA

Proceedings of the Thirty-sixth Annual Congress, South African Sugar Technologists' Association, 1962.

THIS congress was held at the South African Sugar Association's Experiment Station at Mount Edgecombe on the 9th to 13th April, 1962. In opening the congress the speaker (Mr. A. A. LLOYD, Manager of Natal Estates Ltd.) reminded the audience that in 1932 Uba was still the principal variety of cane grown throughout Natal and Zululand, with an average yield per acre of little more than 20 tons. In 1958 a new record was set of 36·9 tons of cane. In the previous season the fields of the Natal Estates Ltd., on which the Experiment Station is situated, produced an all-time record average yield of 56·6 tons per acre from 6000 acres harvested, while one section attained the phenomenal average of 72·7 tons per acre. What more striking evidence was needed of the value of scientific research?

Nitrogen and Urea

The high nitrogen content, ease of application and relative cheapness of urea have established its popularity in South Africa, as evidenced by the recent commissioning of a large commercial plant for its mass production. A paper by J. R. ANDERSON discusses the use of urea in the fertilizing of sugar cane. Volatile losses of nitrogen with this fertilizer can be of a high order, especially under very high temperature conditions or with rapid soil drying. Placement of urea at depth suggests a practical means of minimizing volatile losses, the depth at which no loss occurred being 8 cm (3 inches) or more. Nitrogen loss was greater in sandy than in clay soils. When urea was applied over cane trash a more extensive mycelial network was observed than when ammonium sulphate or nitrate was applied, and the trash receiving urea was darker, possibly indicating a more rapid breakdown. However, applications of urea over trash are not considered advisable unless sufficiently soaking rains are likely to follow.

Another paper concerned with nitrogen is that by J. R. ANDERSON who discusses free living nitrogen-fixing bacteria in Natal sugar cane soils and the distribution of *Azotobacter*. A survey of Natal sugar cane soils revealed a fairly high incidence of *Azotobacter*. There was low incidence in those soils with a predominantly acid reaction. Eighty-three out of 147 samples were *Azotobacter*-positive. No correlation of organic matter content or agricultural practice with incidence of *Azotobacter* was found.

Soil

Soil series in the Natal sugar belt are discussed by B. E. BEATER and R. R. MAUD[1]. There is considered to be greater diversity of soil types in the Natal sugar belt than in most other sugar cane areas, owing to the great amount of faulting in past ages resulting in a large number of parent rocks being brought next to one another, there being a close relationship between the soil and the parent rock from which it is derived. Thirty-seven named soil series are recorded and arranged in tabular form, with descriptions.

Soil moisture relationships of Natal sugar belt soils are also the subject of a paper by R. R. MAUD. It is pointed out that relatively little work on the physical properties of these soils has so far been carried out. In view of the increasing use being made of supplementary irrigation with cane in some parts of Natal, together with the development of extensive irrigation schemes in the northern regions of the industry in low rainfall areas, more information on soil structure and moisture relationships is becoming urgently needed. The soil moisture characteristics of the various major soil groups are presented with particular reference to the amount of available moisture of each soil group. This is correlated with the silt and clay contents of these soils.

Starch in cane juice

A high starch content in sugar cane juice is undesirable for various reasons, notably poor filtrability of the juice. It is often a varietal characteristic, but may also be due to certain agricultural practices and phenomena. This is discussed by G. H. WOOD—some factors influencing starch in sugar cane. When cane is left standing before milling the starch content decreases gradually at first, but rapidly after about 5 days. Starch is largely concentrated in the top 2 or 3 feet of cane. The nodes of the stem contain much more starch (3·5–4 times) than the internodes. Of the 3 major plant foods potash application is by far the most efficacious in reducing the starch content of cane. Irrigation appears to decrease the starch in cane.

Disease

A minor stalk ailment of sugar cane in Natal is discussed by J. R. ANDERSON. A brownish-black marking, termed Meristomatic Blotch, has been observed in the nodal regions of cane stalks and planting setts. The causal organism or agent is uncertain. The sub-surface tissue damage is not severe although buds may be affected thereby reducing germination in setts. Bacteria and fungi, including a species of *Cephalosporium* and *Nigrospora*, have been isolated from affected tissue but results were inconclusive. Two insects, *Saccharococcus sacchari* and a species of *Aspidiotus* may play a part in initiating the condition, fungus spores and mycelial fragments having been observed on the latter.

F.N.H.

[1] *See also I.S.J.*, 1963, **65**, 150.

THE NEEDS OF TROPICAL SOILS

AN article which provides much food for thought for anyone interested in soils and tropical agriculture has recently appeared by H. L. RICHARDSON[1] of the Food and Agricultural Organization of the United Nations, Rome. It is instructive to learn from this article that in the whole great area of the tropics less than two million tons of plant nutrients (nitrogen, phosphorus, potassium) are used and most of this on plantation crops, whereas over 26 million tons are used in temperate climate countries. It is considered that since the fertilizer needs of tropical soils are even larger than those of temperate ones it is fair to say that the use of fertilizers in the tropics has hardly begun, and that a great expansion in the present use is to be expected; also that this will be made necessary by, and will help to supply food for, the rapid increases in population that are taking place in all tropical countries.

Where fertilizers are used on peasant-grown crops in the tropics the rates of application are usually very low and these naturally give small responses. But as experience increases and the fertilizer/crop price ratio improves, heavier rates of application will be made and greater responses obtained. Even under present circumstances average responses (with low to moderate fertilizing) of 25–75% increase are common in the tropics. Instances of doubling the yield are not uncommon and are, in fact, being obtained in the F.F.H.C. Fertilizer Programme, working in many countries with several different crops.

In discussing crop yield possibilities the writer quotes recent examples of very high yields with various tropical crops including sugar cane (82 long tons per acre in Puerto Rico), paddy in India, cocoa hybrids in West Africa, cotton, oil palm, and bananas in West Africa.

With regard to sugar cane the following remarks are of interest. "Where cultivation is continuous, soil organic matter falls to very low levels, and it needs to be replaced by using animal manures, composts, green manures, or temporary leys. Each of these measures offers special problems in the tropics, and may be difficult to introduce under prevailing local conditions. On the other hand certain tropical crops—for example sugar cane, tea, and other plantation crops—have been cultivated continuously and successfully for long periods using only chemical fertilizers and with no organic manuring. It may well be that when crop yields are raised to a high enough level by fertilizers, the roots and crop residues left behind in the soil are able to maintain the organic matter content.

"The improvement of cultural practices usually coincides, as might be expected, with an improved response to fertilizers. This does *not*, however, mean that fertilizers should not be introduced to primitive farmers until they have adopted better varieties and cultural methods—excellent results have been and are being obtained by using fertilizers without waiting for other improvements." Compared with many other tropical crops sugar cane may be in a better position to maintain a reasonable level of organic content in the soil with its fibrous roots and the leaf trash that accumulates.

Other remarks that may be of special interest to the cane grower appear under the heading "Fertilizer needs of tropical crops", where it is stated that "The fertilizer needs of the principal tropical crops are closely linked with the rainfall zones and with the textural soil classes in which they are mainly grown, as well as with their own physiological requirements; and it is difficult to separate these aspects. Thus paddy rice is largely grown on heavy clay soils, and it rarely responds to potash except in localized areas such as peaty or coarse textured soils. On the other hand, sugar cane is often grown in sandy or coarse textured soils, and although nitrogen is still of primary importance, potash responses are much more general with sugar cane. This could be partly because of the importance of potash in carbohydrate synthesis, but is likely to be related also to the generally coarser texture of sugar cane soils. The same is true of other crops, such as tobacco, which are reported to require potash but which are mainly grown on light soils."

Reference is made to the fertilizer field work of the F.A.O. in more than 60 tropical countries and on over 30 tropical crops. From this it is apparent that "nitrogen is the most generally needed and effective of the primary nutrients in the tropics. Phosphate also is very widely needed; on the average it gives smaller responses than nitrogen, yet when it is acutely deficient phosphate replaces nitrogen in first importance. In such circumstances nitrogen and phosphate together can be very effective. Potash is less generally needed or effective, perhaps because of the more rapid weathering of tropical soils; the immediate need for potash tends to be localized to certain kinds of soils such as sandy soils (whether alluvial or residual) and heavily leached lateritic soils. As the use of the other two nutrients increases and as crop production levels rise, however, potash will doubtless become more widely necessary."

The special problems of the savannah zones of the world, which cover such vast areas and which have relatively low and seasonal rainfall, receive special treatment by the writer. The curious flush of available nutrients, notably nitrogen and phosphates, that can occur with the first rains after a long dry period, is referred to. It is this that may account for little or no response from nitrogenous and phosphatic fertilizers applied at this period. It is factors such as this that can make the application of fertilizers in the savannah zones rather unpredictable.

F.N.H.

[1] The fertility potentials and needs of tropical soils. H. L. RICHARDSON. *Tropical Science*, 1963, **5**, (3), 166–178.

SUGAR CANE RESEARCH IN TAIWAN

Report of the Taiwan Sugar Experiment Station, 1963, (32).

THE interplanting or intercropping of sugar cane with quick maturing food or cash crops is peculiar to Taiwan and does not normally occur in commercial sugar cane production in other countries. Reasons advanced for this intercropping in Taiwan are density of population, shortage of arable land and the extent of peasant cultivation on quite small holdings.

Interplanting

Two papers in this report are devoted to the subject of interplanting. That by Y. C. PAN and K. M. LEE deals with the soybean. Six varieties of soybean were used with both plant cane and ratoon cane. With careful weeding and the use of fertilizers there was little ill effect on the cane. There was no reduction in yield with ratoon cane, but 3% in autumn plant cane and 11% in spring plant cane. In the other paper (by C. H. CHANG and T. M. LAI) use was made of ^{32}P as a tracer to evaluate competing root systems (sugar cane with peanuts and sugar cane with sweet potato) and the fertilizer consumed. Sweet potatoes consumed larger quantities of P than peanuts. As a result of this work recommendations are made on the best way of utilizing fertilizers in cane interplanting.

Mulching

The value of mulching sugar cane fields is discussed by L. H. LEE *et al.*, the main source of mulching material being cane trash. Bagasse and sand are also discussed. The beneficial effects of mulching on cane fields was greater as the compactness of the soil increased. The most economical method of using the mulch is to completely cover the whole area of soil between the cane rows. Larger quantities do not increase the effect and are considered wasteful. A study of utilizing cane trash mixed with green green manure (Poona-pea) was made by TSAI and PAI. Different proportions were used and the decomposition time studied.

Diseases

White leaf disease, one of the main sugar cane diseases of Taiwan, is the subject of two papers—one by H. P. LIU *et al.* on heat treatment and the other by C. CHUANG-YANG and K. C. LING on a comparative test of healthy and diseased stools. The latter was undertaken in an attempt to determine the loss in sugar cane tonnage due to the disease. Plots of healthy and diseased cane were laid out. Hot water treatment (50–51°C for 2 hr) of planting setts used for controlling ratoon stunting disease was ineffective in controlling white leaf disease, although hot air treatment (54–58°C for 8 hr) gave partial control. The higher temperatures severely affected germination of the setts.

There are also papers on ratoon stunting disease, now almost under control, and on *Pythium* root rot—the relationship between the causal agent (*Pythium arrhenomanes*) and the root of sugar cane.

Gibberellin

The effects of gibberellin on the germination and seedling growth of sugar cane is discussed by F. Y. SHIAH and T. P. PAO. Soaking planting setts slowed up rather than hastened germination. There was marked elongation of the young shoots in the early stages. The effects of various treatments appeared to have no practical significance.

F.N.H.

AGRICULTURAL ABSTRACTS

Mole crickets damage young cane. G. WILSON. *Cane Growers' Quarterly Bull.*, 1963, **27**, 66.—An instance is given where damage to newly planted cane by mole crickets was much more severe than usual—in deep yellow sand in the Mourilyan area. The insect and the nature of its damage are described.

* * *

The southern cane grubs. N. McD. SMITH, J. ANDERSON and R. W. MUNGOMERY. *Producers' Rev.*, 1963, **53**, (9), 37, 41.—A broad outline is given of the nature of borer attack under different soil or environmental conditions in South Queensland with notes on the rôle of cultural operations and of chemical insecticides in effecting control. Photographs of the following beetles are shown: frenchi, Childers and Bundaberg beetles, *Lapidiola mungomeryi*, *Rhopaea consaquinea* and *Rhopaea rugulosa*.

Giant sensitive plant control. ANON. *Producers' Review*, 1963, **53**, (9), 5.—Details are given of proposals for intensifying the campaign against the giant sensitive plant (*Mimosa invisa*), a pernicious weed of Queensland cane fields. A regional and assistant regional inspector, with headquarters at Innisfail, are to be appointed. Consideration will be given to further research on more effectively controlling the weed.

* * *

Square cultivation is disappearing. ANON. *Producers' Review*, 1963, **53**, (9), 45.—It is pointed out how square cultivation is being replaced by contour working on Queensland farms to lessen soil erosion; 3000 farmers now apply contour cultivation principles over some 240,000 acres, the area increasing by 50,000 acres each year.

A new rotary slasher. ANON. *Producers' Review*, 1963, **53**, (9), 45.—Details are given of the new McCormick International G.A.4-2 Rotary Slasher and its ability on light scrub or rough grassland. It has a cutting width of 4 feet and is easily fitted to any tractor with Category 1 or 2 three-point linkage, power being delivered by the tractor to the cutting blade.

* * *

Rat baiting in canefields. F. W. BLACKFORD. *Australian Sugar J.*, 1963, **55**, 363–365.—The advantages of thallium sulphate as a poison are stressed and the best ways of using it outlined. It is pointed out that more sugar cane is destroyed by rats in Australia than by any other pest, as much as 73,000 tons of cane having been lost in a season through them.

* * *

Irrigated sugar beet production on Maui. O. R. YOUNGE and D. H. BUTCHART. *Hawaii Agric. Exp. Sta., Tech. Bull.*, 1963, (52), 36 pp.—Results are given of trials with sugar beet at four different sites on Maui, the heartland of sugar cane production in Hawaii. Beet in dry irrigated areas gave best results. In wetter areas seedling diseases caused trouble. In favourable areas it is considered beet could serve as an inter-row crop in sugar cane during the first six months while the cane stand is still open, or as an inter-cycle crop. For continuous culture in Hawaii sugar cane is likely to remain superior as a producer of sugar.

* * *

Poultry manure for sugar cane. ANON. *S. African Sugar J.*, 1963, **47**, 648–649.—A Natal farmer's experience with using poultry manure on cane near Maritzburg is here outlined, conditions (3600 ft) being almost marginal for cane. The dried manure was broadcast at 1000 lb per acre, a ton of manure being considered the equivalent of 250 lb ammonium sulphate, 300 lb superphosphate and 50 lb muriate of potash. It is proposed to supplement the above poultry manure dressing in future with 300 lb potash, 600 lb basic slag and 150 lb nitrogen.

* * *

Israeli sugar beet. RUTH B. STERN. *World Crops*, 1963, **15**, 486–489.—"Sugar beet, like much of the population of Israel, is farily new to the country, and, like many of the new immigrants it has been rapidly and successfully absorbed into the economy." An acreage of 2000 in 1956–7 had increased to 14,000 in 1960–61. Sugar beet is a winter crop in Israel and is important because of its ability to utilize off-season irrigation water. A general account of the agronomy of sugar beet in Israel is given, including pests and diseases, some of which, like mildew (*Oidium*), can be very serious if not checked.

Damage by army worm (*Laphygma exempta*). A. V. BOGDAN. *East African Agricultural and Forestry J.*, 1963, **29**, (2), 120–121.—A severe attack by this army worm on the experimental plots of the Kitale Grassland Research Station in Kenya, where 190 different grasses, including sugar cane, were being grown, took place on 11th and 12th May, 1961. This afforded a good opportunity to record the damage caused to different species and this is given in tabulated form. Sugar cane was recorded as moderately damaged. No preference was shown for grasses with soft or succulent leaves. Often those with hard fibrous leaves suffered most damage.

* * *

Results of subsoiling, autumn fertilizing and seed-bed preparation on sugar beet yield. W. CZERATZKI. *Zucker*, 1963, **16**, 421–426.—The need for good tilth to ensure successful sugar beet seed germination is stressed. The advantages of subsoiling and autumn preparation of land, with exposure to frost or winter weather, are discussed in detail.

* * *

Sugar industry in Uttar Pradesh. H. R. SWARUP. *Indian Sugar*, 1963, **13**, 91–92, 95.—Although Uttar Pradesh is the home of the sugar industry in North India, sugar production there is now at a low level economically and is considered to be facing a crisis, with world competition. Reasons for this are given. Much could be done with more irrigation and fertilizer. Better varieties with higher sucrose content are also needed. An article in similar strain but dealing with Eastern Uttar Pradesh, by M. KHAITAN, appears in the same journal (pp. 93–95).

* * *

Soaking cane setts before planting. S. C. SEN and A. K. DOHARE. *Indian Sugar*, 1963, **13**, 127–129. Mineral nutrients and carbohydrates are claimed to be absorbed by planting setts on soaking, to be subsequently utilized by the young growing plant. Suggestions are given for making up suitable solutions.

* * *

Recent currents in sugar cane breeding. T. RAO and R. NARASIMHAN. *Indian Sugar*, 1963, **13**, 135–137. Reference is made to the phenomenal success of the earlier Coimbatore hybrids which led to an ever increasing demand for high tonnage, quality canes, with built-in resistance to a wide spectrum of unfavourable environments. An attempt is here made to briefly outline the restrictions that apply to further considerable genetic improvement. Mounting costs have in some instances caused the breeder to modify his techniques.

Rôle of chemicals in sugar cane disease control. K. KAR and H. S. VARMA. *Indian Sugar*, 1963, **13**, 139–141.—Unsuccessful attempts to control red rot, the most serious cane disease of northern India, by the addition of certain elements to the soil at planting time, are described, the elements being sulphur, boron, copper, zinc, molybdenum, and manganese. Treatment of setts with traditional fungicides gave negative results with red rot but had a significant effect in the control of smut.

* * *

Studies in pithiness in sugar cane with particular reference to time of planting and frequency of irrigation. K. K. P. RAO. *Indian Sugar*, 1963, **13**, 151–155. Factors leading to pith formation, especially inadequate water supply, are discussed. Adequate soil moisture when the plants are young is considered to be important to avoid pithiness.

* * *

Agriculture of the sugar industry in Taiwan. K. C. LIU. *Sugar J.* (La.), 1963, **26**, (2), 14–24.—The agricultural structure of the Taiwan sugar industry is discussed at some length, particularly the organization of farmers for the supply of cane. It is on this successful organization that the future of the industry is considered to depend. Intercropping of cane, peculiar to Taiwan, is explained.

* * *

The agronomic aspects of irrigation scheme design. G. D. THOMPSON. *S. African Sugar J.*, 1963, **47**, 478–479.—Over the past 18 months the S.A.S.A. Experiment Station near Durban has evolved a system of irrigation advice for cane growers based on soil physical factors, the results of lysimeter experiments, statistical analysis of rainfall records and general field observations. The significance of this is outlined. Growers contemplating irrigation may now obtain advice from the Station on the water duty which should be employed and the precipitation rate which should not be exceeded. The average likely response to irrigation in southern Natal is considered to be 12 tons of cane per annum. An average of 14 in of irrigation water per annum is required to produce this response. In the winter months in Natal little or no rain falls.

* * *

Irrigation: disputes between the farmer and equipment supplier. G. S. BARTLETT. *S. African Sugar J.*, 1963, **47**, 481–485, 487–491.—Throughout the world disputes often arise between grower and equipment supplier regarding the desired or claimed performance of an irrigation system. Because of this the American Society of Agricultural Engineers made a recommendation, endorsed by the Sprinkler Irrigation Association, regarding the minimum requirements for the design, installation and performance of sprinkler irrigation equipment. Details are given along with reproductions of charts.

* * *

Influence of increasing amounts of "Disulfoton", applied during seed sowing, on certain insect pests of beet and on yield. W. STEUDEL. *Zucker*, 1963, **16**, 448–452.—During 1960/1962 tests were made with granular "Disulfoton", a systemic insecticide applied during planting, at rates of 20, 40 and 60 kg/ha. Good results were obtained against beet flies and aphids and consequently virus yellows. There was no loss of yield but a few plants succumbed under the 60 kg/ha application.

* * *

Sugar cane mosaic in the Dominican Republic. L. J. LIU. *Sugar J.*, (La.) 1963, **26**, (3), 12–17.—This refers to the Central Romana properties of the South Puerto Rico Sugar Company, where a survey was made of the strains of mosaic disease present. In most cases strains isolated corresponded with those recorded or described for Louisiana, but some did not. These, four in all, are described. The opinion is expressed that the disease might be controlled by the selection of suitable varieties but there will always be need for vigilance.

* * *

Growing sugar beets on organic soils in South Florida. F. LE GRAND. *Sugar J.* (La.), 1963, **26**, (3), 21–24. Results are given of an experimental sugar beet planting on organic soils in an attempt to prolong the season of sugar factories beyond February. Four varieties of sugar beet were grown and gave satisfactory yields, all being frost- or cold-resistant.

* * *

A new weed killer in sugar beet. ANON. *Sugar J.* (La.), 1963, **26**, (3), 36.—An announcement of the new herbicide "Pyramin", suitable for controlling germinating weeds in sugar beet, beet root and mangels has been made by BASF (Badische Anilin und Soda-Fabrik AG., Ludwigshafen-am-Rhein, Germany) who issue a bulletin about it. Rates of 2 to 3 lb per acre are claimed to control most annual weeds in the germinating and early growth stage.

* * *

Sugar cane cultural practices in Taiwan. W. C. HSU. *Taiwan Sugar Quarterly*, 1963, **10**, (2), 13–17.—The methods employed in cultivating sugar cane in Taiwan are described under four main headings—tillage and green manures, planting, ratoon treatment, and interplanting of cane with rice. Green manures referred to are *Crotalaria juncea* (sunn hemp), *Sesbania aegyptiaca* and *Mucuna capitata*.

* * *

The sugar industry of Taiwan as seen by sugar experts from Mexico. ANON. *Taiwan Sugar Quarterly*, 1963, **10**, (2), 20–27.—The history and organization of the

Taiwan Sugar Experiment Station, with its subdivision and seven departments, are given. Then follow accounts or impressions of the following: plant breeding, agronomy, soils and fertilizers.

* * *

The dependence of field emergence of monogerm seed on type and condition of soil. H. RID. *Zucker*, 1963, **16**, 479–484.—The need for cultivation at the right time, in order to secure a good seed-bed, is stressed. The effect of different kinds of soil on germination or emergence and of methods of improving the structure of soils is discussed.

* * *

Effective control of termites and shoot borers through soil application of "Heptachlor" in sugar cane crop. T. P. S. TEOTIA *et al. Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 203–211.—"Heptachlor" proved superior to BHC (benzene hexachloride) and was more lasting than any other insecticide tried. It could be used as a dust (0·5 to 1·5 lb per acre) or better as an emulsion (3 lb per acre) applied in the rows at planting time. Cost per acre for the emulsion was Rs 45·00 and for the dust Rs 6·69–20·07.

* * *

Cyto-genetical studies on certain *Saccharum-Eranthis* hybrids. K. S. SUBBA RAO *et al. Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 213–218.—The history of intergenetic hybrids of *Saccharum* is outlined, which commenced with the work of BARBER nearly 50 years ago, when he crossed *Saccharum* with *Narenga*. Hybridizing work with *Saccharum officinarum* var. *Manjri Red* and *Erianthus ciliaris* is described, 14 hybrid seedlings being obtained. Brix, sucrose and fibre estimations were carried out.

* * *

Studies on the germination of sugar cane. III. A proposed mathematical model for viability of sugar cane buds. R. S. SRIVASTAVA. *Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 219–225.—This is a mathematical study on the viability of buds along the cane stalk, buds towards the end of a stalk germinating at different times from other buds.

* * *

Assessment of losses caused by the internode borer of sugar cane, *Proceras indicus* Kapur. H. DAVID and K. ANANTHANARAYANA. *Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 226–229.—The work was carried out in the Tanjore district. Observations were made on two varieties (Co. 419 and Co. 449) both in the main and special season crops, infested cane stalks being put in 3 categories according to whether one, two or three or more internodes were damaged. These were kept separate for weighing and juice analysis. Infested internodes recorded lower Brix than healthy ones and were inferior in juice quality. Loss of yield was estimated at from 3·1 to 8·8 tons of cane per hectare.

Outstanding canes of Bihar. VII. BO.22, a high tonnage mid-season late variety. C. THAKUR *et al. Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 230–234.—A detailed description of this variety is given, accompanied by a coloured plate showing stem and bud characteristics. It tillers profusely, even under poor soil conditions, which accounts for its popularity, but it is susceptible to red rot.

* * *

Fertilizer experiments on sugar cane in South India. V. Nitrogen-cum-varietal trial at Samalkot. R. D. REGE *et al. Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 238–241.—The practice with cane growers in the region is to apply the full nitrogen dressing, 150–200 lb per acre, in June with the onset of the monsoon, the cane having been planted in Jan.–Feb. The idea is that, if the early season fails through drought, the fertilizer is not wasted. Trials with two varieties (Co. 419 and Co. 527) showed increased yields by applying some of the fertilizer earlier, especially with the variety Co. 527. Growers are being urged to do this.

* * *

Study of total solids-sucrose content relationship in sugar cane juice with reference to varieties. D. J. DURAIRAJ and N. RAJAMONY. *Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 242–247.—This is a continuation of earlier papers (see *I.S.J.*, 1963, **65**, 323) and bears the sub-title "VI. Reduction of sucrose yields in Co. 419 due to predominance of inferior total solids—sucrose relationship-patterns." It is believed there may be different Brix-sucrose relationship-patterns within the same variety, some abnormally low sucrose values having been obtained for the variety Co. 419.

* * *

A decade of sugar cane development in Maharashtra. D. G. DAKSHINDAS and R. P. DANI. *Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 260–269.—The State of Maharashtra is responsible for about 11% of the total cane production of India, production having increased greatly as a result of new canals and increased irrigation facilities. Facts and figures relating to production are given, as well as a history of the development of the sugar industry in the State.

* * *

Control trashworms. ANON. *S. African Sugar J.*, 1963, **47**, 551.—The trashworm or ratoon worm feeds mainly in fields of young ratoon cane and in severe cases may destroy practically all the young leaves. Although plants ultimately recover, this severe defoliation may result in losses in yield of as much as seven tons of cane per acre. Early inspection and treatment is advised—as soon as the young leaves appear. Suitable insecticides are indicated. This insect has previously been regarded as a pest of trashed fields but recent observation shows that it may occur in burnt fields as well.

SATURATION TEMPERATURE by DIFFERENTIAL THERMAL ANALYSIS

By ANDREW VANHOOK
(Department of Chemistry, Holy Cross College, Worcester, Mass., U.S.A.)

IT was suggested at the Hamburg meeting of ICUMSA in 1962 that the saturation temperature, and thereby the supersaturation[1], of low purity massecuite can be determined satisfactorily by means of differential thermal analysis (D.T.A.). While the usual microscopic method is adequate in most cases, and has been adapted as a highly accurate method for determining solubilities by WISE[2] and others, some dissatisfaction has been expressed in the application to low-grade products. It is for these cases that alternative methods were considered and of these D.T.A. seemed most suitable upon preliminary examination. The present account describes these exploratory experiments in the hope that further investigation at the factory laboratory level may be prompted.

Qualitative Theory

Sugar massecuites are essentially mixtures of crystals and supersaturated syrup. They adjust to saturation only slowly according to the temperature, crystal content and syrup purity. Since the last two are essentially fixed for any given massecuite, the temperature remains as the only primary factor to be considered. As this is raised the crystallization velocity will change according to two factors: (1) a normal Arrhenius increase and (2) a decrease occasioned by the diminishing supersaturation. Since the former factor is the more temperature dependent[3], there will ensue a continuously changing exothermal crystallization until the saturation temperature is reached. Beyond this the change will be endothermal as dissolution sets in. The saturation temperature, then, will be ascertained by a change from an exo- to an endothermal reaction or, more practically, by the onset of the endothermal change corresponding to dissolution. This is not only a more rapid process than the reverse crystallization[3] but it also defines the working saturation temperature more practically as that temperature at which crystals in a massecuite begin to dissolve. Differential thermal analysis is admirably suited for the determination of this point.

In this method equal amounts of material, in which a transition is suspected, and a control, in which there is no transition, are heated simultaneously at a uniform rate in identical containers. As long as no transformation occurs the two will increase in temperature at the same pace. But when a transition does occur the temperature of the sample will either forge ahead or lag behind that of the control according to whether the change is exo- or endothermal.

Experimental

The equipment used in these experiments was fairly simple. Two 8 × 1 in test tubes were mounted side by side and fitted with matched thermometers, thermocouples and reciprocating stirrers. It is important that the two cells be identical in performance when filled with common material. A Photovolt Linear/Log "Varicord 43" recorder was used to record the essential temperature difference versus temperature of sample data in these experiments, but a wide variety of instrumentation is immediately obvious for this purpose.

Samples weighing 25 g were employed in most of the experiments, the control consisting of an equal weight of massecuite which had been heated to dissolve the crystals completely. In some cases syrup spun from the magma was substituted for massecuite. A common beaker of water and hot plate provided the necessary heating schedules, and rates of 4 to 6° per min were found to be most effective—the only requirement in this respect being that the rate be regular.

Results

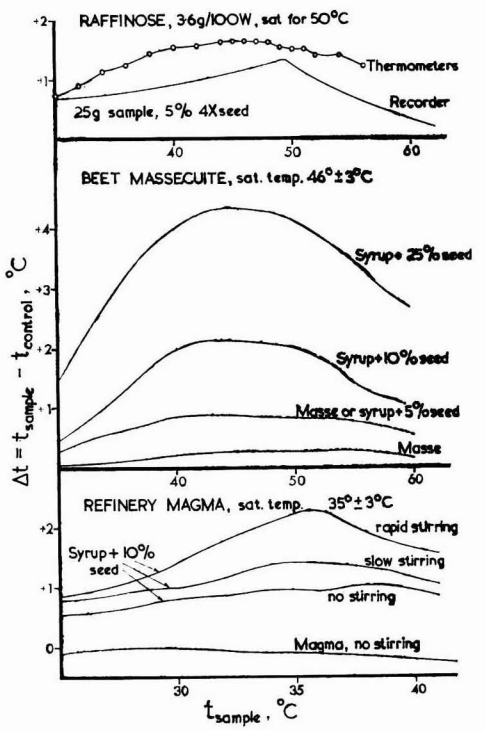
Changes from an exothermal reaction to an endothermal one could be detected in all cases as the temperature was increased, but the differential curves varied considerably from sharp, almost cusp-like, records to broad, gradual transitions. This difference occurs according to material and conditions, and is also quite sensitive to the geometry of the cells and their inherent differences. The former sharp type usually appeared in these experiments at low heating rates and in unstirred mixtures. Although they specify a transition temperature more uniquely, they are not as reproducible or certain as the latter, smooth type. These were generally, but not always, realised at higher heating rates and with stirring. This kind of curve also featured a pronounced and relatively sudden drop which corresponded closer with the microscopically estimated saturation temperature and was better reproducible than either the beginning of the transition plateau or the sharper type curve. It is also considered to be a more realistic determination of the saturation temperature for practical purposes since it indicates the temperature at which dissolution becomes significant.

The first trials were performed with pure syrups made up to saturation at various temperatures. Massecuites were simulated by adding crystals. Both thermometers and thermocouples gave curves exhibiting maxima—broad when only little growing

[1] SIR JOHN SAINT *et al.*: *Proc. B.W.I. Sugar Tech.*, 1960, 187–192; *I.S.J.*, 1963, **65**, 18.
[2] *Sugar J.* (La.), 1959, **22**, (2), 26–32; *Proc. B.W.I. Sugar Tech.*, 1960, 205; *I.S.J.*, 1960, **62**, 24; 1962, **64**, 374.
[3] VANHOOK: "Principles of Sugar Technology", Vol. II. Ed. P. HONIG. (Elsevier, Amsterdam). 1959, p. 156.

area had been added but sharper as the amount of seed was increased. Simulated molasses were then made up by saturating various solutions (salts, dextrose, raffinose, etc.) with powdered sugar for more than a week in a constant temperature bath. The results for one of these, which is typical, is illustrated in the figure. The recorder end-point was generally sharper and slightly higher than that taken from the thermometer readings. It is defined within less than a degree when thermocouple leads are bare (to reduce heat lag) and the stirring sufficient to keep the crystals suspended.

Real massecuites exhibited the same salient feature of an exo- to endothermal change, but not always as well developed. Six beet and four cane massecuites were examined in this preliminary survey and the following schematic reproductions of one of each of these represent most of the variables considered.



The saturation temperature of the beet massecuite illustrated was estimated microscopically as 46°C, within 3°. This variation is probably greater than a trained operator could realise. The control in this case was the syrup spun from the massecuite, heated to dissolve the fines. With this control in both tubes, there was no significant temperature difference over the entire range, proving the uniformity of the apparatus. With unheated syrup against control there was no change until about 60°C, when a very mild endothermal change set in. The masse itself at first rose slightly in temperature, with respect to the control, to a long plateau which gradually began to fall away at about 55°C. This change was accentuated by adding powdered sugar to either masse or syrup, and with 10% or more a decline was indicated at the proper temperature. This was estimated as occuring within 1° in the present instance and, at most, within 2° in the other cases. The break-away point is quite reproducible. More than 5% seed on massecuite introduced difficulties in stirring but these can be alleviated by substituting syrup for magma. Very similar, but displaced, curves were obtained from the visibly observed temperature changes.

Two of the beet products indicated their saturation temperatures with only a slight depression in the thermal record, followed by a gradual rise which hinted of an exothermal reaction rather than a continued endothermal one. There was visible in the samples at the same time a change of colour and apparent de-aeration. The substitution of unheated syrup as control obviated these hindrances and, in turn, suggested the use of inert materials for controls. A heavy silicone oil, which happened to be on hand, proved satisfactory in the few cases in which it was tried.

The patterns exhibited by the cane products were similar to those already described and the example given in illustration supplies additional information about process variables. This magma was very heavy and difficult to stir even without added seed, so that the corresponding syrup was employed. With no stirring only a weak change was indicated but this was adequately developed by proper agitation. The slow speed referred to was a reciprocating movement throughout the height of the sample once every 20 seconds, whereas rapid stirring amounted to once every 5 seconds. Initial mixing of added seed by hand also effects an improvement and D. H. FOSTER of the Sugar Research Institute, Mackay, Queensland, has suggested that this best be delayed until within 10° of the anticipated saturation temperature.

Reverse cooling curves intimated changes from an endo- to an exothermic reaction but these were very poorly defined and, besides which, were displaced from the original saturation temperature according to the treatment during the heating cycle.

It is also possible to reduce the size of the sample considerably and satisfactory results were realized with only 2 g of material in modified equipment. Possibly even milligram samples might suffice in ultra-sensitive apparatus such as the differential scanning and micro-calorimeters now available. Changes were also detected in other systems capable of sustaining supersaturation in the presence of excess crystals (i.e. sorbose, glucose, borax and citric acid) but the resolution of the thermal record in terms of saturation temperature is complicated in some of these cases on account of hydrate formation, mutarotation, etc.

Discussion and Conclusions

These exploratory experiments demonstrate positively that saturation temperatures can be detected by differential thermal analysis and that methods could probably be perfected to realize a high degree of accuracy and precision. This preduction finds some support in the comparative values obtained in a few independent trials conducted at the Sugar Research Institute[4] in Mackay, using only mercury thermometers:

By microscope	*By D.T.A.*
50·0	50·2
54·0	54·2
56·5	56·7
65·0	63·8
49·0	48·1

The heating rate should be fairly rapid. The optimum amount of seed to be added depends primarily upon the size of this seed and the crystal content of the massecuite. Prompt and complete suspension of added seed as well as continued stirring throughout the test are necessary for smooth curves and good reproducibility, at least with large samples. Under these conditions there appears, to the writer, no reason that results should not be accurate and reproducible to within even less than 1° in low grade products. The amount of material required is small and the test rapid—a matter of just a few minutes.

It is hoped that this survey of the prospects of D.T.A. methods may stimulate further investigations on the part of those actively concerned with the determination in factory operation. The early discussions on this question with the workers at the S.R.I. laboratories in Mackay, and their continued encouragement, are gratefully acknowledged.

DAMAGE TO SUGAR CRYSTALS IN CONTINUOUS CENTRIFUGALS

By DIPL.-ING. WERNER SIEPE

THE continuous purging of massecuites in centrifugals which dispense with the normal discharge plough was developed approximately ten years ago, as a result of practical experience. They are thus relatively new in the sugar industry.

As continuous working is a sign of progress in engineering, continuous centrifugals have become very well known. Many hundreds of machines of this type are in use in all the important sugar manufacturing countries of the world and it is probable that to-day there are no sugar engineers who have not studied the operation of the continuous centrifugal.

It is well-known that the continuous centrifugal works in accordance with the thin layer principle. Unlike that in the classical batch type machines, the thickness of the layer of sugar in the continuous centrifugal amounts to only a few millimetres, the sugar travelling continuously over a screen, the perforations of which are oblong in shape, and 0·04 mm – 0·2 mm wide. The slope of the screen is generally about 34°. In connexion with this slope the parallelogram of forces (Fig. 1) is distributed in such a fashion that the movement of the sugar is induced by means of the massecuite being fed to the basket; that is, if the massecuite feed is stopped, no movement of the sugar on the screen takes place. If the layer of sugar has reached the upper edge of the centrifugal screen, however, the crystals are discharged into the sugar compartment of the monitor case.

The separation of the sugar crystal from the molasses, with which we are not here concerned, is

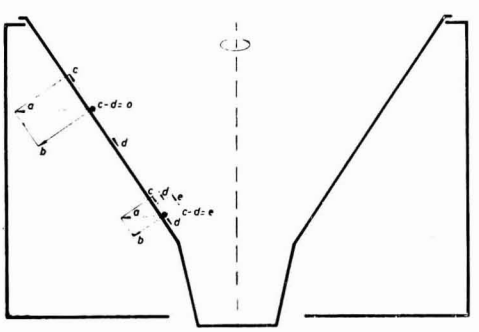


Fig. 1
Forces acting on a sugar crystal

a Centrifugal force *b* and *c* Components of *a*
d Friction μb. *e* Pushing Component.

influenced by numerous other factors, e.g. centripetal acceleration, feed rate, viscosity of the massecuite, open screen area, thickness of the layer of sugar, size of screen perforation, method of washing etc.

The most important of these is the centripetal acceleration. At the same time it is the only damaging influence which can affect the sugar crystals within

[4] D. H. FOSTER: Private communication.

the centrifugal basket. Unlike that in intermittent batch-type centrifugals, the massecuite in continuous centrifugals is exposed for only a short time to the influence of the acceleration forces. Every effort must therefore be made to make these forces as powerful as possible. In this connexion, limits are placed, in the first case, by the thickness of the sugar wall and, in the second, by the strength of the basket material.

While the sugar is on the screen, high acceleration is not injurious. Tests have shown that destruction only takes place at approximately 300,000*g*. By comparison, continuous centrifugals seldom exceed 2,500 *g*. The sugar crystal can become scored however, owing to friction, while moving up the screen and can as a result lose its lustre. First traces of scoring become apparent on acceleration rates from 200 *g* upwards. This scoring of the sugar crystals only affects its appearance and is of minor importance.

The sugar crystal is therefore in effect undamaged, and certainly not destroyed, while passing up the centrifugal basket. Damage to grain can therefore take place only *after* the crystals leave the basket if they strike the monitor case or other sugar crystals. It has been ascertained that, under unfavourable conditions, the damage to grain takes place at speeds above 10–20 metres/sec. The speed at which the crystals leave the basket corresponds to the circumferential speed of the revolving basket at its upper edge, and is dependent on that alone. The retarding effect of the air is small, although with increasing distance between the basket and the monitor case less damage is caused to the crystals. This physical law must be borne in mind when establishing the dimensions of the basket and of the monitor case.

It is thus necessary to find an optimum size of basket, which, while affording the lowest practical speed, allows the greatest possible centripetal acceleration, which, as mentioned above, is the essential component for the effective separation of the molasses from the sugar and which, it should again be emphasized, has no influence on the speed at which damage to the grain takes place.

From the comparison of the revolving force $Z = m\frac{v^2}{r}$ (where m = mass, v = circumferential velocity and r = radius) it can be seen that the one requirement—low circumferential speed—does not exclude the other requirement—high centripetal acceleration—for the latter $\left(\frac{v}{r}\right)$ becomes greater as the radius r is reduced while maintaining the circumferential speed unchanged by an increase in the number of revolutions n, in accordance with the formula $v = 2\pi rn/60$

The relationships between the diameter of the centrifugal basket, the speed of rotation and the centripetal acceleration are illustrated graphically in Figs. 2 and 3. The centripetal acceleration is expressed as acceleration figure c; c is the ratio of centripetal acceleration to the acceleration due to gravity, i.e. $c = \frac{v^2}{rg} = \frac{2v^2}{dg}$, where d = diameter. Fig. 2 consists of two groups of graphs. The steep straight lines show the relationship between the circumferential speed and basket diameter for speeds of 1000 r.p.m. to 3000 r.p.m. and the second flat-running parabola group gives the circumferential speeds of basket diameters up to 1200 mm for acceleration figures of

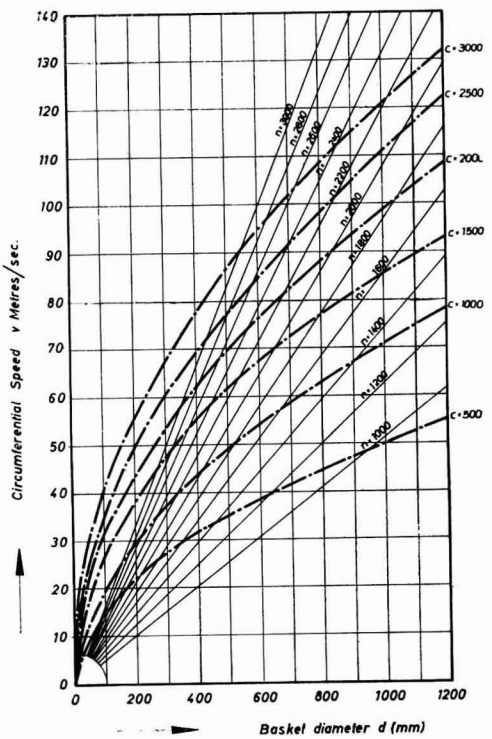


Fig. 2

Relationship between circumferential speed (v) and basket diameter (d), at various speeds of revolutions (n, r.p.m.) and acceleration figures (c).

500 to 3000. From the illustration it may be clearly seen that with the exception of small diameters (0 = 200 mm), an increase in the diameter increases the circumferential speed by a proportion greater than the proportional increase in the acceleration figure. Consequently, if the diameter of the centrifugal basket is increased, the increase in those forces which have a damaging influence on the sugar crystals is greater than the increase in the forces which cause the separation of the molasses from the sugar crystals.

An illustration of these relationships is shown in Fig. 3. For the same circumferential speeds, the acceleration figures are shown in relation to the

diameter of the centrifugal basket. The range which is of interest in the case of continuous centrifugals, lies between 600 and 1100 mm diameter, and 70 to 100 m/sec circumferential speed.

It has already been mentioned that the optimum size of basket is governed by the strength of the material employed and by the need to keep the damage to grain as low as possible in relation to the highest possible centripetal accelerations.

For chromium nickel steel (A.I.S.I. 321, German Working Material No. 4541) the comparison is $\delta = v^2$) according to which the tensions in ring shaped component parts are calculated as dependent upon the circumferential speed. An allowable circumferential speed of 95 m/sec with a safety factor of 5 has been established. As this safety factor is specified by some countries, it is important to bear this in mind in connexion with the construction of the basket. The graph of the maximum circumferential speed is drawn at 95 m/sec. Its curve confirms the above; with an increase in the size of the centrifugal basket from 600 to 1100 mm, while maintaining the same circumferential speed of 95 m/sec, i.e. in conformity with the maximum material strength and the speed at which the grain would be damaged, the acceleration figure decreases from approximately 3000 to under 1800.

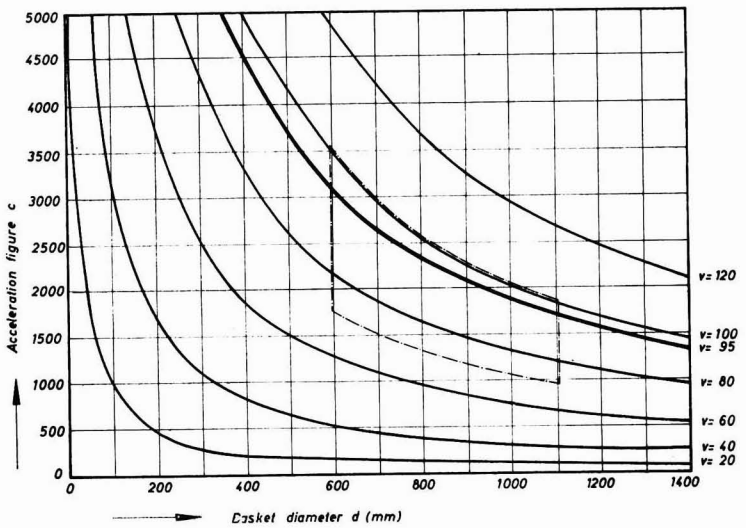


Fig. 3

Relationship between acceleration figure c and basket diameter d over a range of circumferential speeds v.

From Fig. 2 it may be clearly seen that the greatest increase in acceleration with diameter is attained at small basket diameters (less than approx. 200 mm). It is therefore correct to reduce the lower diameter of the basket to the minimum, and introduce the massecuite at the point of lowest acceleration.

A further physical law may be observed in connexion with the establishing of the basket size, and the acceleration reached. The specific application of power, W, is defined as the power which is required to accelerate a body by 1 g. The load accelerated in the centrifugal, i.e. the sum of the sugar crystals, has at the beginning kinetic energy $E_1 = O$ and at the end of the acceleration period has kinetic energy $E_2 = \frac{m\,v^2}{2}$.

The rise in kinetic energy is equal to the power applied: $A = E_2 - E_1$.

Since $E_1 = 0$, $A = \frac{m\,v^2}{2}$.

Thus the specific application of power becomes $W = \frac{A}{c} = \frac{m.\,v^2.\,r\,.\,g}{2.\,v^2}$ (c = acceleration figure).

With $r = \frac{d}{2}$ and $\frac{gm}{4}$ = constant, the expression simplifies to $W = constant \times d$.

This means that the application of power required to produce a specified acceleration figure is directly proportional to the diameter of the basket. The greater the basket diameter, the more unfavourable is the relationship between power applied and the acceleration reached.

Thus, from consideration of the application of power, there follows the same result as from Fig. 3. The power applied for acceleration of the crystals has a direct bearing on the speed at which damage to the crystals takes place; with the same acceleration figures, this speed becomes proportionally greater as the basket diameter increases.

The above shows that an increase in the diameter of the baskets of the continuous centrifugals at a constant circumferential speed results in a substantial reduction of the acceleration figure and an increase in the specific working application, i.e. an increase in the size of the basket means an increase in the specific working application, i.e. an increase in the size of the basket means an increase in the danger of excessive damage to the sugar grains, and a very poor use of the energy applied to drive the basket.

SUMMARY

The damage to grain in continuously operating centrifugals is a fact which necessarily results from the principle employed to effect separation in continuous centrifugals. The speed at which damage takes place is directly related to the circumferential speed of the basket at its greatest diameter. In order to obtain a good solid-liquid separation, a high centripetal acceleration is required. The relationships between the circumferential speed, centripetal acceleration, and diameter of basket are shown in two diagrams. The circumferential speed responsible for damage to the grains rises with an increase in the diameter of the basket, a result confirmed by examination of the specific application of power for the attainment of a specified acceleration figure. It appears more practical to effect the separation of the crystal from the molasses by employing both working screens and backing screens, with the maximum open surface area. An increase in the diameter of the basket under identical working conditions produces a greater danger of crystal damage and a greater waste of energy.

ENTRAINMENT

Theoretical considerations

By L. A. TROMP, A.M.I.Mech.E.

THE carry-over of liquid in the apparatus used for boiling sugar solutions, whether evaporators or vacuum pans, may cause considerable losses in the sucrose balance of sugar factories since, not being readily measurable, it will increase the "undetermined" losses and in addition will also contaminate the condensate.

Unfortunately, because of the varying and uncertain nature of the symptoms involved, no exact theory of the phenomena concerned has been evolved. There are nevertheless several theoretical and practical considerations, examination of which may lead to better understanding of the subject. As the boiling performance in evaporators differs from that in vacuum pans, both cases should be examined as to the causes of entrainment.

Entrainment in Evaporators

It may be said that practically all evaporators used in sugar factories nowadays are of vertical tube design, the heating and evaporating surface being composed of tubes assembled between two tube sheets and surrounded by a steel shell, thus forming the "calandria." The heating medium, steam or vapour, is admitted around and between these tubes, while the juice is boiled inside them.

In a vertical tube the evaporation increases towards the top as shown in Fig. 1, which assumes entry of the juice at boiling temperature. This drawing is according to CLAASSEN, who divided the tube length into 5 equal zones, the gauge level of the juice normally being kept within the second zone, i.e. below 40% up the tube length. Boiling causes formation of vapour bubbles which start below gauge level; because the vapour-juice mixture has a lower density than the juice this will climb as a film along the tube wall owing to displacement of the juice by vapour bubbles.

The thickness of the film will decrease towards the upper end of the tube through continued evaporation and the velocity of the juice-vapour mixture will increase, owing to the increasing volume. According to Fig. 1, the evaporation in the two lower zones does not reach 20% of the total evaporation in the tube, the third zone evaporates a little of 20%, and the two upper zones evaporate the remainder—60% of the total.

It is also interesting to note the increase in the ratio of vapour volume to juice volume which, at the mouth of the tubes, for the first body of a quintuple effect will reach about 200:1, rising to 2000:1 for the fifth body, as shown by the curves marked I and V in Fig. 1.

Because the total area of cross-section of the tubes of a modern evaporator is about 30% of the calandria cross-sectional area, it is apparent that the vapour velocity above the tube sheet V_b will be only about 33% of the velocity V_t of the emergent vapour, when streamline flow does not occur.

As a result of the surface tension of sugar solutions, bubbles of vapour form and will remain intact as long as the inside and outside pressures are in equilibrium. When this condition no longer applies,

or collision with the body walls occurs, the bubbles will explode or collapse, changing into droplets; the reverse does not occur.

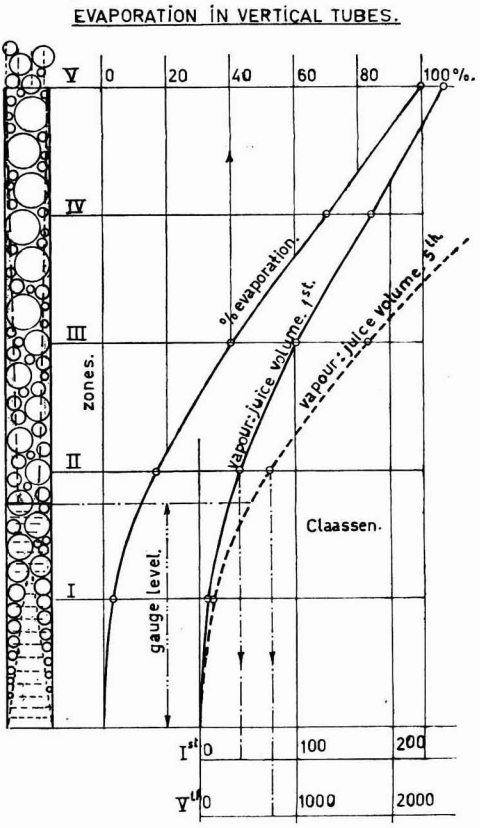


Fig. 1

When the vapour enters the vapour pipe or the inlet of the entrainment preventer mounted on the evaporator body, surviving droplets and bubbles are dragged along with it, owing to the high vapour velocity.

Flashing

This situation is somewhat modified when flashing occurs. Flashing is caused by spontaneous evaporation when the temperature of the incoming juice is higher than its boiling point under the vacuum obtaining in the respective body; it thus increases the vapour velocity V_t inside the calandria tubes. Flashing normally occurs in the bodies subsequent to the first of a multiple-effect evaporator but can also occur in the first effect when the juice is pre-heated.

For the last body of a quintuple effect the temperature difference may be about 25°C; thus from one kilogram of concentrated juice entering this body and having a specific heat of approximately 0·60, there will be $25 \times 0{\cdot}6 = 15$ kcal available for flashing.

With concentration in this body from say 56 to 66°Bx, the evaporation will be $\frac{66-56}{66}$ or 0·15 kg of water per kg of juice entering. The latent heat of water at 56°C when leaving the body is 566 kcal/kg, and the evaporation requires $0{\cdot}15 \times 566 = 85$ kcal. Thus flashing in this case accounts for $15/85 = 17\%$ of the vapour evaporated in the fifth body; in previous bodies this flashing effect is considerably less.

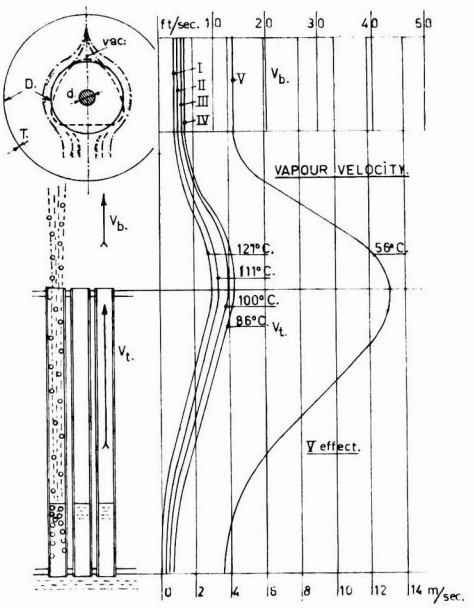


Fig. 2

Spouting as a result of flashing has been observed, aided by the absolute pressure difference between adjacent bodies, especially when syphons are omitted from the connecting juice pipes and throttling by hand is practised. An efficient juice distributing device in the bottom of the evaporator will dampen the flashing effect, but where the juice enters from a butt-ended pipe, a hammering effect may occur, which has loosened tubes in the lower tube sheet of old evaporators.

The vapour pressure will flatten bubbles and droplets on the acting side as shown approximately in the upper left-hand part of Fig. 2. Theoretically the juice particles, when ejected with the same velocity V_t as the vapour emerging from the tubes, will reach

a height $h = \frac{V_t^2}{2g}$, where g is the acceleration due to gravity (9·81 m/sec/sec). This height will not be reached in practice as the drag coefficient may be 0·30, as admitted by HAUSBRAND. With a starting velocity of say 12 metres/sec as the supposed maximum, the droplets will not be thrown higher than about 4·5 metres above the calandria, and a vapour belt height of 5–5·5 m is considered safe under *normal* conditions.

Concerning the tube diameter and tube length, it should be noted that:

(a) a *smaller tube diameter* will cause a higher vapour velocity V_t because the heating surface decreases in proportion to the diameter while the cross-sectional area of the tube decreases in proportion to the square of the diameter. Thus a reduction of the diameter by 20% will increase the vapour velocity by 0·8/0·64, i.e. by 25%.

(b) a *longer tube* will cause a higher evaporation as a result of the larger heating surface. The area of cross section being the same, the vapour velocity will increase approximately in proportion to the increase in length.

The vapour pressure acting on the droplets or bubbles is derived from the velocity head h, multiplied by the specific weight of the vapour. It is extremely small. To accelerate the droplets or bubbles, the vapour pressure must equal twice the weight of the droplets, multiplied by $V_2 = 1{\cdot}41$ times the vapour velocity.

From the graph shown in Fig. 3, the comparative drag equivalents are shown for droplets of 0·1 mm diameter; it is doubtful whether any bubbles will pass through the vapour belt as they explode readily. Nevertheless, owing to the large contact area, the bubbles will be ejected from the tubes at a velocity close to the vapour velocity V_t, but the inertia of the bubble weight will be transferred to the droplet produced when the bubble explodes, and a high droplet velocity may result.

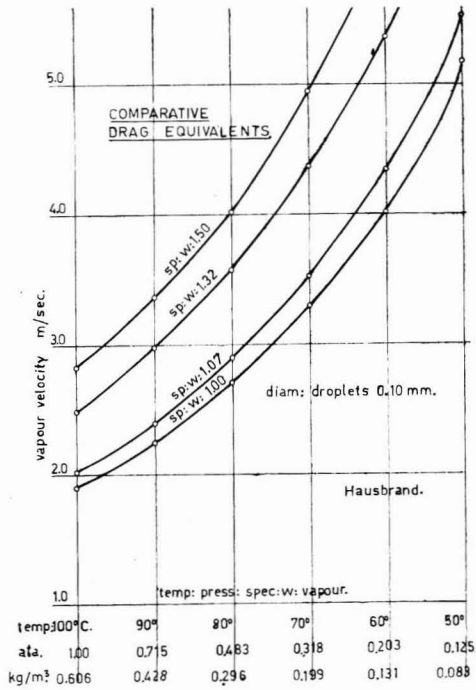


Fig. 3

From the graphs it appears that:

with *increased density* (Brix) of the juice there is less drag effect, and

vapours of a higher absolute pressure, i.e. at higher temperature and of higher specific weight, increase the drag effect.

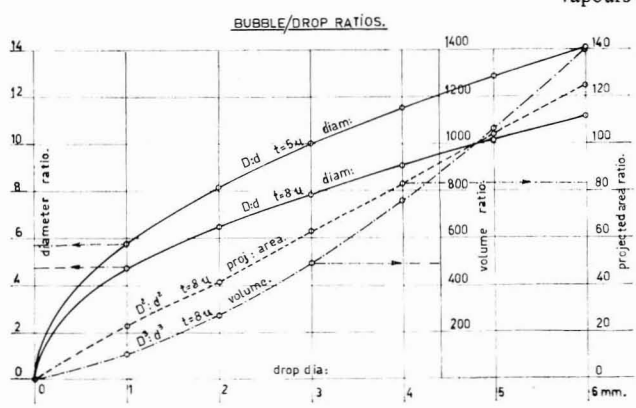


Fig. 4

It is also interesting to compare the ratios of diameter and contact area of droplets and bubbles of thes ame weight. The skin thickness of bubbles from sugar solutions is not known exactly but it may be accepted that it will be greater than for water owing to the higher surface tension of the latter.

In Fig. 4 the skin thickness T has been assumed to lie between 5 and 8μ (0·005–0·008 mm) and the following equation can be written, where d is droplet diameter and D is bubble diameter.

Drop volume = bubble surface × skin thickness

$$\frac{\pi d^3}{6} = \pi D^2 \times T$$

$$\therefore D = \sqrt{\frac{d^3}{6T}}$$

A droplet of 1 mm diameter thus corresponds to a bubble of 5·74 mm diameter when $T = 0{\cdot}005$ mm, the vapour weight inside the bubble being neglected. The corresponding areas, considering the drops and bubbles as spheres, will be in the proportion of $D^2:d^2$ while the volumes will be in the proportion of $D^3:d^3$.

It should not be overlooked that the bubble weight is always greater than the weight of displaced vapour volume, because it is the sum of the skin weight (juice) and the vapour weight inside. Consequently, bubbles will not float in the vapour belt but, owing to their large contact area, may be entrained by vapour currents, when the pressure equilibrium is not disturbed.

Summarizing, the danger of entrainment is greater in evaporators having:

(1) too low a vapour belt height,

(2) longer tubes and/or smaller diameters (Kestner)

(3) higher rates of evaporation,

(4) eruptive flashing through deficient distribution of incoming juice in the bottom of the vessel,

(5) deficient steam distribution (i.e. uneven temperature) in the calandria,

(6) varying vapour pressure (vacuum), or

(7) streamline flow in the vapour space because of bell or splash covers at a low height.

Entrainment in Vacuum Pans

The design and evaporating performance of a vacuum pan differ greatly from those of an evaporator. Observation has shown that in a vacuum pan bubble formation will usually start near the massecuite surface, and an attempt will be made to explain this phenomenon.

The differences with regard to entrainment may be summarized as follows:

(i) The calandria is always covered with syrup, molasses or massecuite and film formation does not occur.

(ii) The liquids or semi-liquids to be concentrated by evaporation are of higher density and particularly of much higher viscosity, which hampers circulation as well as heat transmission and convection.

(iii) The concentration and hydrostatic head of the massecuite above the calandria varies during the boiling process, making the uniformity of performance irrelevant.

(iv) The boiling point rise (BPR) is of greater influence and increases with the concentration of the massecuite.

(v) A lower purity requires a higher BPR for evaporation.

(vi) The specific heat of the massecuite decreases with rising concentration, and

(viii) Temperature differences between steam and massecuite are considerably higher than in evaporators.

Two phases of the boiling process will be considered; first, the initial concentration and, second, the finish of a strike of about 60 purity.

The temperature rise of the massecuite when circulating through the heating tube of the calandria may be assumed to be linear. It will be obvious that the temperature difference between steam and massecuite will be higher at the lower end of the tube than at the upper end. Owing to the relatively large tube diameter of 3½–4 inches or even greater, the highest temperature in the massecuite will prevail nearest the tube wall, falling off towards the centre of the column and also towards the massecuite above the calandria.

In Fig. 5 the heating and evaporating performance is illustrated graphically for a constant absolute pressure of 0·13 atm absolute (66 cm or 26·1 inches

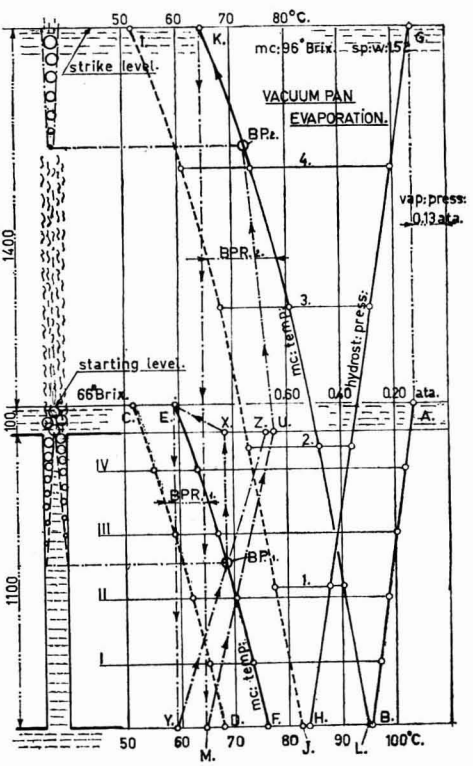


Fig. 5

of mercury vacuum), the corresponding vapour temperature at the massecuite level being approx. 51°C (the boiling temperature of water). The absolute pressures are indicated from the right-hand side, while the temperatures are from the left.

Considering the *starting level*, syrup is charged at 66°Bx (specific gravity 1·32) up to 100 mm above the calandria, which has an assumed height of 1100 mm. At "A", i.e. at the level of the liquid, the absolute pressure prevailing is 0·13 atm absolute, while at the lower end of the tube (at "B") the pressure has increased to $0{\cdot}13 + 0{\cdot}12 \times 1{\cdot}32 = 0{\cdot}28$ atm absolute, the increase being linear.

For the five sections starting at the top, corresponding pressures will be 0·16, 0·19, 0·22, 0·25 and 0·28 atm absolute. The boiling temperature of water under these pressures are 51°C at A and 55°, 59°, 62°, 65°, and 67°C for the five sections as shown on the slightly curved line C–D of Fig 5. Sugar liquors boil at higher temperatures than water at the same pressures and the boiling point rise, assumed to be 8°C for the concentration and purity prevailing, raises the boiling points to the slightly curved line E–F.

Owing to circulation in the vacuum pan the massecuite descends through the downtake to the bottom of the pan as shown by E–Y, where heating starts again. Depending on the heat transmission from the steam to the massecuite, and assuming that no evaporation took place, the temperature of the massecuite would rise from 59° to say 76°C, according to Y–Z. This rise in temperature cannot take place, however, when boiling under vacuum, because at the intersection BP_1 between E–F and Y–Z, the massecuite starts to boil and bubble formation occurs.

There is no further increase in temperature and thus at "X" the boiling temperature still prevails, from which point it drops towards the surface of the massecuite, according to X–E, owing to further evaporation.

Because the bubble formation at the beginning of the boiling process starts in the upper half of the tube length, evaporation is not so eruptive as in an evaporator, and also, owing to the concentration (and higher surface tension), droplets will be larger than with lower concentration.

Moreover, owing to the low level of the massecuite, carry-over through evaporation is, in practice, excluded under normal conditions. The vapour space of a vacuum pan, above the strike level, is usually small, although modern designs are more liberally dimensioned in this respect than formerly, so as to reduce the danger of entrainment.

At the higher concentration the boiling point rise BPR_2 is greater than PBR_1 and, furthermore, the hydrostatic pressure at the bottom end of the tubes is greatly increased through the higher specific gravity of 1·52 (at 96°Bx) and the increased head (2600 mm *vs.* 1200 mm), as assumed for the case depicted in Fig. 5.

On the right-hand side of the figure it is seen that the absolute pressure at the bottom of the tubes is 0·525 atm absolute (40 cm or 14·25 inches of mercury vacuum). The hydrostatic pressure is indicated by the straight line G–H and the corresponding boiling points for water by I–J. With an assumed boiling point rise (BPR_2) of 13°C resulting from the higher concentration, the massecuite temperature at the different levels is given by the curve K–L. At the strike level the massecuite temperature will be around 64°C and reheating of the descended flow will start at "M". Reheating is finished at "U" to about 78°C and there is no further heating through the massecuite, but as the area above the calandria is larger than the total cross-sectional area of the tubes, the massecuite temperature may drop from "U" to BPR_2 through heat diffusion. It is here that bubble formation will start. Unfortunately the temperatures at "X" and "U" are not known exactly and their measurement by means of thermocouples would throw more light on the subject.

It is however confirmed by practical observation that the point of bubble formation normally rises nearer to the massecuite level as the concentration increases. Although the danger of splashing is not so pronounced with vacuum pans as with evaporators, several conditions may be conducive to entrainment; these are:

(i) too small a vapour space above the strike level of the massecuite (the habit of some sugar boilers to finish the strike at or above the highest sight-glass must be condemned),

(ii) a sudden increase in the temperature difference between the heating steam and the vapour produced,

(iii) an intermittent heavy intake of a liquid having a lower concentration than the massecuite (especially water admitted to dissolve out false grain),

(iv) deficient intake distribution,

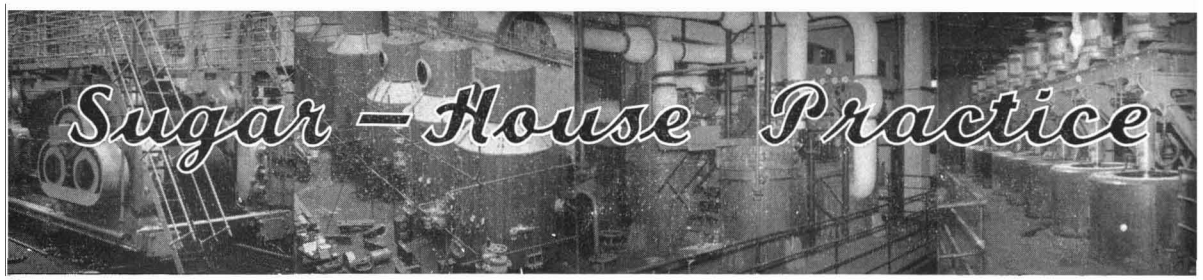
(v) uneven steam distribution in the calandria, and

(vi) overheating of the massecuite by re-starting a filled pan, after the steam supply has been cut off temporarily—bubble formation then takes place at a lower level and eruptive splashing may occur.

In coil pans with the heating surface close to the final massecuite level and where steam of high temperature is normally used, intensive formation of bubbles may induce splashing.

Conclusion

The danger of entrainment may be reduced by careful design of the evaporator vessel or vacuum pan but it cannot be eliminated completely. A safety device must therefore be provided and representative designs of such separators or catch-alls will be discussed in a corresponding article.



The drying of cube sugar. S. KOBAYASHI. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1963, **13,** 30–35.—Tests were carried out with a batch tray dryer to find the optimum conditions for cube sugar drying.

* * *

The Bach "Poly-Cell" clarifier. W. M. GRAYSON. *Sugar J.* (La.), 1963, **26,** (4), 38–40.—The design and operation of the Bach "Poly-Cell" clarifier manufactured by The Mirrlees Watson Co. Ltd. are described and its settling area compared with that of tray clarifiers.

* * *

New sugar refining process. J. R. ALBISÚA C. *Bol. Azuc. Mex.*, 1963, (166), 22–27.—A process is described and illustrated, by a flow sheet and plant layout diagram, in which investment costs are only half those of conventional refining, while adsorbent, steam, electricity and maintenance costs are reduced to a fraction of the usual. Secondary juice from the last mill of the tandem is mixed with the turbid filtrate from the vacuum filters and, like the primary juice, is sulphited cold, limed, heated and settled, the muds from each settler going to the filter. The clear primary juice is of higher purity than if mixed juice had been processed but is purified further by passing through a mobile column of granular active carbon which is removed, sweetened-off and revivified when exhausted (using a multiple-hearth Herreshoff kiln), and then returned to the head of the column. The treated juice passes through the evaporator and is boiled to the "direct-refined" *A* strike which gives an *A* molasses of the same purity as the clarified secondary juice. The latter is mixed with the *A* molasses and boiled to two further strikes. The *C* sugar is used for graining the *B* strike, while the affined *B* sugar is melted, limed and phosphated, clarified, filtered and passed through another granular active carbon column before boiling to two "indirect-refined" strikes which are cured and the sugar dried and mixed.

* * *

Central Guánica outboard roller cane carrier. N. M. ZYNIECKI. *Sugar y Azúcar*, 1963, **58,** (7), 32–33. Details and specifications are given of the cane carrier installed at Guánica which is of a type used in other industries such as the cement industry and consists of a chain and outboard rollers used to move and maintain the cane on a bed of slats. The carrier is compared with conventional types used in the factory and the advantages of longer life and less maintenance mentioned.

* * *

Special evaporator combinations. A. L. WEBRE. *Sugar y Azúcar*, 1963, **58,** (7), 37–42.—Details with heat flow sheets are given of: a quintuple-effect evaporator scheme (the so-called "Puerto Rican" system) in which the 1st effect is much larger than the other effects, since it supplies vapour to the juice heaters and vacuum pans; a quintuple-effect system where 4th and 2nd vapours are bled to the juice heaters, while the vacuum pans are heated by exhaust steam; and a sextuple-effect system.

* * *

Durban's bulk sugar terminal. J. DE K. BOSCH. *S. African Sugar J.*, 1963, **47,** 390–399.—Details are given of the bulk sugar terminal which is to be erected at Maydon Wharf, Durban. The 817 ft long silo will be of reinforced concrete, with an inverted caternary section, and will have a capacity of 200,000 tons of sugar. Sugar will be transferred to and from rail and road trucks and outloaded to ships, provision also being made for bagging of sugar for those countries without bulk handling facilities. Sugar will be conveyed via a junction tower situated at a point along the ridge of the roof and will be discharged onto a reversible conveyor which will discharge at either end of the silo onto a shuttle conveyor. This will distribute the sugar via a thrower to any point along the length of the silo. A series of louvred hoppers located centrally in the floor of the silo will allow sugar to be reclaimed from any part of the silo by gravity flow, the hoppers discharging to a conveyor running below the silo floor and ending at a junction pit, whence the sugar will be conveyed to the top of the Servo-Balans weighing tower before passing to the wharfside conveyor gantry. When required, sugar will be diverted from the reclaim conveyor to another junction tower which will discharge it to hoppers in the building housing the bagging unit and sack store. This plant is designed to weigh and bag sugar (210 lb bags) at the rate of 100 tons/hr. A combined road and rail truck weighbridge is provided as well as electric ship loaders. Closed-circuit television will be used for central operations control.

* * *

First South African-designed vacuum pans in operation. ANON. *S. African Sugar J.*, 1963, **47,** 419.—A general description is given with a diagram of the floating-calandria vacuum pan manufactured and designed by Elgin Engineering Co. (Pty.) Ltd. who have installed the first ones at Riverview (Zululand) factory of Umfolozi Co-operative Planters Ltd. The advantages claimed for the pan are a 25–50% reduction in boiling time and a 20–30% increase in the heat transfer rate per sq. ft. of heating surface. The pan has a capacity of 1600 cu. ft. for *C* massecuite and a heating surface of 2400 sq. ft.

Results of experiments with "Busan 881" for mill sanitation. E. C. VIGNES and R. DE FROBERVILLE. *Ann. Rpt. Mauritius Sugar Ind. Res. Inst.*, 1962, 89–92.—Tabulated results show that at 15 p.p.m., "Busan 881" organo-sulphur bactericide did not significantly affect the purity drop or glucose ratio from crusher juice to mixed juice at two factories, i.e. it did not prevent the growth of micro-organisms. It is suggested that this was due to the high standard of sanitation maintained at the factories where regular hot water washing of the mill housings keeps slime formation to a minimum, cleaning being continued throughout a week-end shut-down.

* * *

Notes on the performance of rotary vacuum filters. H. F. WIEHE. *Ann. Rpt. Mauritius Sugar Ind. Res. Inst.*, 1962, 92–94.—Comparison of the filtration performance at a number of factories showed that one factory sustained a sucrose loss in filter-cake of only 32 kg/100 tons of cane as opposed to 61 kg/100 tons in other factories, although it used less sweetening-off water than the others. It uses 0·65% bagacillo on cane in its filter feed compared with an average of 0·42% for the others, however, and it is recommended therefore that to achieve high overall filter performance, adequate amounts of bagacillo should be used and a strict chemical control maintained at the filter station.

* * *

Experiments on the curing of low-grade massecuites in high-speed centrifugals. J. DUPONT DE R. DE SAINT ANTOINE and H. F. WIEHE. *Ann. Rpt. Mauritius Sugar Ind. Res. Inst.*, 1962, 94–95.—At Mon Loisir factory, it was found preferable for the 1700 r.p.m. fully-automatic low-grade centrifugals equipped with Ward-Leonard drives to attain top speed in 3 rather than 4 min, since the greater acceleration does not affect the quality of the sugar and a 6% capacity increase can be achieved at a total cycle time of 15 min. The machines had 25–30% more capacity than centrifugals of the same dimensions operating at 1450 r.p.m. The higher-speed machine can cure more viscous massecuite than the lower-speed machine and the massecuite may therefore be re-heated to a lower temperature before curing. A *C*-sugar purity of 85 or higher is obtainable as compared with a maximum purity of 82 in the 1450 r.p.m. machines, thus reducing the recycling of molasses. It appears possible to reduce the molasses sugar considerably by reducing to 60°C or lower the temperature of the water used to re-heat the final massecuite.

* * *

Results of tests carried out with a DSM screen on mixed juice. M. RANDABEL. *Ann. Rpt. Mauritius Sugar Ind. Res. Inst.*, 1962, 98–99.—The performance of a Dorr-Oliver DSM stationary screen[1] was compared with that of a vibrating screen at Mon Loisir and found to reduce the bagacillo content of mixed juice to a level half that from the vibrating screen. The other advantages are claimed to be low maintenance costs and ease of cleaning.

* * *

An automated clarification system. A. J. ANCONA and F. DIDONATO. *Proc. 22nd Ann. Meeting Sugar Ind. Tech.*, 1963, 75–94.—Details are given of the melt liquor clarification system at SuCrest Corp. and its development. The liquor is treated with phosphoric acid and lime saccharate and sent to a 600-gal holding tank, the flow being automatically regulated by a level controller. The addition of phosphoric acid is controlled by a Fischer & Porter flow-ratio mixer and lime saccharate addition, to maintain a pH of 6·9–7·2, is regulated by a proportional-reset controller. The mixing is divided into four phases. Controlling the feed of the chemicals reduced lime consumption by 14·5% and phosphoric acid consumption by 21%. The ash content of the clarified liquor was reduced by 25%, compared with 10% with the previous manual arrangement, and colour removal was 36% instead of 25% originally. From the holding tank the liquor is transferred via a Moyno pump, where aeration takes place, to specially designed clarifiers. These are provided with heating surfaces and steam at 10–15 p.s.i. is used for heating, the clarifier temperature being regulated within the range 175–180°F by a set-point dial controller which positions an automatic steam valve. The clarifier level is also automatically controlled as is liquor discharge. A mechanical scum remover makes a complete sweep of the clarifier surface in 1 hr, the mud being discharged to a trough, thence to an agitator-fitted storage tank, from which it is sent to the filters on demand. The clarifier throughput is 150 g.p.m. Colour removal has averaged 70·6%, i.e. an improvement of 65% on the original system, and invert formation has been reduced by 80% compared with the previous system.

* * *

The technique of white sugar crystallization supplemented with vacuum pan tests. A. L. WEBRE. *Proc. 22nd Ann. Meeting Sugar Ind. Tech.*, 1963, 86–100.—The three phases in the boiling of white sugar massecuite are discussed and tests with three pans at different refineries are appraised. It was found that heat transmission is a better measure of pan efficiency than the rate of steam consumption. Boiling efficiency can be improved by installing a vent in the condensate drain pipes. Mechanical circulation is recommended since with this no material difference was found in heat transmission between that using 5 p.s.i. steam and using 10 p.s.i. steam, the boiling time being respectively 99 and 80 min. A steam flow meter is also advocated, since this would enable maximum steam flow to be used; during the tests the heat transmission in the third phase of boiling was double that of a pan not provided with a steam flow meter.

[1] *I.S.J.*, 1961, **63**, 253.

Study of heat transfer in sugar factory (juice) heaters. N. YU. TOBILEVICH, I. I. SAGAN' and V. T. GARYAZHA. *Sakhar. Prom.*, 1963, (10), 20–29.—Tests were conducted on factory juice heaters and on experimental units. Several graphs are presented based on the results and demonstrating the effects of the heater time cycle (days) on the coefficients of heat transfer (K), heat flow resistance (R) and heat surface utilization (ϕ). Values of the last were found to be always less than those recommended, except for raw and circulation juice. The amount of scale deposited fell with increase in the juice circulation rate, increasing the values of K and ϕ.

* * *

Loading fresh pulp into road transports. P. V. GLAVATSKII. *Sakhar. Prom.*, 1963, (10), 39.—The water is separated from fresh pulp by passing it via a tower provided with screens to a rake conveyor, which is also provided with a perforated trough. The conveyor unloads the pulp into road trucks standing below. The pulp quality is not impaired and silo storage is better than with the use of presses.

* * *

Device for automatic control of boiling of refined sugar massecuites. S. I. SOKOLOV. *Mekhaniz. Avtomatiz. Proizvod.*, 1962, (4), 33–34; through *S.I.A.*, 1963, **25,** Abs. 747.—Components of the fully automatic system are shown in photographs, and consist of a B.P.E. recorder (with an attached water vessel and simple mechanical computation of the temperature difference), a device for introducing seed crystals, a massecuite stiffness indicator with rotating vanes, and a programme control box. A massecuite level indicator is also provided. The sequence of automatic boiling is described. Tests at Mantulin refinery, Moscow, have shown that the system is suitable for the manufacture of pressed cubes, owing to the uniform size of the crystals.

* * *

Some considerations on the place of ion-exchange in beet sugar manufacture. G. B. AIMUKHAMEDOVA, M. I. DAISHEV and K. P. ZAKHAROV. *Izv. Akad. Nauk Kirgiz SSR, Ser. Estestv. i Tekh. Nauk*, 1962, **4,** (6), 11–15; through *S.I.A.*, 1963, **25,** Abs. 749. The advantages of ion-exchange purification of beet molasses[1] over the system of ion-exchange purification at the thin juice stage are considered. The molasses purification process is likely to be more economical since it can be operated all the year round, provides valuable by-products in addition to the recovered sugar and has fewer technical difficulties. The yield of these by-products is higher than that obtained from vinasse or Steffen's wastes. The contents of sucrose and invert sugar in the purified sugar solution are 6–10·5% and 0·7–1·8% respectively at a purity of 70–82 (sucrose) or 88–94 (total sugars).

* * *

A contribution to the discussion on the steam jet compressor as a heat pump in multiple-effect evaporation with special reference to the sugar industry. N. HINDEFELT. *Socker Handl. I*, 1962, **18,** 37–53; through *S.I.A.*, 1963, **25,** Abs. 784.—The theory of steam jet ejector operation and its application to quintuple-effect evaporation are discussed. Tests of an ejector at Jördberga factory, Sweden, in 1959 as a thermocompressor for 1st effect vapours are reported. A steam saving of 1% on beet was obtained.

* * *

Latest equipment for filtration in the sugar industry. R. BERLINE. *Ind. Alim. Agric.*, 1963, **80,** 769–774. Descriptions are given of some filtering equipment, for 1st and 2nd carbonatation juice as well as syrup, without mention of the manufacturers' names.

* * *

One week at Dinteloord. M. MOUCHET and R. MOUCHET. *Ind. Alim. Agric.*, 1963, **80,** 778–794.—A fully illustrated description is given of the equipment and processes at Dinteloord (Holland) factory[2] of Verenigde Coöperative Suikerfabrieken G.A. This is the largest beet sugar factory in the world, with a daily slice of 10,000 tons.

* * *

Experimental evaluation of sugar losses of microbial origin in diffusion. P. BIDAN, M. BLANCHET and J. GENOTELLE. *Ind. Alim. Agric.*, 1963, **80,** 717–720. Two replica-scale DdS diffusers were used in tests to evaluate the sugar losses due to bacterial contamination. One was maintained sterile throughout the tests by adding formalin (500 g/ton of beet) and both were operated at 60–65°C average temperature, the cossette feed rate varying from 20 to 50 kg/hr. The tests were conducted during two campaigns for a duration of 10–50 hr per test. Where there was bacterial development and slight lactic acid production, the sugar losses were 0·5–1·0% of the original sugar without any drop in pH. Over a longer period, where there was marked lactic acid production and a period of fermentation, with a fall in pH, the losses were as high as 2·9% of the original sugar with a pH drop to 5·2–5·0. With poor cossette exhaustion (2% residual sugar on beet) there was little difference between the sugar extractions for the two diffusers. However, with the normal factory exhaustion of the

[1] *Cf. I.S.J.*, 1964, **66,** 164.
[2] *I.S.J.* 1956, **58,** 332–334.

order of 0·2–0·3% residual sugar, the losses corresponded to the difference in weight of extracted sugar for the two diffusers. The main factors affecting sugar losses in diffusion are: temperature, juice and cossette retention time and the concentration of sugar in the juice. Some tabulated test data demonstrate the effects of these factors.

* * *

Rationalization of the beet feeding system and of 2nd class waste water purification. D. G. GRINFEL'D. *Sakhar. Prom.*, 1963, (10), 11–14.—The conventional system in Soviet sugar factories for beet feeding (pile—flume—beet pumps—overhead flume—washer —elevator—slicers) is criticized and a new scheme described in which the washing section is located outside the main body of the factory near the beet piles. The length of flume is reduced to the shortest possible necessary for trash and stone traps. Two washers are used, the first with a lower level of water (so-called "semi-dry") and the second the normal type of washer, in which 6 mg of chlorine are added per litre of flume-wash water. A combined washer is also planned for the future. The scheme is expected to reduce sugar losses and difficulties associated with inadequately cleaned beet. Water purification equipment should be located in the beet wash section, hydrocyclones for this purpose being sited on the 2nd floor and the tanks and pumps on the 1st. The length of water feed pipes to the settling tanks and thence to the fields should be reduced. Comparative building costs are tabulated for conventional schemes and the scheme described and an approximate saving in sugar calculated for the latter.

* * *

Unsatisfactory design and poor operation of VTs-58 evaporators. A. F. YAKIMOV. *Sakhar. Prom.*, 1963, (10), 14–20.—Defects in the design and operation of Soviet VTs evaporators are discussed. They include clogging of pipes through caramelization; inadequate downtake area, causing juice circulation difficulties (this should be 25–30% of the total boiling tube area); and excessive vapour flow rate leading to high entrainment losses. Suggested remedies are discussed, including increasing the heating surface by using an external downtake.

* * *

Ion exclusion purification of sugar juices. L. NORMAN, G. RORABAUGH and H. KELLER. *J. Amer. Soc. Sugar Beet Tech.*, 1963, **12**, 363–370.—Information is given on the fundamentals of ion exclusion with reference to the possibilities of applying this on a commercial scale to thick juice purification. A description is given of the Higgins continuous contactor[1] as adapted for ion exclusion of juices. The contactor comprises a circuit (an 8-inch dia. loop has been used in certain pilot-scale tests) most of which is filled with resin ("Dowex 50-W" in the salt form), the section between the two ends of the resin charge being filled with water. The resin is moved along the loop in "pulses", i.e. for a definite, pre-fixed distance in positive displacement motion, by introducing water at 60 p.s.i. into the resin-free section, valves at each end being closed and opened, respectively, to allow this. The water displaced by the resin is discharged at a point above the resin-free section and can be re-used. When the "pulse" is completed, operation of valves allows the resin to settle back to the previous position before the next "pulse". Feed is introduced on the opposite side of the circuit from the side containing the resin-free section, the sucrose preferentially entering the resin beads while the impurities remain in the liquid stream. The resin beads (and sucrose) are carried along the circuit by the "pulses", while a counterflow of rinsing water strips the sucrose from the beads, the purified solution being withdrawn at a point intermediate between juice feed and rinse inlet. The impurities are carried back along the circuit by the combined effect of feed plus rinse minus product withdrawal, and is discharged as waste at a point before the feed inlet, the part of the circuit between feed and waste being the "loading" section. Careful attention must be paid to liquid flow: resin volume ratios and to resin movement to achieve satisfactory separation. The advantages of ion exclusion are enumerated, while also listed are the criteria for economical juice purification by this process.

* * *

Effect of solids recirculation on purification of raw juices. F. GALE. *J. Amer. Soc. Sugar Beet Tech.*, 1963, **12**, 378–392.—The effect of the recycling of calcium carbonate particles on raw juice purification is discussed with descriptions of a number of modifications to the Dorr carbonatation system, which includes solids recycling. Schemes incorporating Brieghel-Müller pre-liming and solids recirculation have resulted in better settling and filtration, giving a juice of improved colour and reducing the lime consumption. A scheme developed in Italy includes re-pulping of the 1st carbonatation filter-cake with clean water, pumping the slurry through a battery of "DorrClones" (Dorr-Oliver hydrocyclones) and returning the under-flow (which contains clean calcium carbonate) to the raw juice before heating and liming. The "DorrClones" classify the suspended solids in the slurry and reject the fines, which are chemically and physically the most harmful in carbonatation. In one variant of the scheme a factory obtained a 40% reduction in lime consumption. A simplified materials balance is given for a factory with a daily slice of 2000 tons of beet.

* * *

Suitable selection of feed water preparation. H. ANDERS. *Zucker*, 1963, **16**, 562–564.—The treatment of boiler feed water to prevent corrosion, especially by CO_2 from bicarbonates, is discussed with particular reference to the use of hydrazine, which increases the alkalinity of the system. While ammonia is suitable in many cases, in some it has harmful effects.

[1] U.S.P. 2,815,322.

Boilers treated with hydrazine have been found to be cleaner and more efficient than those treated with sodium sulphite. It is emphasized that there must be adequate excess of hydrazine to maintain the condensate pH at 8·5–9·0, and it should be added continuously. Hydrazine dinaphthylmethane disulphonate is better than hydrazine itself because it reacts more reasily with dissolved acids.

* * *

Pure water to the drain. G. HELMKE. *Zeitsch. Zuckerind.*, 1963, **88**, 568–569.—To reduce the amount of impure water going to the drain, the following scheme is suggested : pulp is first pressed to 10% dry solids and the water used for diffusion. The wet pulp (55% on beet) is then pressed to 18–19% solids and the resultant pressed pulp (30% on beet) sent to the dryer. The press water (25% on beet) of 0·6% sugar content is mixed with unsweetened-off muds (6% on beet) of 7% sugar content and 1·5% CaO on beet is added. The purified press water (25% on beet) at 1·84% sugar content and pH 7 is mixed with molasses (2% on beet) and concentrated in a special evaporator to molasses consistency, giving a final molasses yield of 2·8% on beet. The advantages of the scheme include higher purity diffusion water, reduction of load on defecation, etc. Part of the press water-mud mixture (at least 10%) could be returned to the exhausted cossettes before the presses. A scheme is also suggested for using condenser water and beet wash water in diffusion.

* * *

Cross-flow extraction. D. SCHLIEPHAKE and A. WOLF. *Zucker*, 1963, **16**, 587–596.—The theory of cross-flow diffusion (as adopted in the De Smet diffuser) is examined mathematically and formulae are derived for calculating the extraction processes by compartments. Calculated results compare well with determined values and graphs are presented of juice pol *vs.* diffusion length (by cells). For ease of calculation, a diagram is given of the extraction characteristic (C_m = the average dimensionless concentration in cossettes on discharge from one cell to the next) *vs.* $K.t_z$, where K = the mass transfer constant (sec^{-1}), t = total diffusion time (sec) and z = number of cells.

* * *

Effect of length of beet storage on the activity of ferments and the trisaccharides, organic acids and amino acids contents. M. Z. KHELEMSKII, E. A. VOROB'EVA and M. L. PEL'TS. *Trudy Tsentr. Nauch.-Issled. Inst. Sakhar. Prom.*, 1963, **11**, 18–31.—In beet stored from October to March at 0–2°C electrophoresis and paper chromatography revealed that after remaining constant in the initial period, the catalase activity then decreased; peroxidase was more active in November-December than in February-March, while the level of invertase activity rose during storage until February, then remained constant. Kestose was detected in freshly harvested beet, and in juice from Kiev region its content was 50% higher than that of raffinose. The contents of both trisaccharides rose at an increasing rate with increase in the storage period, the amino nitrogen content remaining constant and acid nitrogen falling. There was a considerable fall in the glutamic acid nitrogen. With prolonged storage, the total organic acids content first rose, then fell from February onwards. The purity of juice from beet processed in January-February was higher than at both extremes of the storage period, and the total purity drop was 0·5% after 150 days' storage. No microbial infection occurred at the test temperatures.

* * *

Effect of the temperature factor on the change in beet quality during storage. M. Z. KHELEMSKII, N. T. POEDINOK and M. L. PEL'TS. *Trudy Tsentr. Nauch.-Issled. Inst. Sakhar. Prom.*, 1963, **11**, 31–44.—Long-term storage of beet (144–164 days) at various temperatures and at 92–98% R.H. in wooden boxes in special rooms from October to March demonstrated the advantages of freezing the stored beet. At —16° to —17°C the chemical composition and technical quality of the beet remained almost constant and the daily and total sugar losses (0·002% and 0·27% on weight of beet, respectively) over 164 days were the lowest for the four temperature ranges (the others were —3 to —4°, 0–3°, and 10–11°C). The total weight loss was 3·86% on weight of beet, while the activity levels of invertase, peroxidase and catalase were approximately the same as in unstored fresh beet. There was negligible accumulation of reducing substances and of Ca salts in thick juice from the beet, the purities of the raw juice and thick juice remaining almost the same as with fresh beet and the colour of the thick juice not rising appreciably. There was a 200–400% increase in the raffinose and kestose contents when the beet were first frozen, although there was only slight further change during storage. The organic acids content rose both during freezing and during storage, although this did not affect the technical quality of the beet after storage. At 0–3°C the daily sugar losses were only 0·004% during 150 days' storage and the other factors discussed above were of comparatively low proportions although higher than with the frozen beet. Appreciable accumulations of trisaccharides did not affect subsequent processing. Long-term storage at —3 to —4°C caused slight freezing, but any subsequent slight rise in temperature even over a short period caused thawing and deterioration in the beet. The daily sugar losses over 144 days were 0·008%. During storage at 11°C all the factors were far worse than at the other three temperature ranges (daily sugar losses of 0·019%). However, further tests at this temperature are recommended, since the relative humidity was low (68–70%) and at higher values the temperature effect is less noticeable. The effect of humidity on the various factors should also be studied.

LABORATORY METHODS AND CHEMICAL REPORTS

Some data on the effect of diffusion temperature and pH on juice quality. J. HENRY, R. VANDEWIJER and R. PIECK. *Sucr. Belge*, 1963, **83**, 1-14, 57-65.—Laboratory diffusion tests using beet of two varieties were continued[1] during the 1962 campaign and the results expressed in graph and tabular form. The values of the various factors in 1962 (quantity of flocculate and galacturonic acid, ash and albumin content and filtration rate) were all higher than in 1960; all but the last (which fell) increased with higher pH and higher temperature.

* * *

The structure of aqueous sucrose solutions. D. SCHLIEPHAKE. *Zucker*, 1963, **16**, 523–528.—Modern theories on molasses formation are based on complex interaction between sucrose, non-sugars and water in which hydration of the dissolved substances is decisive. Because of the difficulties of discussing the hydration effects with so many components without knowledge of the hydration of pure sucrose, formulae were derived for calculating the "apparent" hydration number and volume restriction (volume of water—water of hydration) of pure sucrose at infinite dilution. The sucrose molecules are considered under these conditions to be in a hydration equilibrium. The calculated values were very close to measured values, as was determined from viscosity and water activity measurements. Deviation occurred between the calculated and determined values at a sucrose concentration above 40% (by weight) when association structures are formed and the effects of hydration predominate. Three types of water molecules in the solution are suggested: free solvent, compressed hydration water, and bound water. It is suggested that with increasing concentration the dissolved molecules have an increasing mutual effect, i.e. the way is paved for an association structure. This is attributed to the fact that the solvent ceases to envelope the sucrose molecules completely and the sucrose molecules, drawing nearer together, exert sufficient tension on the hydration layer for the volume compression of the hydration water to decrease. The association structure does not extend over the complete solution but merely surrounds groups, so-called "clusters," the size of which depends on concentration and temperature. With further decrease in the water content, the solution becomes a melt, with very slow diffusion movement. With a rise in concentration, non-sugars present, particularly ions with a symmetrical charge distribution, insinuate themselves between the sucrose associates, so that they attract an increasing amount of the external hydration water for purposes of their own hydration. By hindering free movement of the associates, they raise the stability of the solution. This prevents or retards crystallization. If these ions are present in very small concentration, they will only remove water, i.e. reduce the solubility. The second category of substances which reduce sucrose solubility up to a high concentration also has a great tendency to hydration, but because of spatial hindrance or spatial charge distribution they act as bridge molecules. They remove water without stabilizing the solution and thus have a salting-out effect.

* * *

On the Amadori re-arrangement products in the final molasses from Taiwan raw sugar. A. KAGAYA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1963, 13, 1–6.—Specially prepared molasses solution was passed through a column of "Dowex 50W" (H^+ form) in series with a column of "Amberlite IRC-50" (H^+ form) and a strongly reducing substance was eluted from the first column with trichloroacetic acid solution. The eluate was passed through "Dowex 50W" which was then eluted with NH_4OH. The two peak fractions were concentrated and subjected to paper chromatography using 6:4:3 butanol: pyridine: water as solvent. By comparing R_g values with those of reference standards, the two fraction were found to contain N-substituted 1-alanine-1-deoxy-2-fructose and N-substituted 1-glycino-1-deoxy-2-fructose respectively.

* * *

Application of gas chromatography in the sugar industry. I. Separation of monosaccharides. T. NISHIO. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1963, **13**, 17–21.—QF-1-0065 (fluoroaltyl silicone polymer) was compared with SE-30 (manufactured by the General Electric Co.) as a stationary liquid phase in the gas chromatography of acetyl derivatives of monosaccharides. While both were equally effective in the isolation of stereo-isomers of pentoses, QF-1-0065 is not effective in the isolation of hexoses if the position of the acetyl bases and the peaks of the chromatogram are the same. In a column of QF-1-0065, fructose decomposed at 225°C in a hydrogen stream, so that peaks cannot be obtained. However, it can be analysed at 179°C in an N stream.

* * *

On the behaviour and change of nitrogen-containing compounds in refinery process. A. KAGAYA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1963, **13**, 7–16.—Nitrogenous compounds occurring in refining were studied by analysis of total N and amino-N and use of ion exchange. With Taiwan raw sugar, 60% of the original raw liquor containing low-grade sugar re-melt was removed by carbonatation, decolorizing and ion exchange treatment, while the total N concentration was reduced to 50% of that in the original. It was found that affination removed more of the smaller molecule N compounds, while carbonatation and active carbon decolorization removed more

larger molecules. Anion exchange resin adsorbed the smaller molecules. Whereas the distribution ratio of Cl^- in syrup to that in massecuite changed little with massecuite purity, in the case of N compounds it fell sharply with purity drop. The rate of fall in total N and Cl^- content of a sugar with washing indicated that it contained a preponderance of small molecule N compounds. The total and amino-N content of soft superior sugar before and after storage at 4°C for 45 days was found to be unrelated to its browning, which was also independent of any difference between the total N content and the amino-N content; this indicates that the N-containing substances present are only a minor factor in browning.

* * *

The coloured substance in thick juice of a beet sugar factory. T. YAMANE and K. SUZUKI. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1963, **13**, 37–41. The coloured substance removed by regeneration with NaCl solution from a bed of "Amberlite 401" (Cl^- form) used to decolorize thick juice was examined. The regeneration effluent was concentrated and deashed by passing through "Retardion 11 A8" ion exchanger and by dialysing. After vacuum distillation and drying, the substance obtained was decomposed by oxidation and hydrogenation using the procedures of BINKLEY[1]. Acid hydrolysis was also used to identify the amino acid components. Paper chromatography gave results almost identical with those of BINKLEY[1] and some of the amino acids and polyols identified were also found by YAMANE & ONDA[2], from which it follows that the colour substances found in juice and liquors in beet and cane sugar factories as well as refineries consists of almost the same types of amino acids combined with reducing sugars[3]. Comparison of the empirical formulae of the recurring component in the thick juice coloured substances as deduced by the present author, BINKLEY[1], and YAMANE & ONDA[2] shows that the N content in the present author's formula is approximately double that in the other two; this is attributed to a much higher amino acid content and lower reducing sugars content in beet sugar products than in cane products.

* * *

Improving the method of determining the colour of sugar products. S. Z. IVANOV, A. R. SAPRONOV and V. G. CHERNIKINA. *Sakhar Prom.*, 1963, (10), 5–11. Six different Soviet photometers (three visual and three photoelectric) were compared and the FEK-N-57 (or FEK-56) with interference light filters found to be the most suitable for sugar factory work. The properties of interference filters are discussed. The spectral characteristics of various glasses and solution were determined and the 1-normal glass of the KSM colorimeter produced in 1961 recommended as a unit of sugar solution colour, the glass being expressed in units of optical density. The optimum wavelength in the visible spectrum for sugar factory work, particularly for weakly coloured solution, is 420 mμ. For dark solutions, green filters ($\lambda = 540$ mμ) are recommended. To express optical density in °St, a coefficient of 0·210 instead of 0·160 is recommended. K_2CrO_4 in 0·05N KOH solution or $CuSO_4$ and $CoSO_4$ are recommended as standards for photoelectric instruments. Graphs and tabulated test data are presented.

* * *

A problem deserving attention (Beet sucrose determination). E. M. GRITSENKO, N. I. GRIZODUBOV, G. F. TYAZHELOVA, G. I. STASEEV and Z. A. MIL'KOVA. *Sakhar. Prom.*, 1963, (10), 28–33.—Numerous tests have shown that polarimetric determination of sucrose in stale beet can give inaccurate results. Comparison with iodometric determinations shows that this discrepancy also occurs in all the beet products; the higher the purity of the product, the smaller is the difference between the two measurements. The inaccuracy of the polarimetric method is increased by freezing and thawing of the beets and by various effects of putrefaction, and is a direct result of accumulation of dextro-rotatory substances.

* * *

Simplifying analysis of sugar factory products by the 1:1 dilution method. N. A. ARKHIPOVICH, V. N. BONDAREVSKAYA and V. P. PODKOLZINA. *Sakhar. Prom.*, 1963, (10), 33–34.—To reduce possible errors, the three weighments usually required in the 1:1 dilution method are eliminated. After dry solids determination (in juice, refractometrically), 50 ml of the solution is poured into a 100 ml flask, the clarifying agent added and the solution made up to volume, filtered and the pol determined. The sucrose content of the original product is given by

$$1{\cdot}04 \frac{\text{pol of solution}}{\text{density of solution}}$$

* * *

Separation of ketose and aldose by chromatography on an ion-exchange column. S. ADACHI and H. SUGAWARA. *Arch. Biochem. Biophys.*, 1963, **100**, 468–471; through *S.I.A.*, 1963, **25**, Abs. 763.—Solutions of fructose, glucose, sucrose and other mono- and disaccharides in 75% *n*-propanol were added to a column of "Amberlite IRA-400" strong anion-exchange resin (bisulphite form). Fructose and other ketoses, including sucrose, were eluted with 75% *n*-propanol. The elution was continued (after ~3 bed volumes, particle size 0·2–0·4 mm) with water to remove glucose, maltose and galactose. The sucrose peak overlapped with the fructose and glucose peaks, but separation of the two latter sugars was complete.

[1] *I.S.J.*, 1957, **59**, 64; 1958, **60**, 165.
[2] *I.S.J.*, 1960, **62**, 200.
[3] *See also* CARRUTHERS *et al.*: *I.S.J.*, 1962, **64**, 343.

Bacteriological problems of sugars. L. COIGNERAI-DEVILLERS. *Ind. Alim. Agric.*, 1963, **80**, 695–701.—A survey is presented of bacteriological problems in the production and storage of sugar and in connexion with the use of sugar in other food industries. The forms of degradation of sugars containing 6 and 12 carbon atoms and of starches and celluloses are enumerated and the bacteria involved are named. Bacterial contamination in the factory covers diffusion and pan boiling as well as more general danger areas such as machinery, waters, and the air. Studies of the storage problem have shown that while jute sacks are liable to serious contamination, polyethylene and kraft paper bags are practically free from bacterial infection. Some of the more important bacteria in the sugar-consuming industries, particularly the soft drinks and canning industries, are noted.

* * *

Colour substances in thin juices and molasses. V. PREY, E. HAMMER and W. BRAUNSTEINER. *Zeitsch. Zuckerind.*, 1963, **88**, 371–376.—The colour substances in thin juice and molasses samples were adsorbed on "Asmit 261" ion exchange resin and eluted by NaCl. The eluates were then concentrated under vacuum and by means of an electrolytic lag process with "Retardion 11 AB" resin were separated from the salt and divided into two clearly different fractions —a black and a yellow fraction. The black fraction was hydrolysed and subjected to paper and thin layer chromatography. The results of the qualitative analyses are tabulated and show that the compositions of the black fractions from thin juice and molasses were almost identical; glucose, fructose and glyceraldehyde as well as dihydroxyacetone were present. Hydrogenation of the colour substances gave mannitol, sorbitol and glycerin. The yellow fractions from the molasses and thin juice were also very similar. In the case of the molasses, the composition was: 46% ash (44% Na, 0·6% Ca and 0·1% K), 26·5% lactic acid, and the remainder amino acids.

* * *

An improved paper chromatography method for the determination of raffinose and kestose in beet root samples. S. E. BICHSEL and J. R. JOHNSON. *J. Amer. Soc. Sugar Beet Tech.*, 1963, **12**, 449–454.—With the procedure described, a 200–300 g sample of rasped pulp is blended at high speed in water, the resultant slurry filtered and 50 ml of the filtrate clarified with basic lead subacetate. The clarified solution is applied to chromatography paper and 4:1:5 *n*-butanol: glacial acetic acid: water (v/v) used as solvent. After 16–18 hr, paper strips containing standard and unknown spots are developed with a solution consisting of 0·5 g resorcinol and 15 g trichloracetic acid in 100 ml anhydrous ethyl acetate. The kestose is evaluated by dividing the raffinose equivalent (found by reference to a standard curve) by a factor of 2, since the resorcinol reacts only with the fructose moiety in the raffinose and kestose contains two fructose molecules. Cations and anions in the clarified solution do not affect the resolution of carbohydrate mixtures.

* * *

Filtrability of clarified juice in relation to quality of raw sugar. E. E. COLL, J. J. FRILOUX, N. A. CASHEN and W. F. GUILBEAU. *Proc. 22nd Ann. Meeting Sugar Ind. Tech.*, 1963, 18–24.—In tests using the "Millipore" membrane filter and the modified Elliott method, no correlation was found between clarified juice filtrability and raw sugar filtrability, although very good correlation was established between the syrup and raw sugar filtrabilities as determined with the "Millipore" filter, which is thus considered superior to the Elliott filter in predicting refinery performance. Physical or chemical changes apparently affecting filtration and which occur during concentration from juice to syrup are probably due to variation in juice composition rather than to clarification efficiency. Factors possibly affecting raw sugar filtrability are listed.

* * *

Method of raw sugar analysis for evaluation of refining quality. C. W. BEAL. *Proc. 22nd Ann. Meeting Sugar Ind. Tech.*, 1963, 34–53.—New procedures developed at Crockett refinery for determining filtrability, crystal colour and grain size are described. A common washing or affining procedure has also been developed which is similar to that proposed by KNOWLES[1] and in which a nearly saturated syrup is used for mingling followed by an alcohol rinse. Illustrations are given of a pressure filter with horizontal septum which has replaced the Elliott filter. A previously mixed 50% sugar solution containing 1% filter-aid (on weight of sugar solids) is used. The filtrate is separated into a cloudy portion, filtered during the first ½ min, and a clear portion filtered during the next 4½ min. The filtrability is expressed as the total weight of filtrate. Details are given of the design features and of the filter accessories. The clear filtrate is used for colour determination with a Beckman colorimeter at 420 mμ, the result being expressed as the attenuation index at this wavelength × 10. Comparison of the colour and turbidity measurements using septums of different pore sizes showed that "Filter-Cel" removed almost as much turbidity as a 0·2μ "Millipore" filter and also seemed to remove little colour. The turbidity remaining in the filtrate can be disregarded for routine colour determinations. The washed sugar obtained from the new affination procedure is suitable for grist size determination, but the method described is suitable only for small grain. The total time taken to determine grain size, colour and filtrability has been reduced to an average of 1 hr (two samples running simultaneously) from a minimum of 2½ hr. Because of generally good agreement between results, the procedure has been adopted by California & Hawaiian Sugar Refining Corp. and the H.S.P.A. Full details of the procedure are appended.

[1] *I.S.J.*, 1950, **52**, 195–196.

BY-PRODUCTS

Feed ingredient orphan earns status in industry. W. W. HALL. *Sugar J.* (La.), 1963, **26,** (4), 32–34. The use of cane molasses, the "orphan" in the title, as a fodder ingredient is briefly discussed.

* * *

Wet beet pulp. E. J. MAYNARD. *Sugar J.* (La.), 1963, **26,** (4), 37.—Although wet beet pulp demand as a fodder has diminished, it is still considered an excellent carbohydrate source in feedstuffs, and at 11% dry solids one ton of wet pulp is equivalent in feeding value to 148·6 lb of corn plus 355·4 lb of alfalfa hay.

* * *

Yeast culturing and fermentation in distilleries. B. G. KRISHNAMURTI. *Indian Sugar,* 1963, **13,** 277–281. Various aspects of yeast fermentation are considered, including selection and acclimatization of yeast strains, yeast culture vessels, aeration, main and continuous fermentation, temperature and CO_2 collection. The use of sulphuric acid in main fermentation is discussed as is determination of fermentation efficiency.

* * *

A continuous elutriation method for pulping bagasse. N. D. MISRA. *Tappi,* 1963, **46,** (2), 146A–149A; through *S.I.A.,* 1963, **25,** Abs. 654.—A pilot plant at Rohtas Industries Ltd., India, is described with a diagram. Dry depithed bagasse is introduced at the top of a soaking tower and descends through a column of hot spent lye from a later stage of the process. A short screw conveyor transfers the soaked bagasse to the bottom of a tower-shaped digester. The bagasse ascends the tower in a rising current of pre-heated feed lye (~3% NaOH, including some spent lye) and leaves the top of the digester after 27 min at 100–105°C. The alkali consumption is 7% on bagasse. The raw pulp is then refined, washed, screened and bleached (where necessary). The mechanical properties and appearance of the pulp, both unbleached and bleached, are superior to those of bagasse pulp from a conventional process.

* * *

Studies on the analysis of sucrose fatty acid esters. I. Qualitative analysis of sucrose fatty acid esters by thin layer chromatography. S. KINOSHITA. *Kogyo Kagaku Zasshi* (*J. Chem. Soc. Japan, Ind. Chem. Sec.*), 1963, **66,** 450–455, A33–A34; through *S.I.A.,* 1963, **25,** Abs. 666.—Crude sucrose esters were separated into their component monoesters, diesters, triesters and polyesters by ascending chromatography on 5 × 20 cm glass strips coated with silica gel containing 15% of calcined $CaSO_4$. The solvent mixtures were methanol:chloroform:acetic acid:water (10:80:8:2), methanol:chloroform:acetic acid (15:80:5) or tetrahydrofuran:*n*-hexane:acetic acid (29:70:1). The spots were revealed by spraying with 50% H_2SO_4 and heating. Up to 4 individual mono- or di-esters were separated. R_f values are tabulated.

* * *

Studies on the analysis of sucrose fatty acid esters. II. Quantitative analysis of sucrose fatty acid esters by thin layer chromatography. S. KINOSHITA and M. OYAMA. *Kogyo Kagaku Zasshi* (*J. Chem. Soc. Japan, Ind. Chem. Sec.*), 1963, **66,** 455–458, A34; through *S.I.A.,* 1963, **25,** Abs. 667.—A routine method with the use of methanol: chloroform:acetic acid:water (10:80:8:2) solvent mixture is described. The spots are scraped off the plate, extracted, and analysed by spectrophotometry with anthrone or iron hydroxamic acid complex.

* * *

Production of glutamic acid, betaine hydrochloride and other useful materials by an ion-exchange scheme from molasses and its recovery by-products. G. B. AIMUKHAMEDOVA, M. I. DAISHEV, K. P. ZAKHAROV and E. P. RUKAVISHNIKOVA. *Izv. Akad. Nauk Kirgiz. SSR, Ser. Estestv. i Tekh. Nauk,* 1962, **4,** (6), 5–9; through *S.I.A.,* 1963, **25,** Abs. 755.—A laboratory process is described with a flow diagram, whereby a 15–20% solution of beet molasses, Steffen's filtrate or vinasse is passed successively through a cation-exchange column (H^+form) and an anion-exchange column (OH^- form). Betaine hydrochloride ("Acidol"), choline, glutamic acid and aspartic acid are obtained from different effluent fractions. A purified sugar solution is also obtained from which ⩽60% of the original molasses sugar may be crystallized. The process is to be tested on a pilot scale.

* * *

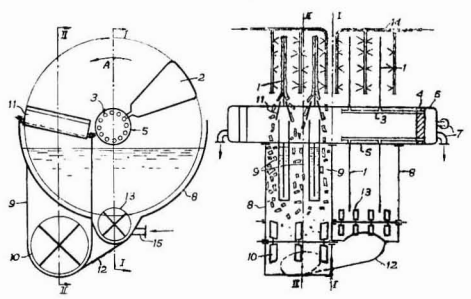
Influence of rate of molasses addition on yeast quality. H. KREIPE. *Brot u. Gebäck,* 1963, **17,** 67–70; through *J. Sci. Food Agric. Abs.,* 1963, **14,** ii–198.—The effects of variations in the rate of addition of molasses in the culture of yeast and its relation to yeast quality for baking purposes are reviewed. Molasses addition must be related to the rate of yeast propagation and for optimum yeast quality and yield should be increased logarithmically during the first three-quarters of the fermentation period and be added at a constant rate during the last quarter. Any reduction in the rate of addition tends to produce a flocculent yeast. Thirteen references are given to the literature.

* * *

Molasses as animal fodder. M. GÖBELEZ. *Seker,* 1963, **12,** (47), 17–20.—The advantages of beet molasses animal fodder are discussed and information is given on the average composition of molasses, the nutritive value (digestibility, energy value, fattening value and effect on animal health), proportion of molasses to add to other feedstuffs, and the effect on cattle breeding, milk and meat yields.

UNITED KINGDOM

Disc filter for methodical washing. G. GAUDFRIN, of Sceaux (Aisne), France. **939,975.** 5th November 1959; 16th October 1963.—Clarifier muds enter the disc filter through entry pipe 15 on the left side of the dividing wall between the two halves of tank 8. On each side of this wall are plates 1 (only two are shown on each side for simplicity) constructed in segments 2. Each segment has a filter cloth bag over it and is connected to collector tube 3 and through the smooth-faced plate 4 at the end of rotating shaft 5 to a collector head 6. Appropriate vacuum, air-pressure and liquid outlet connexions 7 are provided in the head so that for most of the cycle vacuum is maintained in tubes 3, causing juice to flow through the cloths. The cake forming on the cloth is drained



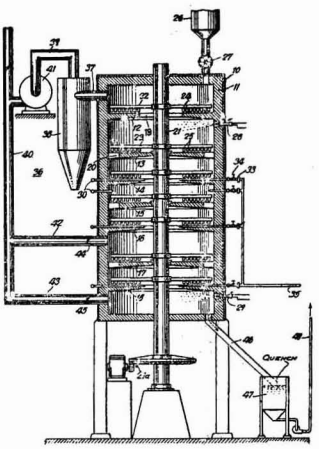
when the segment rises above the level of liquid in the tank and then is washed by sprays supplied through pipes 14. At an appropriate point in the cycle the tube 3 is brought opposite a source of air pressure which inflates the bag; the cake is then detached by scrapers 11 and falls into hopper 9. Here it is mixed with sweet water by agitator 10 and transferred through duct 12 to the right-hand side of the filter. It is homogenized by agitator 13 and passes through a similar cycle to the first, yielding a cake which is discharged, a weak wash which is used to dilute the cake in hopper 9, and a filtrate which is used as the wash liquor for the left-hand sprays. The filtrate and stronger wash from this side are sent to process.

* * *

L-Glutamic acid fermentation (of high-test molasses). COMMERCIAL SOLVENTS CORPORATION, of New York, N.Y., U.S.A. **940,058.** 2nd February 1962; 23rd October 1963.—The organism *Brevibacterium divaricatum* (Strain NRRL B-2311) is grown until it has attained maximum growth as shown by an optical density of 0·5–0·7 (for about 12 hr) on an aqueous medium containing 3–9% (5%) of a carbohydrate (glucose, sucrose, fructose, etc.). Subsequently 3–7% (5%) of high-test molasses is added to the medium (over a period of 4 hours) to produce glutamic acid.

* * *

Regeneration of granular activated carbon. NICHOLS ENGINEERING & RESEARCH CORP., of New York 5, N.Y., U.S.A. **941,635.** 9th November 1961; 13th November 1963.—The sheet steel cylindrical shell 10 includes a series of hearths 12–18 provided with alternate central and peripheral openings. A central shaft 21, driven by motor and gear 21a, carries radial arms 22, 23 with rakes 24, 25. Granular active carbon to be regenerated is fed through star valve 27 from hopper 26. The rakes are fitted so that the carbon is carried from the periphery to the centre



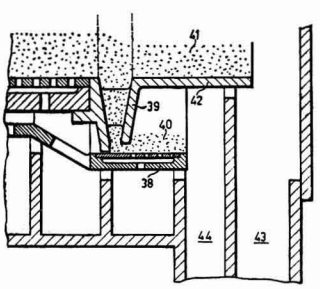
of hearth 12 and then from the centre to the periphery of hearth 13, and so on until it is discharged from hearth 18 to the quench tank 47 through discharge line 46. At intervals in the sides of the shell 10 are burners 28, 29, while air under pressure is also admitted through air tubes 30. The furnace gases are drawn off through line 37 to cyclone 38 which collects the dust while the gases are drawn by fan 41 through pipes 39, 40 and recycled by pipes 42, 43 which are fitted with dampers 44, 45 to control the flow.

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).

Purifying solutions containing sugar. FARBENFABRIKEN BAYER AG., of Leverkusen-Bayerwerk, Germany. **941,011.** 11th February 1960; 6th November 1963. The sugar solution (raw beet or cane juice, clear juice, syrup or molasses) is contacted with a spongy anion-exchange resin having basic nitrogenous groups as exchanging groups. These are amino-, (quaternary amino- or preferably tertiary amino-groups) attached through alkylene groups, e.g. methylene groups, to a matrix obtained by copolymerizing a mono-ethylenic monomer, e.g. monovinyl, benzene, an α, β-ethylenically unsaturated amine, and a poly-ethylenically unsaturated monomer, e.g. a monomeric polyvinyl benzene, in 30–300% of an inert organic liquid, e.g. an aliphatic hydrocarbon, which is a non-solvent for the linear non-cross-linked polymers; this produces a cross-linked copolymer in which is occluded all the inert liquid which is then removed. The sugar solution is then contacted with an acid-activated spongy cation exchange resin having sulphonic or carboxylic acid groups linked to the same type of heterogeneous matrix as the anion exchanger. When exhausted the cation exchanger is regenerated with an alkaline earth hydroxide, which is then used to regenerate the exhausted anion exchanger.

* * *

Centrifugal separators. ESCHER WYSS AG., of Zurich, Switzerland. **942,396.** 26th February 1960; 20th November 1963.—The continuous push-type centrifugal has a housing containing a drum into which material is supplied by an inlet pipe from a hopper. Mounted in the drum is a strainer on which a layer of material being centrifuged is advanced intermittently by a pusher. At the discharge end of the drum is a device for removing the "capillary layer" of solid material containing liquid which cannot be removed by centrifuging; this layer enters a ring of perforations around the end of the drum and passes into corresponding chambers of a surrounding

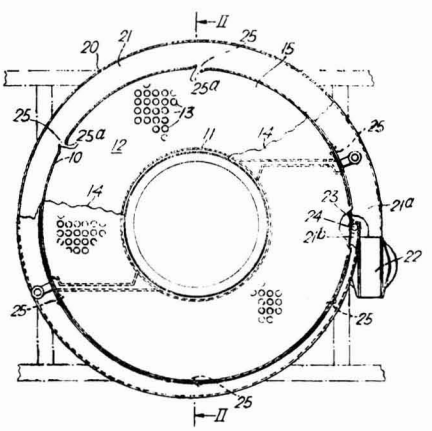


cylindrical slide-valve. The latter is moved by rods connected to the pusher so that the action of the latter brings the valve chambers opposite openings through which the "capillary layer" material passes to a collection chamber. In the case of a multi-stage machine the stages each have rings of perforations and valves connected to the previous drum section, the first stage having a valve connected to the pusher; thus a "capillary layer" is removed from each stage of the machine and passes to the collection chamber.

Alternatively, the removal device may be in the form of an annular layer funnel 39, on the discharge end of the drum which the "capillary layer" enters; the funnel attracts the capillary liquid in the material passing over that in the funnel so that this liquid passes through the funnel giving a drier discharge product. If the funnel is suitably dimensioned the liquid discharges automatically at the outer end, otherwise this discharge of liquid and "capillary layer" material may be intermittent, under the action of an annular slide valve. The discharged liquid and material may then strike a secondary sieve drum 38, the funnel serving as a pusher to discharge the solid separating 40. This and the main solid separated 41 may be collected individually or may be mixed.

* * *

Vacuum pan or evaporator. GEORGE FLETCHER & CO. LTD., of Derby, and C. W. MURRAY. **942,692.** 8th September 1961; 27th November 1963.—An even supply of steam to the calandria is achieved by feeding it to the chamber 21 which surrounds the calandria,



suitably located and sized slots 25 admitting the steam. The chamber is constructed in such a way that the distance between its inner wall and the outer wall 20 decreases with distance from the steam feed 22. A suitable condensate drain 24 is also provided.

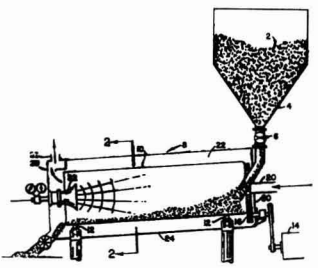
* * *

Extraction of juice from cane. A. F. CRAIG & CO. LTD., of Paisley, Renfrewshire, Scotland. **942,817.** 10th July 1961; 27th November 1963.—Juice from the crusher and first mill of a tandem is pumped from its receiving trough into a screen which is in the form of a drum rotating inside a tank from which the screened juice passes to process. The drum is mounted

on a hollow shaft and contains a trough which slopes downwards towards the end of the drum, through which it passes. Bagacillo separated from the primary juice falls into the trough as the drum rotates, and is washed along it and out of the drum by a flow of secondary juice pumped to the higher end of the trough through the hollow shaft of the drum. The bagacillo and secondary juice are then distributed on the bagasse blanket leaving the first mill.

* * *

Drying sugar containing materials. THE AMERICAN SUGAR REFINING COMPANY, of New York, N.Y., U.S.A. **942,727.** 19th July 1962; 27th November 1963.—Moist sugar 2 passes from hopper 4 through the rotary louvre-type drum dryer 8, losing its moisture to a stream of gas supplied either co-current as shown



(through pipe 2) or counter-current. To assist drying a source of acoustic energy 32 is fitted near the discharge end, generating sound at frequencies between 500 and 30,000 c/s, at an acoustic power level of at least 0·001 watts/cm (at least 2 watts/lb of wet sugar).

* * *

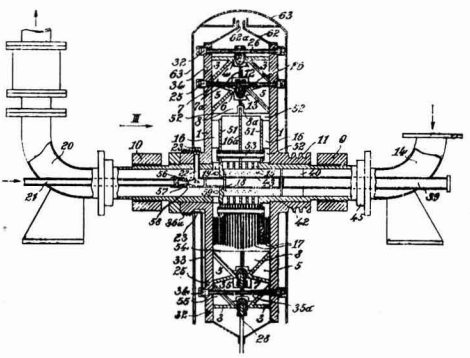
Production of bleached pulp for paper manufacture. F. D. PUDUMJEE, of Bombay, India. **942,958.** 13th April 1961; 27th November 1963.—Fibrous raw material (bagasse) (6 parts) is mixed with an aqueous chloride solution (100 parts of 15% NaCl) and subjected to electrolysis whereby it is simultaneously digested and bleached by the joint action of the chemicals formed during electrolysis. The treatment is continued until the bagasse is completely digested and bleached. Both electrodes may be of carbon or the anode of carbon and the cathode of stainless steel.

* * *

Beet thinner. J. CRACKNELL, J. C. CRACKNELL and D. N. COOPER, of Sudbury, Suffolk. **943,102.** 21st April 1961; 27th November 1963.

* * *

Centrifuges. MASCHINENFABRIK BUCKAU R. WOLF AG., of Grevenbroich, Germany. **943,296.** 1st August 1961; 4th December 1963.—The centrifuge is designed for treatment of carbonatation juice to separate the solids; since the centrifuging technique does not require a well-settling and filtering precipitate, it permits the use of less lime than customary, only enough being required for coagulation of colloids, etc. The centrifuge drum consists of two housing side discs 1 joined fast to the hollow shaft 2. Side rings 3 of triangular section are connected to the discs 1 and taper towards the centre, leaving an annular gap 4. Similar chamber rings 5, attached to discs 1 and tapering to leave a gap 6, form with rings 3 a washing chamber 7, while the inner walls of rings 5 form a receiver 8 for the solids. The shaft



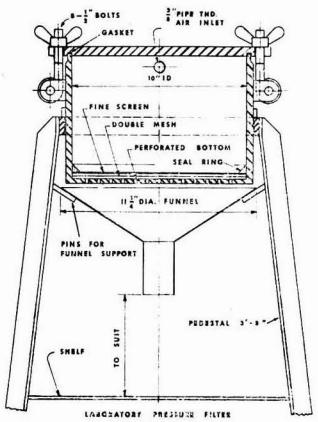
2 is mounted in bearings 9, 10 and is driven through a V-belt pulley 11 or other means. The gaps 4 and 6 are opened and closed using annular rubber seals 12, 13. These are closed by admitting water under pressure through pipe 21 and radial passages to annular passage 23. This is connected to annular rings 34, 32 through electromagnetically operated slide-valves. Cross pipes 26 from these rings connect with a space inside each of the seals to which the water under pressure is admitted, expanding the seals to fill the gaps 4 and 6 between the rings 3 and 5. At the same time, chamber 7 is filled with water under pressure which enters through apertures 35a. The suspension is introduced under pressure through tube 14 into hollow shaft 2 from which it flows through passage 15 and between deposition blades 16 or plates 17. With the seal 13 closed, solids collect in receiver 8 while clarified juice passes through passages 53, 52 and 19 to the other side of a seal in shaft 2 and thence to discharge tube 20. When receiver 8 is filled with solids the water pressure to seal 13 is released gradually by means of the slide-valve, when the solids pass through gap 6 against a counterflow of water which it is displacing; the solids are thus washed and transferred to chamber 7. The gap 6 is then closed and gap 4 opened when the washed solids leave the chamber 7 and are received by jacket 62 delivering to channel 63, passage being assisted by more water supplied through apertures 35a. The operating cycle may be regulated by measurement of the difference in pressure when the washing chamber is filled with solids and with water, the electromagnetic slide-valves being operated automatically. A working cycle will occupy about 20 seconds.

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.

Laboratory pressure filter. The Western States Machine Company, Hamilton, Ohio, U.S.A.

A laboratory pressure filter that assists the sugar man in evaluating the operation of final crystallizers, Stevens coils and *C*-massecuite centrifugals has been developed by The Western States Machine Company, Hamilton, Ohio. This unit has been working effectively in their laboratory. It consists of a cylindrical container with a perforated bottom supporting the screens for separating the crystals from the liquor. The removable top is gasketed and held tight by wing nuts. Compressed air introduced near the top of the cylinder provides the force to accomplish the separation.



Proper working of the Stevens Coil as a massecuite reheater can best be measured by comparing the purity of the mother liquor prior to reheating with the purity after heating. This will indicate the crystalline sugar loss, if any, due to grain melting. Similarly, the efficiency of separation in the final centrifugals can be measured by comparing the purity of the mother liquor before centrifuging with the final molasses purity. Construction drawings of the laboratory pressure filter are available at no cost. If there is enough interest, the Company will build these units for sale to the industry.

* * *

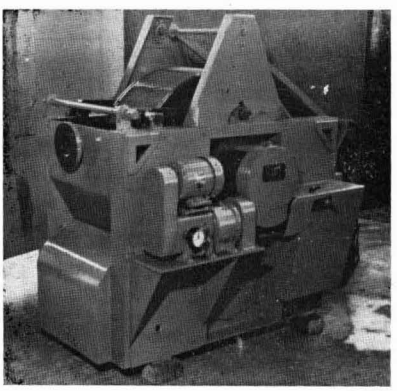
Chlorination plant. Chlorination Equipment Ltd., 129 Kingsway, London W.C.2.

The Model SC is a small capacity gas chlorinator, a self-contained panel unit constructed mainly of plastic materials, metallic components being of special corrosion resistant materials. Devices cut off chlorine flow in the event of interruption of the water supply or loss of gas vacuum. Gas enters the vacuum regulator chamber and its flow rate is then accurately controlled by a calibrated valve. An injector assembly converts it into an aqueous chlorine solution which is then delivered under pressure to the point of application. The unit is designed for a maximum output of 4 lb of chlorine per hour, and its low initial cost, long operating life and insignificant maintenance make it a highly economical unit.

* * *

Deep submergence precoat vacuum filters. Stockdale Engineering Ltd., Poynton, Cheshire.

This new range of filters is particularly useful for continuous clarification of materials containing small amounts of solids with which filtration rates may be lower. The extended area available for filtration gives greater throughput whilst reducing precoat consumption and operating cost. They may be supplied in stainless or mild steel, may be of rubber covered construction and have areas of 10 to 700 sq.ft. filter area. They can operate with a 4-inch thick precoat bed, the unit illustrated having 60% submergence and a mechanical knife advance system with a selected range of forward speeds.



* * *

Liquid level controls. Electronic Switchgear (London) Ltd., Hitchin, Herts.

An improved and extended range of electrode-pattern liquid level controls has been introduced for the automatic switching of signals, pumps, valves, etc. They are housed in compact, moisture-proof, cast alloy housings suitable for installation under the most severe conditions. Operation is based on conductivity measurement; a sensitivity adjustment is provided to permit control of liquids of widely different conductivity. A dual circuit unit holds two controls in one casing which can be used for two levels in the same tank or levels in two tanks.

Electrode fittings are available to withstand high pressures up to 3000 p.s.i. and high temperatures up to 200°C, and also attack by aggressive chemicals.

* * *

PUBLICATIONS RECEIVED

CANE SUGAR EQUIPMENT. Stork-Werkspoor N.V., Hengelo (O), Holland.

This new 24-page booklet illustrates and describes the Stork-Werkspoor range of equipment which ranges from cane unloading cranes and cane preparation machinery to mills with gearing and drives, juice or melt purification systems, evaporators, calandria and coil pans, crystallizers, final product treatment equipment, steam and power plant, factory and irrigation pumps, water-jet condenser systems, steel structures, and general erection of factories, mechanical and electrical and civil projects.

* * *

MECHANIZED SAMPLING OF CANE AND POL-RATIO ANALYSIS. American Factors Associates Ltd., 745 Fort Street, Honolulu, Hawaii 96813, U.S.A.

A new mechanized system is offered which is practically authomatic and can be installed complete in the cane sugar factory and personnel trained to carry out the process efficiently. A coring machine hydraulically pushes a hollow tube into a load of cane and withdraws a sample of approx. 33 lb. Automatic equipment then disintegrates the sample and analyses it for refractometer solids and pol to determine pol % cane and purity. The sampler and pol ratio method analysis have been developed at the Experiment Station of the Hawaiian Sugar Planters' Association and has been approved by the U.S. Dept. of Agriculture as a means to make payment for cane grown by independent growers.

* * *

BULK MATERIAL HANDLING PRODUCTS. Stephens-Adamson Manufacturing Co., Ridgeway Ave., Aurora, Ill., U.S.A.

Bulletin 263 is a 4-page leaflet describing and illustrating the Stephens-Adamson range of standard conveyor and bulk material handling products, including belt conveyor components—carriers, pulleys, holdbacks and cleaners—as well as sectional belt conveyor and bulk loading equipment, car pullers, bin level controls, etc.

* * *

ANTIFOAMING AGENTS. Glovers (Chemicals) Ltd., Wortley Low Mills, Whitehall Road, Leeds 12, Yorkshire.

A small leaflet gives a list of the range of antifoaming agents, describing their physical state and characteristics, with recommendations as to suitable applications.

* * *

R.B.S. 25 CONCENTRATE. Medical-Pharmaceutical Developments Ltd., Mercantor House, 5 East Street, Shoreham-by-Sea, Sussex.

A new leaflet refers to this non-foaming, non-corrosive laboratory surface active agent which will clean glass, metal and plastic laboratory apparatus, optical lenses and equipment, leaving no trace after rinsing. It will remove stubborn contaminants, including silicone and apiezon oils and greases, etc., and presents no problems in preparation or disposal.

* * *

PLATE AND FRAME TYPE FILTER PRESS. Port Engineering Works Ltd., 8 Clive Row, Calcutta 1, India.

The Port Engineering Works filter press is supplied in three standard sizes of 650, 800 and 900 sq.ft. total filter area, respectively, and having 42, 52 and 60 chambers. The plates, frames, stands, pressure plate and swivel cross-head are of cast iron, the plates and frames having machine-ground faces. The forged-steel rectangular section side bars are machined on fitting faces and are reinforced with welded strips. The pressure screw is of mild steel, a gear and ratchet tightening device is fitted, and the press is built to withstand a pressure of 40 p.s.i. The press can be supplied for either co-current or counter-current washing.

* * *

GET OFF TO A GOOD START. Crofts (Engineers) Ltd., Thornbury, Bradford 3, Yorkshire.

The good start can be ensured, according to this new leaflet, by installing a Crofts centrifugal clutch in the transmission line. Advantages claimed include reduced power demand, with consequently smaller and simpler motors and switchgear, provision of overload safeguard, and automatic operation. There are two designs—spring-controlled and springless.

* * *

CONTINUOUS BAND DRYERS FOR THE PROCESS & CHEMICAL INDUSTRIES. L. A. Mitchell Ltd., Harvester House, Peter Street, Manchester 2.

General arrangements, design and construction features of the Mitchell continuous band dryers are described and illustrated in a new leaflet, No. MD 23, which also illustrates a number of applications. The dryers are noted for safety, efficiency, unit construction, ease of maintenance and cleanliness, as well as high productivity per unit of floor space, low operating costs, uniformity of temperature, versatility, flexibility, robust construction and accessibility.

* * *

BUCKAU-WOLF CENTRIFUGALS. Maschinenfabrik Buckau R. Wolf AG., 4048 Grevenbroich/Ndrrh., Postfach 69, Germany.

This attractive new booklet is devoted to the current range of Buckau-Wolf centrifugals; this Company has more than 70 years' experience in their manufacture and has supplied more than 300 fully automatic machines during 1961–63 to sugar factories all over the world. The booklet illustrates the various fixed and rotating parts of the centrifugal with a detailed description of each; especial attention is paid to the electric motors employed and the control equipment. Examples are illustrated of typical batteries, and information is provided on the Buckau-Wolf continuous centrifugal. This is a horizontal cone-type basket machine driven by a 30 h.p. motor which, by means of interchangeable screens, can be used for pre-curing (2½–3 tons of *C*-massecuite per hr) or after-curing (3–5 tons/hr). Massecuite feed may be manually or automatically controlled, maintenance is limited to cleaning and checking the oil level, and steam and water spray nozzles are provided for washing the sugar. Illustrations are provided of ultrasonic and X-ray testing of centrifugals at the Buckau-Wolf manufacturing plants.

* * *

NORIT GRANULAR CARBON DRK-1. N.V. Norit-Vereeniging Verkoop Centrale, Amsterdam C., Tweede Weteringplantsoen 15, Holland.

The new Bulletins, Nos. NR 31 and 32, have recently heen issued, dealing respectively with use of this granular carbon for sugar refining and in bone char refineries. Bulletin NR 31 describes the use of this carbon in columns for treatment of cane sugar liquor and beet sugar syrups, providing, in addition to characteristic data on the carbon, a typical flow sheet and comparative cost data on the use of granular vs. powdered carbon. Bulletin No. 32 gives similar comparative data for bone char and granular carbon use in a refinery (the latter is calculated to give 30% lower decolorizing costs), while the use of a combination of columns of the granular carbon and of bone char is discussed, the char's main purpose being de-ashing of the liquor. The flow sheet is repeated, and in both bulletins appear questionnaires to permit the formulation of proposals for use of granular carbon DRK-1 under the conditions applying in individual cases.

Farrel in Mexico.—The Farrel Corporation, of Ansonia, Conn., U.S.A., has formed a new company Farrel Mexicana S.A. which will be responsible for the sales and service of Farrel equipment—including sugar machinery—in Mexico. Its office is located at Madrid No. 21-114 in Mexico City.

JAPANESE SUGAR IMPORTS[1]

Metric tons, tel quel	1963 *Raws*	1963 *Refined*	1963 *Non-Centrifugal*	*Total 1963*	*Total 1962*	*Total 1961*
Argentina	—	—	—	—	8,627	23,170
Australia	327,866	—	—	327,866	274,319	96,158
Brazil	5,053	—	—	5,053	20,970	375,266
Cuba	163,664	—	—	163,664	522,716	325,690
Dominican Republic	—	—	—	—	8,660	106,808
Ecuador	—	—	—	—	—	15,040
France	—	—	—	—	—	11,865
Hong Kong	—	—	—	—	—	22
Hungary	—	—	—	—	—	49
India	91,233	—	—	91,233	—	—
Indonesia	10,830	—	—	10,830	—	—
Mauritius	9,855	—	—	9,855	—	—
Peru	5,732	—	—	5,732	6	2,677
Philippines	8	—	—	8	—	5,023
Poland	—	—	—	—	10,576	10,500
Ryukyu	67,936	77,640	19,277	164,853	111,457	76,198
South Africa	179,052	—	—	179,052	82,582	—
Taiwan	472,499	—	4,892	477,391	428,498	361,819
Thailand	34,899	—	50	34,949	24,880	—
United Kingdom	—	—	—	—	—	150
U.S.A.	—	—	—	—	—	130
Other Countries	—	610	200	810	565	3
	1,368,627	78,250	24,419	1,471,296	1,493,856	1,392,568

BREVITIES

Developments in Swaziland sugar. Our Note & Comment on page 101 of the April 1964 issue was mistitled since it was concerned, in fact, with Southern Rhodesia and not Swaziland. However, sugar production in the latter territory is itself increasing markedly. Mhlume Sugar Co. Ltd. has an expansion programme under way and so has Swaziland Sugar Co. Ltd.; sugar production by the latter Company was 28,240 tons in 1961/62 and 40,033 in 1962/63. Production in the campaign now ending is estimated at 54,000 tons and extensions to milling capacity and cane area are expected to raise production to 75,000 tons in 1964/65 and to 85,000 tons in 1965/66. There is production and consumption potential for an eventual production of 100–120,000 tons of sugar.

* * *

Sugar in Iran.—In the article on sugar in the Middle East which we reprinted in February issue[2], it was stated that sugar cane cultivation in Iran is today restricted to the Caspian provinces and Khuzestan; we are now advised that no cane is grown on a commercial basis in the Caspian provinces.

* * *

Paris white sugar terminal market[3].—The opening of the white sugar terminal market in Paris is scheduled for May 5th. Trading will begin in the positions June, August, November, February, May and August. A member of the Technical Committee of the market on white sugar has stated[4] that the opening of a Futures Market in raw sugar in Paris is now also under study.

* * *

The late H. M. Thompson. We regret to announce that Dr. HUBERT M. THOMPSON died on the 14th February 1964. He was born in 1909 and after graduating and obtaining his Ph.D. at Liverpool University joined Macfie's Sugar Refinery, subsequently absorbed by Tate & Lyle Ltd. in 1938. After some years at Love Lane Refinery and at Merton Grove, he was transferred in 1947 to the Tate & Lyle Research Dept. at Ravensbourne where he was in charge of the Bone Char Section and latterly of Analytical Control. He contributed a number of papers to this Journal, the latest appearing only in our April issue.

The late E. W. Brandes.—We regret to announce the death at his home in Florida, on the 3rd February, of Dr. ELMER W. BRANDES, the distinguished plant pathologist who led sugar research for the U.S. Dept of Agriculture for many years. Dr. BRANDES was born in Washington, D.C., in 1891 and served as plant pathologist with the Agricultural Experiment Station in Puerto Rico in 1915/16, transferring to the Office of Sugar Plants, U.S.D.A., after service in the U.S. Army. From 1919 to 1922 he conducted the definitive studies on mosaic, the cane disease which almost ruined the Louisiana sugar cane industry. He showed it to be caused by a virus, spread by the corn leaf aphid, and introduced mosaic-resistant varieties from Java which saved the industry. New hybrids were bred at Canal Point in Florida for the U.S. industry, and BRANDES also set up a quarantine station near Washington for testing of introduced varieties under conditions which prevented the spread of diseases introduced with the cane. He made exploratory trips in search of new germ plasm for breeding purposes, visiting Java, New Guinea, etc. BRANDES was also active in sugar beet research; he organized and administered a programme of breeding beets resistant to the diseases curly top, leaf spot and black root which were causing severe damage. The success of the cane and beet programmes is evidenced by the higher yields from the new varieties compared with those before the diseases attacked the crops. Just before World War II, BRANDES became concerned with a programme for encouraging rubber production in the Western Hemisphere, and in 1951 he retired from the U.S.D.A. after 35 years' service. He became a Sugar Consultant to a group of American-owned sugar centrals in Cuba and in the next seven years sought to develop improved varieties and cropping systems; this work was unfortunately stopped before coming to its full fruition. From 1958 to 1962 he was concerned with breeding of disease-resistant banana varieties, thereafter retiring from active research. BRANDES was one of the founders of the International Society of Sugar Cane Technologists, serving as president from 1934 to 1938 and on its Executive Committee for a score of years. He was the author of numerous papers on sugar cane diseases, cultivation and breeding including publications of the U.S.D.A.

[1] C. Czarnikow Ltd., *Sugar Review*, 1964, (649), 44.
[2] *I.S.J.*, 1964, **66**, 35–36.
[3] F. O. Licht, *International Sugar Rpt.*, 1964, **96**, (9), 8.
[4] *ibid.*, (8), 9.

Cuban Sugar Statistics 1963[1]

		1963		1962
		(metric tons, raw value)		
Stocks 1st January ..		341,200		1,030,000
Production		3,820,263		4,815,234
		4,161,463		5,845,234
Consumption	525,730		373,094	
Exports	3,520,505		5,130,940	
		4,046,235		5,504,034
Stocks 31st December		115,228		341,200
Exports:				
Aden		6,104		—
Albania		6,419		10,700
Algeria		5,389		—
Bahrain		12,552		—
Belgium		20,386		18,622
British West Indies ..		—		33
Bulgaria		56,177		117,796
Canada		70,068		19,880
Chile		4,585		80,867
China.....		500,928		937,893
Czechoslovakia		150,105		155,680
Dutch West Indies		—		2,122
Finland.....		—		5,881
Germany (East)		244,490		179,343
Germany (West) ..		—		3,800
Greece		15,483		49,658
Holland.....		123,545		15,104
Iceland		—		749
Iran		10,431		—
Iraq		36,711		17,991
Italy		157,904		2,167
Japan		160,771		431,482
Jordan		—		10,907
Korea (North).....		20,000		·14,038
Kuwait		4,280		—
Lebanon		10,437		1,795
Morocco		285,028		265,124
Norway		22,636		36,138
Oman		1,124		—
Poland		103,895		151,285
Qatar		4,494		—
Saudi Arabia		7,651		—
Spain		102,737		58,312
Sudan		8,988		—
Sweden		15,243		28,232
Switzerland		61,502		16,814
Syria		20,666		50,478
Tunisia		—		90,057
U.S.S.R.		973,423		2,112,245
U.A.R.		78,115		105,112
United Kingdom ..		173,698		76,143
Uruguay		20,467		—
Vietnam (North)		13,373		10,490
Yugoslavia		10,700		54,002
		3,520,505		5,130,940

The Antigua Sugar Factory Ltd., 1963 Report.—Crop started on the 4th December 1962 and ran to the 10th July 1963, with a break from the 22nd December to 15th January. Total output was 27,687 tons of commercial sugar, made from a harvest of 255,354 tons of cane; these figures compare with 19,286 tons made from 194,583 tons of cane in the 1961/62 crop. The sucrose in cane was higher at 12·46% compared with 11·37%, and recovery was also higher at 84·38% vs. 83·66%. Although the Company's own estates produced more cane, the cane from other suppliers dropped by 25%, and it is not prudent to anticipate a crop of more than 22,000 tons of sugar in 1963/64.

BREVITIES

Hungarian beet seed husk remover.—A new mechanical method of removing the protective husk from sugar beet seed has been developed by Dr. FERENC HARMOS in Hungary. The husk on the sugar beet seed keeps it from germination until favourable conditions such as warmth and humidity are assured, but it is hard to remove and has the drawback of making mechanical sowing of single seeds very difficult. Various methods of removing the husk have been used up to now but they have often had the disadvantage of damaging the irregular-shaped seeds. Dr. HARMOS's machine subjects the seeds to a mutual self-rubbing procedure, instead of a stone-wearing one. By an ingenious mixing arrangement the husk is removed when an appropriate speed is reached, and is in turn removed from the machine. The machine has been patented in all major agricultural countries, including the United States. Hungary is now using seed treated by Dr. HARMOS's method over almost the whole of her sugar beet area.

* * *

French sugar production, 1963/64[2].—In 1963/64 1,842,000 metric tons of beet sugar was produced in Metropolitan France, exceeding the target set in July 1963 by 273,000 tons. Export of sugar in excess of home consumption requirements is a possibility, particularly since the world market price is some 3 francs/ton higher than the fixed home price. Consumption of sugar in Metropolitan France has risen by 50% since 1950 from 950,000 tons to 1,470,825 tons in 1963. While the annual per caput consumption was only 24·7 kg in 1954, it rose to 30·9 kg in 1963, of which 11·2 kg was in sugar-containing products. The French Institute for Sugar Statistics (B.I.E.S.) calculates the requirements of Metropolitan France in 1985 as 6,676,000 tons, corresponding to an annual per caput consumption of 35–40 kg.

* * *

Yugoslavia sugar consumption[3].—According to the publication "L'Usine Nouvelle," dated 6th February 1964, sugar consumption in Yugoslavia will rise from the present 17 kg per caput per annum to 25–28 kg at the end of the Seven-Year Plan. To meet this rising demand five new sugar factories are to be built in Vorovitica, Bijeljina, Pozarevac, Sombor and Hormos.

* * *

Indian sugar situation[4].—Final statistics in respect of the 1962/63 season in India are now to hand. At the commencement of the campaign in November 1962 stocks amounted to 996,000 tons. The crop was a considerable disappointment, however, and only 2,152,000 tons were produced and, as 511,000 tons were exported, it was found necessary to resort to domestic rationing. In this way it was possible to reduce consumption to 2,482,000 tons, compared with 2,584,000 tons in the previous season, but even so stocks were so reduced that the tonnage carried forward to 1963/64 amounted to no more than some 150,000 tons. Current consumption works out at 12·5 lb per caput per annum, white value; it will not be possible to maintain even this level if production does not show a marked and unexpected improvement. Estimates of the crop now in progress are in the region of 2·6 million tons, but of this quantity 300,000 tons has been earmarked for export and it will hardly be possible to draw further upon stocks so that some further decrease in consumption appears unavoidable.

* * *

Czechoslovakian beet sugar production, 1963/64.—Calculating from various official statistics, F. O. Licht K.G. estimate[5] that the beet crop in 1963 totalled 7,773,000 tons, or 33·1% higher than the 5,810,000 produced in 1962. The increased crop was due to the extended beet area and to better yields per hectare; the latter is set at 27·3 tons/hectare since the area was 283,000 ha. Sugar production in 1962/63 was 993,000 tons, refined value (1,103,000 tons, raw value), while 1963/64 production is estimated at 1,025,000 tons.

[1] C. Czarnikow Ltd., *Sugar Review*, 1964, (648), 35.
[2] *Zeitsch. Zuckerind.*, 1964, **89**, 95.
[3] *Zeitsch. Zuckerind.*, 1964, **89**, 96.
[4] C. Czarnikow Ltd., *Sugar Review*, 1964, (650), 47.
[5] *International Sugar Rpt.*, 1964, **96**, (6), 12.

BREVITIES

Chile sugar production.—in the 1962/63 crop, 692,288 tons of beet were obtained from 17,012 hectares and 98,644 metric tons of sugar were manufactured. For the 1963/64 crop some 18,492 hectares have been sown to beet.

* * *

Japanese beet sugar production[2].—Beet sugar production in Hokkaido was completed by the end of January. During the 1963/64 campaign 147,314 metric tons of sugar were obtained from 1,042,008 tons of beets. In the previous campaign 1,044,503 tons of beet yielded 145,224 tons of sugar.

* * *

Polish campaign results[3].—A sugar beet crop of 10·6 million tons was harvested from 370,000 hectares during the 1963/64 campaign. The beet yield was 28·6 tons per hectare. Sugar production reached 1,454,000 tons, raw value, as compared with 1,357,778 tons in 1962/63, corresponding to a sugar extraction of 13·63%. The sugar beet acreage provided in spring 1964 is 445,000 hectares.

* * *

New sugar factories for Pakistan[4].—Sugar factories are to be built in Jessore and Dinijpur in East Pakistan, capacities being 1000–1200 tons of cane per day.

* * *

Sugar factory for Burma[5].—The construction of a sugar mill is expected to commence shortly in the Thaton district of Burma, with finance to be supplied by China. Towards the end of last year the Government announced that, in order to attain self-sufficiency in respect of sugar, two mills would be built with loans obtained from abroad. There are already four factories in that country which are fully operational.

Ivory Coast sugar factory[6].—In the Ivory Coast Republic in West Africa, the erection is planned of a number of factories, including a sugar factory.

* * *

Canada-South African sugar agreement[7].—A long-term agreement has been negotiated with the Canada and Dominion Sugar Co. Ltd. of Montreal for the sale of 56,000 short tons (50,000 long tons) of sugar annually on price-fixing terms based on the London Daily Price. Announcing this in Durban, the South African Sugar Association said that, in addition, 44,800 short tons (40,000 long tons) have been sold to the St. Lawrence Sugar Refineries Ltd. for 1964 shipment, bring the total actual sales in Canada so far concluded in the 1964/65 season to 100,000 short tons. This compares with the 105,000 short tons of sugar sold to Canada by South Africa during last season. The Association's statement said that other refiners in Canada had not yet indicated their full requirements, and it was expected that present sales would be exceeded.

* * *

Hawaiian sugar production[8], 1963.—Hawaii's official sugar production tonnage for 1963 is 1,100,768 short tons, raw value. The output was the third highest on record, exceeded only by the production in 1955 (1,140,112 tons) and in 1962 (1,120,011 tons). By islands, Hawaii led again with 373,484 tons, but fell below its 1962 output of 393,434 tons. Other island productions were: Kauai 260,819 tons (257,850 tons in 1962), Maui 242,812 tons (249,797 tons), and Oahu 223,654 tons (218,930 tons). The average yield of sugar per acre was 10·25 tons[9] which, although the highest industry-wide figure in the world, was only the fourth highest for the Hawaiian industry, falling behind the 1955 record of 10·74 tons and the 1956 and 1962 figures of 10·28 and 10·31 tons. The top plantation yield was that of Waimea Sugar Mill Co. which achieved no less than 14·60 tons. The total harvested was 107,436 acres. Preliminary estimate for the 1964 crop, now under way, is 1,150,000 tons, assuming that all goes well. The most popular cane variety is 50–7209 which, at 31st December, occupied 65,468 acres or 28·56% of the total caneland area of 229,254 acres in the state. During 1963, 17,068 acres were newly planted with this variety, i.e. 41·92% of the 40,715 acres planted. Varieties 49–5 (17·08%) and 39–7028 (6·88%) were the next most popular in new plantings, second and third places in total cane area being held by varieties 49–5 (18·82%) and 44–3098 (11·28%).

* * *

Townsville bulk terminal fire finding[10].—The Townsville Coroner has found that the fire which damaged the Townsville bulk terminal in May 1963[11] was caused by sparks from a welding machine which ignited a rope supporting scaffolding. The rope later burnt through and fell on the sugar at the spot where the fire started. The Coroner said he completely exonerated employees concerned from any suggestion of negligence in the use of the welder. He also found that there was no evidence whatsoever that the fire was caused by the criminal act of any person.

* * *

Cane breeding in Trinidad[12].—New varieties of cane will be bred in Trinidad this year for the first time. Previously all new varieties have been bred in Barbados at the B.W.I. Sugar Association Research Station and new varieties will continue to be supplied from there. But with the strengthening of the scientific staff of the Central Agricultural Research Station at Carapichaima, Caroni Ltd. will be in a position to breed some of their own varieties.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 17th April* 1964)	s d
Anglo-Ceylon (5s)	9/9
Antigua Sugar Factory (£1)	14/6
Booker Bros. (10s)	22/3
British Sugar Corp. Ltd. (£1)	32/3
Caroni Ord. (2s)	4/8½
Caroni 6% Cum. Pref. (£1)	15/10½
Demerara Co. (Holdings) Ltd.	10/1½
Distillers Co. Ltd. (10s units)	26/1½
Gledhow Chaka's Kraal (R1)	34/–
Hulett & Sons (R1)	101/–
Jamaica Sugar Estates Ltd. (5s units)	6/1½
Leach's Argentine (10s units)	17/3
Manbré & Garton Ltd. (10s)	38/4½
Reynolds Bros. (R1)	35/6
St. Kitts (London) Ltd. (£1)	21/–
Sena Sugar Estates Ltd. (10s)	9/–
Tate & Lyle Ltd. (£1)	*38/9 †39/3
Trinidad Sugar (5s stock units)	3/7½
United Molasses (10s stock units)	39/9
West Indies Sugar Co. Ltd. (£1)	*19/3 †19/6

CLOSING MIDDLE

New York Stocks (*at 16th April* 1964)	$
American Crystal ($10)	62½
Amer. Sugar Ref. Co. ($12.50)	21¾
Central Aguirre ($5)	29⅞
North American Ind. ($10)	41¾
Great Western Sugar Co.	16
South P.R. Sugar Co.	33⅝
United Fruit Co.	21⅛

* Old † New

[1] C. Czarnikow Ltd., *Sugar Review*, 1964, (650), 49.
[2] C. Czarnikow Ltd., *Sugar Review*, 1964, (650), 49.
[3] F. O. Licht, *International Sugar Rpt.*, 1964, **96**, (6), 11.
[4] F. O. Licht, *International Sugar Rpt.*, 1964, **96**, (6), 18.
[5] C. Czarnikow Ltd., *Sugar Review*, 1964, (652), 57.
[6] F. O. Licht, *International Sugar Rpt.*, 1964, **96**, (6), 16.
[7] *Public Ledger*, 29th February 1964.
[8] *Hawaii's Sugar News*, 1964, **14**, (1), 1–2.
[9] *ibid.*, (2), 1, 3.
[10] *Australian Sugar J.*, 1964, **55**, 768.
[11] *I.S.J.*, 1963, **65**, 162.
[12] *Chron. W. India Comm.*, 1964, **79**, 155.