International Sugar Journal

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NOTES AND COMMENTS

International Sugar Council.

According to a press release by the Executive Director of the International Sugar Council on the 28th January, the Statistical and Executive Committees of the Council met on the 27th and 28th January. The Executive Committee noted that, the necessary formalities having been completed by virtually all signatory governments, the Protocol extending the 1958 International Sugar Agreement until the 31st December 1965 entered into force on the 1st January 1964. In reviewing the market situation, the Committees noted that no changes of significance to the overall picture as then estimated had taken place since the Sixteenth Session of the Council in November last. The Preparatory Committee was to meet on the 29th January to continue its work: that of finding acceptable bases for a new Agreement.

C. Czarnikow Ltd.[1] reported:

"There is a widespread impression in the trade that the apparent world statistical position has during the past few months improved considerably and the deficiencies, which at one time looked to be in the region of one million tons, or perhaps a little more, have been reduced by something of the order of fifty per cent. Some surprise was therefore registered when it was announced, after the meeting of the Statistical and Executive Committees of the international Sugar Council on Monday and Tuesday of this week that little change had been noted from the situation as it had been estimated at the time of the Council meeting in November of last year. No supply figures were issued on that occasion, nor presumably can they be expected now, but it was stated that requirements were considerably in excess of supplies and this, one may conclude, is the situation which the Statistical Committee has found still to exist.

"The Council's first estimates of net world import requirements for 1964 have been published in its Statistical Bulletin[2] and it is interesting to note that China is shown to need 1·1 million metric tons. This in addition to the figure for the U.S.S.R. of 1·8 million tons could roughly absorb the whole of the Cuban surplus now stated to be 3·0 million tons. From this it is plain that the statistical deficit largely stems from the U.S.S.R./China requirement, since some one million tons of Cuban sugar has already been sold to other destinations. A trade agreement between China and Cuba provides for the supply of a very substantial tonnage by the latter but in view of the reduced crop expected in Cuba this year it seems unlikely that such a quantity could possibly be spared for China. This, of course, would not be any argument in favour of reducing the tonnage shown to be required by China if it were believed that this were an actual need. From the somewhat irregular reports which have emanated from China, however, it would seem that there has been an improvement in agricultural conditions in that country and with many new mills having been built, and others modernized, it may well be that if sugar is not forthcoming from Cuba it will not be required from any other origins. In any case, one cannot know for certain what China may require this year and the best prognostication can be little more than a reasoned guess. It is, of course, this type of situation, where differences of opinion exist and where accurate and up-to-date information is not available, which makes the task of the Council's Statistical Committee so exacting."

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Distribution payments on U.K. sugar.

The Sugar Board's distribution payments on sugar were increased from the 21st January, from 28s 0d to 32s 8d per cwt (from 3d to 3½d per lb.) From the 11th February they were reduced again from 32s 8d to 18s 8d per cwt (3½d to 2d per lb). Corresponding changes were made in the rates of distribution payments, and have been made in order to bring the Sugar Board's trading position more into line with the current level of world prices.

Thirteen changes in surcharge and distribution payments were made during 1963; this reflected the instability of the world market, and that this is continuing is demonstrated by the fact that two changes have been found necessary in the first six weeks of 1964.

[1] *Sugar Review*, 1964, (646), 29.
[2] *I.S.J.*, 1964, **66**, 31.

U.S. sugar consumption[1].

Total consumption of sugar in the U.S.A. in 1963 was 8,217,567 short tons, refined value, an increase of 187,802 tons or 2·399% on the previous year's figure of 8,029,765 tons. Of this total, beet sugar factories supplied 2,326,395 tons (28·31%), while cane sugar refiners produced 5,396,297 tons (65·67%) the remaining 494,875 tons (6·02%) being direct consumption white and raw sugars. Per caput consumption rose by 2·339% from 96·04 to 96·69 lb.

Louisiana and Florida cane sugar consumed amounted to 857,656 tons, compared with 729,843 tons in 1962 and 580,564 tons in 1961 while the beet sugar outturn of 2,326,395 tons compares with 2,016,090 tons in 1962 and 2,174,174 tons in 1961, the remarkable growth in domestic supplies (especially cane sugar) being apparent. Hawaiian sugar supplies fell from 891,617 tons in 1962 to 794,408 tons in 1963, while the Virgin Islands sugar amounted to 12,509 tons in 1963 as against 8658 tons in the previous year. Puerto Rico and the Philippines both supplied rather less sugar in 1963 (722,084 tons and 947,923 tons, respectively) compared with 1962 (744,228 tons and 981,286 tons). Full-duty foreign sugar amounted to 2,556,592 tons in 1963 compared with 2,658,043 tons in 1962.

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The 1963/64 campaign in Greece.[2]

The Larissa sugar factory, which has a processing capacity of 2000 tons of beet per day, during the 85-day campaign of 1963/64 processed 185,400 tons of beets to produce 23,700 tons of extra quality white sugar. The mean sugar content at the beet slicers was 15·51% and the extraction achieved was 12·78%. Total losses including sugar in molasses amounted to 2·73%. The figures demonstrate the satisfactory operation of the factory which in 1962 was put into good operating order and turned over to the Hellenic Sugar Industry after successful test runs.

The other two sugar factories, one at Platy and the other at Serrae, ran only on a trial basis. During the test runs, which lasted 45 days for the first factory, 71,300 tons of beets of 13·05% average sugar content were processed and 6947 tons of white sugar were produced, i.e. an extraction of 9·74%. The beets processed by the second factory, during a 47-day test run, amounted to 53,734 tons of 13·83% average sugar content, and the quantity of white sugar produced amounted to 4465 tons, i.e. an extraction of 8·31%. Further test runs will be carried out next year in the two newer factories, which in the meantime will be equipped with additional machinery.

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Brazil sugar situation[3].

The Superintendencia Nacional de Abastecimento (SUNAB) has prohibited the export of sugar and the manufacture of "demerara" sugar, so as to conserve supplies for the domestic market.

The Instituto do Açucar e do Alcool has approved a plan to raise the annual sugar production capacity to 100 million bags (of 60 kg) by 1970/71, compared with a current capacity of about 62 million bags. The chief aim of the plan is to maintain exports, which fell from 14·6 million bags in the 1960/61 season to 9·5 million bags in 1962/63, and are expected to be only 5 million bags in 1963/64.

Internal consumption has risen by 5·4% per year over the past ten seasons, compared with a 4% annual increase in production.

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U.S. supply quotas, 1964[4].

The U.S. Dept. of Agriculture announced on the 21st January that the 1,000,000 tons of global sugar authorized for purchase and importation this year had been fully subscribed. The Department also announced that 162,763 tons of the 186,170-ton deficit, mainly a deficit expected in the marketings from Puerto Rico, had been prorated and subscribed.

Of the total 1,162,763 tons, the Department stated, about 56% was scheduled to arrive in the United States during the first seven months of the year, 37% by the 31st October, and 7% (representing 87,913 tons of deficit prorated to the Philippines) might arrive at any time during the year.

Below are given details of the global quota subscriptions, in short tons, raw value:

Country	*Subscription*
Mexico	222,228
Australia	175,000
South Africa	101,872
India	96,195
British West Indies	52,170
Taiwan	48,300
Philippines	46,350
Fiji	44,828
Costa Rica	35,350
Peru	33,314
Ecuador	30,200
Dominican Republic	21,840
Guatemala	21,200
Nicaragua	20,555
Madagascar	11,550
Southern Rhodesia	10,600
El Salvador	10,373
Panama	10,260
British Honduras	5,250
French West Indies	2,565
Total	1,000,000 tons

The deficit allocation of 162,763 tons was prorated as follows:—

Philippines	87,913 tons
Costa Rica	12,120
Mexico	62,730
	162,763 tons

[1] *Willett & Gray*, 1964, **88**, 43.
[2] F. O. Licht, *International Sugar Rpt.*, 1963, **95**, (Supp. 23), 311–312.
[3] *Fortnightly Review* (Bank of London & S. America Ltd.), 1963, **28**, 1097.
[4] *Lamborn*, 1964, **42**, 12.

CANE GROWING IN SOUTH AFRICA

Proceedings, Thirty Fifth Annual Congress, South African Sugar Technologists' Association, 1961.

SINCE this congress was held in Durban and the Sugar Experiment Station at Mount Edgecombe, the supply position has altered and much of the discussion regarding controls and restrictions in production is now of little more than historical interest.

Historical Matter

One of the papers among the proceedings is, in fact, devoted to historical matter and is likely to interest cane growers in other parts of Africa, viz. "Sugar cane in Central and East Africa—some observations on its history and present position" by A. McMartin. Sugar cane is considered to have been known in East Africa since the 12th century, having doubtless been brought by Arab slave traders who were also responsible for transporting it to the Lake Regions. Originally sugar cane was probably procured by the Arabs from India. Dioscorides, in the first century A.D., refers to the presence of sugar cane in Arabia. Reference has been made in these pages to the preparation of crude sugar or jaggery from cane in Mozambique a century ago[1].

The early Portuguese explorers probably disseminated sugar cane along the Zambesi River. It would have been first grown as a garden cane for chewing and would doubtless have spread quite rapidly from one grower to another. Canes of the noble type, to be seen in some parts of East Africa, are considered to be descendents of these early introductions.

A form of wild sugar cane, *Saccharum spontaneum* var. *aegyptiacum*, occurs from Eritrea to Nyasaland and may interest plant breeders. The author gives a list of localities where it has been recorded and considers more attention should be paid to it for its possible breeding value—a source of genes for disease resistance.

With regard to the early history of sugar cane in Natal there is doubt as to whether the very early references refer to true sugar cane or to the sweet stemmed forms of *Sorghum* sometimes grown for chewing, the "imphi" of the Zulus. However it is known that the Zulu King, Dingiswayo, established trading relations with the early Portuguese settlers at Delagoa Bay and that sugar cane and bananas were grown at the royal kraal for the King's exclusive use.

When the first European sugar producing venture was established on the Zambesi delta the local natives were growing two varieties of cane which were assumed to have been introduced by some of the earliest settlers from Madeira. It is pointed out that, in the East African territories, commercial sugar cane cultivation has had a varied history, somewhat similar to that of Natal—the initial growing of mainly noble canes, their replacement with Uba and the subsequent replacement of the latter by the products of cane breeding programmes in other countries. The more recent enterprises, such as those in Rhodesia, have commenced operations with the newer varieties and have never grown noble or Uba canes.

The author, who made extended tours in East Africa, discusses in some detail the question of varieties now cultivated there and the sugar cane diseases in the areas visited.

Weeds

Weeds and weed control are discussed in three different papers. C. H. O. Pearson examines the critical period of growth of a sprouting cane sett, when weed competition must be eliminated, and supplies a convincing series of photographs of uprooted setts that have been weeded at different times in support of his views. He considers that, with newly planted cane, weeding of the rows should be done not later than 20 days from planting. This is when the lower leaves of the primary shoot bend over and wave about. Weeding at this stage encourages rapid development of the young cane plant for the next 40 days.

The same author discusses the effects of timing of weeding operations on the yield of sugar cane. A notable conclusion is that "to remove weeds every 7–14 days and 21 days has no advantage over removing them every 28 days." Effective weeding and cultivation can give yields of the order of 20–30 tons of cane per acre over the yields of an unweeded cane crop. He also concludes that there is an optimum control of weeds using small amounts of labour, which, if timed correctly, can give the greatest profit.

G. D. Thompson also discusses differences in sugar cane yield due to various degrees of weed control. Three varieties of cane were used with 7, 21, and 63-day intervals between weeding. Results showed that a response of 10 tons of cane per acre could be expected with 21-day interval control as against the 63 day interval.

Eelworms

As in many other cane growing countries nematodes or eelworms may be troublesome with cane in South Africa and cause severe losses. The situation is discussed at some length by J. Dick. Eelworm damage in Natal cane would appear to be most prevalent in the sandy soils, which have little humus, and it is thought this lack of organic matter could be the basic cause of eelworm trouble in that the natural enemies of the eelworm are thereby discouraged.

The species of eelworm most commonly encountered in cane in Natal have been identified as *Meloidogyne javanica* Chitwood and probably *M. incognita* var. *acrita* Chitwood, both world-wide species which occur in a very wide range of plants. A few other

[1] Howes: *I.S.J.*, 1961 **63**, 101.

species, including a spiral parasite, are occasionally present. Weeds are suspected of being responsible for building up populations of eelworms, notably a species of *Wahlenbergia* (family *Campanulaceae*) and several species of the family *Solanaceae*.

An account of an eelworm survey in sugar cane is given and of experiments on soil fumigation, which led to increases of about 14 tons of cane per acre. However, it is concluded that with prices current at the time of the Congress this method of control is unlikely to be economical. Other possibilities of control are discussed, such as biological control, use of resistant cover crops or of resistant or tolerant varieties of sugar cane.

Tractor maintenace

A useful article, especially for the cane farmer or grower, is that on "Some practical aids in tractor maintenance" by G. S. BARTLETT, where the whole question of lubrication and the theory of lubrication is discussed at some length. Two folder tables are included, viz. "Tractor lubrication requirements" and "Corresponding grade table for tractor lubricants." These are intended to aid the farmer in determining what lubricants the tractor distributors recommend for his particular make or model of tractor, where they are available, and their trade names.

Bamboo for sub-soil drains

P. F. BOULLE in an article "Covered drains" discusses the use of bamboo pipes for sub-soil drainage in cane fields. He points out that with increasing mechanization it is desirable to have unbroken field surfaces on which to work and to be rid of excess surface water on fields. Bamboo pipes, properly laid, have been found to be very effective and cheap and to have a reasonable length of life. One observer referred to bamboo pipes having been in use in one particular estate for 25 years. One would imagine length of life would vary much with soil conditions. Previous immersion of the bamboo in old tractor engine oil and in cattle dipping tanks (arsenical) was also referred to by members of the audience.

Cane Varieties

Details are given by T. B. BRASSEY ("Present varieties in pre-release trials") of a new procedure to be adopted before a final decision is taken to release a new variety or discard it altogether. This will mean promising new varieties will be grown over a wider area before release and will lessen the likelihood of a variety adapted to a particular environment being overlooked. Agronomic and other details, including disease resistance, are given for the following four new varieties bred in Natal—*Saccharine*, *Saraband*, *Sabre* and *Salute*. No very marked increases in yield are expected to be achieved by any of these varieties but some may prove superior to existing varieties under specialized conditions.

Irrigation

A preliminary report is given of a co-operative experiment by the S.A. Sugar Experiment Station and two large sugar companies to study the consumptive use of water by sugar cane, making use of the evaporation approach method ("Attempts to confirm irrigation control factors based on meteorological data in the cane belt of South Africa" by C. H. O. PEARSON, T. G. CLEASBY and G. D. THOMPSON). This work, it is hoped, may assist in the fundamental problem in irrigation, viz. to know how much water to apply, and at what interval, to produce the maximum economical yield from the crop being irrigated. Investigations are proceeding.

F.N.H.

AGRICULTURAL CHEMICALS AND "CONTAMINATION"

AN American writer, in discussing sugar cane borers and their control, draws attention to the great need for care by all users of insecticides and other toxic chemicals[1]. He mentions the primary importance now and in the future of "contamination" through the use of agricultural chemicals. The subject has been called to the attention of the public very strongly by a recently published book "The Silent Spring", following the publication of which numerous articles in newspapers and other publications have also appeared, and the subject has been aired on radio and on television, emphasizing bad effects from chemicals such as "Endrin", DDT and others.

"Cane growers and farmers all over the country will have to give special supervision to the use of insecticides to prevent public alarm. When fish are killed in ponds and streams this invites alarm. Growers should caution pilots not to open hoppers over streams and ponds. Care can be taken by flying parallel to the streams when applying 'Endrin' to cane near a bayou. This will not take any more time and will help prevent unfavourable publicity. 'Endrin' should not be used unless it is needed. It should not be put on 'just in case.' The unnecessary use of any chemical is wasteful and it may invite further attention to an already threatening situation. It would be very harmful to the Louisiana sugar industry if the use of 'Endrin' were prohibited. Take care."

F.N.H.

[1] L. L. LAUDEN: *Sugar Bulletin*, 1963, **41**, 192.

THE SUGAR CANE IN HAWAII

Annual Report, 1962, *Experiment Station of the Hawaiian Sugar Planters' Association; 21st Annual Meeting, Hawaiian Sugar Technologists*, 1962.

THESE two reports contain, as in former years, a wealth of information on many different aspects of sugar cane cultivation and sugar production in Hawaii. Much of the work referred to could have application in other countries.

In the Experiment Station Report the subject matter is classified under the following headings: Basic Plant Physiology and Biochemistry, Climate and Related Studies, Experimental Statistics Programme, Mechanical Harvesting and Related Research, Nutrition and Fertilization Research, Plant Protection Research, Sugar Technology Research and Development, Varieties Programme, Water Studies and Irrigation Programme, Weed Control Programme. These headings may serve to give an idea of the wide range of the experimental work and the research work being carried on in Hawaii.

What is noticeable in both reports is the time and attention now being devoted to mechanization, not only to mechanical harvesting, but to other field operations and handling procedure. The Director states in his introductory remarks. "Tests on the cut-convey-load harvester with cleaner bypass at Laupahoehoe showed that there was an average gain of 1·46 tons of sugar per acre, 0·39 at the 95% confidence level over the regular plantation practice of cane harvesting and cleaning. These large sugar gains established without doubt that the new HSPA harvesters have a sizeable potential for saving sugar that is now grown and lost by present methods of harvesting and handling—this is particularly true for unirrigated cane. These savings more than balance the increased capital and operational costs of the new harvesters over existing equipment. HSPA engineers have designed machines that are proving very satisfactory for cutting cane seed, and seed-cane harvesters are now in use on five plantations".

Several action photographs are provided of seed-cane harvesters at work. These give a vivid impression of the complicated nature of these machines. The Kohala side-mounted seed-cane harvester is completing its third year of production operation. The 1961 figures show the cost of machine-cut seed cane to be about half that of hand-cut seed cane. Details of the changes or modifications that have been made to this machine and to the other direct-mounted seed-cane harvesters are given.

Another feature of the mechanical work carried out at the Experiment Station has been the designing and manufacture of a portable core-sampler. This has a 5 in diameter tube, 5 ft long, with a cutting tip and powered by a chain-saw power unit. It is intended for sampling hand-cut field experiment cane. Another core sampler has been designed for taking a core from the top to the bottom of a load of cane.

In connexion with irrigation studies a long barrel sprinkler has been designed and tested to solve the problem of applying high volumes of water to impermeable soils. This prototype sprinkler, which has a barrel 40 ft long and weighs 9000 lb, with power unit, pump and other accessories, was moved satisfactorily by tractor from one site to another. A co-ordinated irrigation project is under way to establish the basic principles necessary to plan an effective irrigation programme on a plantation basis.

Laboratory workers are likely to be interested in the new machine developed at the Experiment Station for grinding or macerating small samples of sugar cane leaf (a tough material not easy to deal with in the ordinary way). The new machine, called the "Lambert disintegrator", is claimed to be the most efficient machine of this type that has so far been designed and to be cheap, easy to operate and simple to maintain.

Work on nutrition has thrown some light on the importance of residual nitrogen in the fertilization of the subsequent crop. Juice quality experiments have pointed out the relationships of nitrogen fertilization, variety and climate as they affect the quality of cane juices.

A study or survey has been made of the susceptibility of Hawaiian varieties of sugar cane to sugar cane diseases in other countries. It is felt that a knowledge of the reaction of varieties to foreign diseases may be of assistance if such diseases should ever become established in Hawaii. Ratoon stunting disease continued as a major threat to sugar yields in Hawaii and was found on seven plantations where it has not previously been recorded on commercial varieties. Methods for inoculating seedlings with the disease were investigated, bunch planted seedlings being easily infected by injuring the roots after drenching the soil with juice from infected stalks. Varieties were tested for resistance to leaf scald, mosaic and red rot disease.

Two insects of potential interest to the sugar industry appeared in 1962, a mosquito and the pentatomid bug, *Nezara viridula*, an insect of catholic food habits which has been reported as a minor pest of sugar cane in other countries. The American weevil first reported in Honolulu in 1960 (*Calendra venatus vestita*) has learned to feed on sugar cane and has demonstrated its ability to cause trouble in the industry. Larvae were found destroying a significant proportion of transplanted sugar cane seedlings at a sub-station.

In the report of the 21st annual meeting of the Hawaiian Sugar Technologists there are some 40 different papers. A paper by KATSUTO HARADA is concerned with the control of grasses with DCMU at Kilauea Sugar Company. Strains of Bermuda grass and crab grass which are quite tolerant of both TCA and "Dalapon" are said to have arisen. A concentration of 2 lb of CMU or DCMU per gallon of final spray, formulated with a spreader or surfactant, proved effective. Careful application reduced cane damage to a minimum.

An interesting paper by W. W. WORDEN is that describing an experimental one-eye seed cutter. He states that one of the main reasons why one-eye seed has not been used on a field scale hitherto is that there has not been a machine or method available to cut such seed economically (one-eye seed being a small section of stalk with only one node or one eye). A machine called the Wink cutter was used in this experiment. It is fitted with rotating knives actuated by a clutching mechanism. It is considered that one-eye seed could reduce the acreage required for seed cane by 70% and that a potential saving of $1.00 per ton of sugar produced could be involved. In the experiments described germination of one-eye seed was good but it appeared to lack vigour and tillering capacity at a later stage, although this needs to be confirmed.

The bulk handling of seed cane as carried out at Grove Farm is discussed by C. E. WARNER. A former method required a total of 20 men to cut, haul and plant the seed cane; by contrast, the new system of bulk or mechanical handling of the seed cane requires only six men. Where the seed cane was previously cut, bundled, loaded, off-loaded and fed to droppers entirely by hand, it is now untouched until the moment the planting machine crewman feeds it into the final planting conveyor. The outfit consists basically of four parts: (1) the specially designed seed cane cutter mounted on a tractor, (2) four specially designed, water-tight hauling trucks which eject the seed cane into the planter bins after treatment, (3) the seed cane treating plant and (4) a new bulk planter. Changing to a completely mechanized system of planting in this way is costly but the elimination of the labour of 14 men is obviously of great importance economically.

F.N.H.

A LARGE CANE GROWING PROJECT FOR ZULULAND[1]

THE tremendous project, now commenced, for irrigating the Makatini Flats of Northern Zululand, from a huge dam in the Pongola River Gorge, will be of special interest to cane growers as sugar cane is expected to be the main crop. The Makatini Flats consist of an extensive low lying region of fertile land covering 1,300,000 acres, between the Lebombo mountains and the sea. The success with cane growing of the existing Pongola irrigation scheme further up the river points to a great future for the transformed Makatini Flats area in sugar production.

The climate of this low-veld area is hot, with a much higher mean average temperature than the cane growing areas of Natal to the south, which results in a higher sucrose content in cane. The limiting factor to cane growing has been inadequate soil moisture for a large part of the year. This will be overcome by irrigation. During the next decade it is expected the region will become a thriving irrigation settlement with complementary industries. While sugar production is expected to be the main activity other suitable crops for the area are considered to be cotton, coffee, citrus, pineapples, kenaf, nuts, rice, tobacco, maize and pulses.

The first cane farms are due to be allotted in 1965, the remainder as the scheme progresses. Each farm will consist of about 50 acres, some of which will be scheduled for irrigation. It has been estimated that there is likely to be a serious shortage of sugar in South Africa from 1967 onwards, unless new areas are planted with sugar cane before that date. When the scheme is completed, in 1976, it is estimated some 150,000 acres should be under cane. Before farms are allocated houses will be built and the land prepared for agriculture by the Department of Lands. Expenditure will be recovered at a later date when the farms are sold to the occupiers.

Sugar mills will be established as required so that cane does not have to be transported over uneconomic distances. It is expected the area may produce some 560,000 tons of sugar a year and keep four large mills active, also that the population will reach about 100,000 when maximum production has been achieved. A central town is being built to cater for the commercial and social needs of the settlement and other centres will be developed.

It is estimated that the dam when completed will have an area of 34,000 acres increasing to 40,000 during peak floods and will be the largest dam in the Republic, larger than the Vaal Dam. It will straddle the Natal-Transvaal border with its northern arm stretching into Swaziland. The first section of the dam's foundations were poured during August 1963. Magazines to house the vast quantity of explosive required to excavate the foundations of the dam had to be provided as well as an ice-plant supplying 125 tons a day. The ice is mixed with the concrete to ensure that its temperature is held at a low level when the concrete is poured, this being necessary on account of the high average temperature of the region.

F.N.H.

[1] Taming a tropical wilderness with water. ANON: *S. African Panorama*, 1963, **8**, (10), 26–29.

Outstanding canes of Bihar. VI. BO.21—an early maturing high sugared variety. C. Thakur, S. W. Akhtar and S. A. Akhtar. *Indian J. Sugar Cane Res. Dev.*, 1963, 7, 139–143.—A full account and detailed description of this cane is given, including a coloured illustration of the stem. The variety was released from the Sugar Cane Research Institute in 1953 and recommended for North Bihar. It was discarded in 1961 because of susceptibility to red rot disease and deterioration in yield.

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Studies in "rayungans" as sugar cane seed material at Anakapalle. M. Lakshmikantham. *Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 144–148.—The Indonesian term "rayungans" is used for the shoots that develop from the lower part of a sugar cane stem when the top portion is cut off. When 4–6 weeks old they harden and are fit for planting. Field plantings made from them and ordinary setts, when mature, showed no differences.

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Agro-ecological conditions in Rajasthan and their relative effects on sugar cane cultivation. M. S. Godhara. *Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 149–157. Various aspects of sugar cane cultivation in Rajasthan (Kota) are discussed and a map provided showing the distribution of varieties (10 Co varieties). The names of the indigenous varieties cultivated prior to 1930 are also given.

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Treatment of seed cane against borer. A. N. Kalra and M. C. Gupta. *Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 158–160.—The cane borer in question, *Chilotraea auricilia*, is troublesome in many cane growing countries. Soaking cane setts for two hours in "Endrin", gamma BHC + DDT and "Basudin", all in 0·1% emulsions, gave high mortality of larvae and pupae. "Dipterex" as 0·2% solution was effective with larvae but not very effective with pupae. The "Endrin", gamma BHC + DDT and "Basudin" emulsions had a depressing effect on germination.

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The influence of certain climatic factors on borer population. D. V. Sivarao and C. Kamalakara Rao. *Indian J. Sugar Cane Res. Dev.*, 1963, 7, 164–167. The borer in question was the shoot borer, *Chilotraea infuscatellus*, on three varieties of cane at the Sugar Cane Research Station at Anakapalle. The average minimum temperature and the difference between maximum and minimum temperatures bore a significant relationship to population increase. In general, warm weather favoured increase of the pest.

First record of a bethylid parasite of the army worm, *Pseudaletia unipuncta* Haw. P. N. Avasthy and J. P. Chaudhary. *Indian J. Sugar Cane Res. Dev,*. 1963, **7**, 192.—A detailed description of this parasite, a species of *Parasierola*, is given and an account of its life history as studied under laboratory conditions. It was first observed as a parasite of the army worm in 1961.

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Occurrence of the shoot borer, *Chilotraea infuscatellus* Snell as a cane borer in the Sriganganagar area of Rajasthan. A. N. Kalra and N. C. Sharma. *Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 193–194.—The severe damage caused by this pest to the young shoots and growing points of sugar cane throughout India is stressed. Recent observations have revealed its activity as a stem borer as distinct from a shoot or top borer in the area mentioned.

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A note on yellow spot disease on sugar cane at Tanuku (Andhra Pradesh). K. K. Prasada Rao and B. S. L. Narasinga Rao. *Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 194–195.—The writer considers yellow spot disease of sugar cane (*Cercospora kopkei* Kruger) to be usually of minor importance. An outbreak of the disease at Tanuku in the West Godavari District adversely affected cane juice quality and sugar recovery at the local factory. Details of studies made to assess quantitatively damage due to the disease are given. The only means of effective control is considered to be the use of varieties resistant to it.

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Review of work on the green muscadine fungus (*Metarrihizium anisopliae*). R. C. Kulshreshtha, A. S. Dhillon and K. A. Gursahani. *Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 195–196.—Reference is made to records of this fungus attacking sugar cane pests (*Pyrilla*) in India and the advisability of work on a field scale under different environmental conditions being carried out. A bibliography is given.

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A complete cutter rake sugar cane harvester. Anon. *World Crops*, 1963, **15**, 399.—The machine is described along with three photographs showing it in action (in Puerto Rico). The cut cane collects on a platform and is loaded periodically, by means of a grab operated by the driver, onto an accompanying vehicle. Adequate transport is essential to keep the harvester in operation. It is claimed that given reasonably level ground the machine successfully harvests high yielding cane, without the necessity of first introducing new varieties and field practices.

A note on the appearance of army worm on sugar cane in Sehore. M. L. PUROHIT *et al.* *Indian J. Sugar Cane Res. Dev.*, 1963, **7**, 196–197.—Reference is made to severe damage to six months old cane by the army worm, *Cirphis unipuncta*, when only the midribs of the leaves were left. A description of the pest, its life history and suggested control measures are given.

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"Diquat"—a new contact weedkiller. F. WALLS. *Agric. Gaz. N.S.W.*, 1962, **73**, 647–649.—Experiments with "Diquat" were carried out to study the control of various weeds including water ferns (*Azolla*, *Salvinia*) and water hyacinth (*Eichhornia crassipes*).

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Correlations of pre-harvest samples and cultural practices with final yield and quality of sugar beet. R. E. FRIEHAUF, H. L. BUSH and E. E. REMMENGA. *J. Amer. Soc. Sugar Beet Tech.*, 1963, **12**, 273–283.—Early (July) sampling, by top weight, gave a satisfactory indication of final yield. The conclusion was reached that present farm fertilizer practices are nearly correct although it might be safe to use a little more nitrogen, if applied early, without affecting beet quality.

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Effect of "Nabam" solutions on emergence of larvae from cysts of *Heterodera schachtii* **in aqueous solutions in the soil.** A. E. STEELE. *J. Amer. Soc. Sugar Beet Tech.*, 1963, **12**, 296–297.—Treatment of sugar beet nematode cysts with 4000 p.p.m. of "Nabam" (disodium ethylene-*bis*-dithiocarbamate) inhibited the emergence of larvae from the cysts; on removal to tap water larvae emerged, which suggests that "Nabam" or a breakdown product is responsible for inhibition. Soil drenches of beet diffusate stimulated emergence of larvae from cysts.

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Evaluation of diffusates and juice of asparagus roots for their nematocidal effects on *Heterodera schachtii*. A. E. STEELE and C. PRICE. *J. Amer. Soc. Sugar Beet Tech.*, 1963, **12**, 299–300.—Root diffusates of asparagus (*Asparagus officinalis*) have reduced populations of other nematodes—e.g. those attacking tomatoes. In this work they were quite ineffective with sugar beet nematodes and did not stimulate the emergence of larvae from the cysts.

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Processing and drill performance of monogerm beet seed. H. S. REDABAUGH and C. W. DOXTATOR. *J. Amer. Soc. Sugar Beet Tech.*, 1963, **12**, 301–308. An account is given of the processing of monogerm beet seed using the Engleburg rice huller, and of the grading of seed for size and the suitability of this seed in three makes of drills.

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Interrupted nitrogen nutrition effects on growth, sucrose accumulation and foliar development of the sugar beet plant. R. S. LOOMIS and D. J. NEVINS. *J. Amer. Soc. Sugar Beet Tech.*, 1963, **12**, 309–322.—These experiments give information on the time course of the nitrogen starvation and recovery responses of sugar beet, especially in leaf growth. With restoration of nitrogen after deficiency, leaf initiation was renewed and root sucrose declined.

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Control of sugar beet nematode with 1,3-dichloropropenes in irrigation water. L. E. WARREN. *J. Amer. Soc. Sugar Beet Tech.*, 1963, **12**, 348–357.—Soil samples from irrigation plots treated with the chemical ("Telone") showed after harvest about one-third as many pearls (cysts) as in untreated plots. Weeds were less on treated plots. Further work on irrigation application of "Telone" is needed.

* * *

Harvesting and delivering beets 24 hours a day. J. C. TANNER. *J. Amer. Soc. Sugar Beet Tech.*, 1963, **12**, 360–361.—Harvesting in Minnesota must be completed between 20th September and 25th October. Increased acreage and multiple unit harvesters have called for increased rates of delivery to factories, hence the need for working round the clock.

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Increased cane production brings grub control problems. ANON. *Producers' Rev.*, 1963, **53**, (7), 83.—The campaign for immediate, increased sugar production in Queensland, involving the growing of third year ratoons or ploughing out and replanting immediately after harvest, has led to increased borer or other insect attack, notably from greyback and frenchi grubs. Recommended increased BHC applications for both greyback and frenchi grubs are here given.

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Tricotyledonous beet plants. T. A. METEL'KOVA. *Bot. Zhur.*, 1963, **48**, (1), 99–100; through *Biol. Abs.*, 1963, **44**, (3), 916.—The author studied other dicotyledonous plants with three instead of two cotyledons, notably beans. He considers the phenomenon may be of practical value since, in addition to having three cotyledons, such plants are proportionally higher in bulk. In the case of sugar beet, tricotyledonous plants not only weighed more but produced almost twice as many lateral roots. The character proved to be hereditarily unstable.

* * *

Control of aquatic weeds. W. G. L. AUSTIN. *Outlook for Agriculture* (I.C.I. Ltd.), 1963, **4**, (1), 35–43. Reference is made to the increasing importance of aquatic weeds and their control throughout the world, especially with the rapid increase in irrigation and use of irrigation channels. The more important aquatic weeds are referred to individually according to the group to which they belong—submerged, free-floating, emergent, and algae. The value or limitations of various modern herbicides, with both temperate and tropical weeds, are then dealt with, the herbicides being: sodium arsenite, copper sulphate, 2,4-D (effective with water hyacinth, *Eichhornia crassipes*), "Silvex," acrolein, "Endothal," "Diquat" (effective with water lettuce, *Pistia stratiotes*), "Paraquat" (successful against water fern, *Salvinia auriculata*), "Dalapon" and aromatic solvents.

HORIZONTAL VACUUM PAN
with plate-type heating element

By F. DAMBRINE and J. C. GIORGI (Centre de Recherche de la Société Fives Lille-Cail)

PART I

THE criteria generally set for a commercial pan may be summarized as follows:

(i) production of sugar crystals of the desired size, without fines,

(ii) high yield of crystal sugar,

(iii) rapid sugar boiling so as to increase the pan output and reduce sugar coloration and molasses formation, and

(iv) heating of the pan with low-pressure steam or vapour.

These objectives can only be attained in a commercial pan if its design permits the following characteristics to be obtained at the same time:

(a) vigorous circulation of the massecuite, favouring not only uniform supersaturation, crystal content and temperature, but also the stirring of crystals in the mother liquor and consequently rate of crystallization, and also heat exchange—at least in principle,

(b) sufficiently high ratio of pan capacity to footing volume, and

(c) low head of massecuite above the heating elements; this characteristic, difficult to reconcile with the above, is basic since, at the low pressures obtaining in a pan, even a small increase in the level of massecuite will considerably increase the temperature of ebullition of the mother liquor, i.e. decrease appreciably the useful temperature difference between the heating vapour and the massecuite in the tubes, and this consequently reduces the rate of evaporation and increases the variations of temperature within the massecuite.

Designing a commercial pan that would meet, if possible, these requirements, determining the optimum size, and experimenting with it on pilot and commercial prototype scales have been the various stages of a study carried out at the Research Centre of the Société Fives Lille-Cail, with the support of the Bouchon sugar factory-refinery at Nassandres.

Design and Dimensioning of the Pan

In a conventional calandria, heat exchange cannot take place by simple heating of the massecuite circulating inside the tubes. In fact, if this were so, the overall heat transfer coefficient would be defined by the relationships applicable to laminar flow heating, since, up to a velocity of about 8 metres/sec and for tubes of 90 mm diameter, the Reynolds number is less than 2500.

Now, according to the relationships between the heat transfer coefficient and various parameters involved in the exchange, such as weight flow, specific heat and conductivity of the massecuite, and diameter and length of the tubes, the heat transfer coefficient can only be equal to 500–600 kcal/sq. metre/°C/hr, the value generally obtained in pans, if the velocity of circulation of massecuite inside the tubes is greater than 8 metres/sec, a condition which is obviously never fulfilled.

What takes place is thus more than simple heating; vapour bubbles are therefore produced inside the calandria, in contact with the walls, and it may be allowed that some of the vapour bubbles so formed emerge at the surface of the tubes while the rest are condensed in the massecuite.

The vapour alone being able to ensure effective stirring of the massecuite, it follows that the true zones of homogenization of the latter in a pan are the intervals between the heating elements and the space above. Consequently, in a calandria pan, if the homogenization zone formed by the space above the calandria favours homogenization of the products during crystallization, this is not the case with the calandria itself, which, by definition, divides the massecuite into as many separate streams as there are tubes.

The massecuite circulates in the tubes under the influence of the difference in density between the massecuite in the downtake and the ascending vapour-massecuite mixture, a difference which defines, to a first approximation, the intensity of circulation.

Increasing this difference is a favourable factor, but it is not by itself sufficient to produce vigorous circulation of massecuite in the pan; the circuit followed by the massecuite must, in addition, be so designed that the total loss of head in the circuit is kept to a minimum, i.e. so as to minimize the friction and vortices caused by variations of speed in the liquid streams.

All these considerations have led us to design a pan not with an axis of symmetry but with a plane of symmetry, such that the massecuite might return below the heating element by parallel plane circuits which are perpendicular to the plane of symmetry; this arrangement offers the advantage of freedom in the design of the profiles of the return sections and helps also to avoid useless losses of head, or dead zones or settling pockets.

This horizontal arrangement of the pan is further advantageous from another point of view; in fact, for equal capacity and with carefully chosen proportions, the surface projected on a horizontal plane is much greater than in a vertical pan, in a ratio of about 1·4 to 1. As a result, with equal capacity, the height of massecuite above the heating element will be less in a horizontal pan than in a vertical pan (in the ratio of 1 to 1·4). From this come the following advantages:

increase in the thermal possibilities of the pan,

more even temperature throughout the massecuite, and

reduction in loss of head in the return circuit by decreasing its length (5200 mm on average in the conventional pan—4000 mm on average in the plate-type pan).

We have, in addition, abandoned the tubular calandria in favour of an assembly of plates, which is more conducive to uniform crystallization of the massecuite, and which, because of the existence of the plane of symmetry of the pan, is composed only of flat plates.

This type of assembly, moreover, presents two further advantages, which are not negligible: first of all it permits a reduction of the dead zone in the steam belt (in a ratio of 6 to 1), a volume which may be used with profit either by increasing the heating surface of the assembly while retaining a small footing, or by increasing the size of the return circuit. This, like the assembly of cylindrical plates in the remaining part, permits a reduction in the loss of head at the entry of the assembly, the variations in section being much less significant than in the tube nests.

The design philosophy of the pan being set forth, it was necessary to select the optimum dimensions; for this we had recourse to dimensional analysis.

First of all we assumed that the circulation of massecuite in the pan was independent of the surface tension—a hypothesis which we have subsequently verified experimentally—which permitted us in our experiments to replace steam by air.

On this assumption, the magnitudes which determine the velocity of circulation of the massecuite may be acknowledged as the following:

l = linear length
g = acceleration due to gravity
Q = volume flow of liquid
V = volume flow of steam
μ = viscosity of liquid
ρ = density of liquid

Six independent magnitudes enter into play in the phenomenon, 3 fundamental magnitudes being required to express these independent magnitudes; any relation between these 6 magnitudes may thus be reduced to a relation 6–3 = 3 similitude constants or dimensionless numbers.

Resolving the matrix corresponding to these data, we have a dimensionless product:

$$\left[\frac{Q}{\sqrt{gl^5}}\right]^a \left[\frac{V}{\sqrt{gl^5}}\right]^b \left[\frac{\mu}{\rho\sqrt{gl^3}}\right]^c = K$$

where a, b and c, respectively, are the exponents of the Froude number relative to liquid, of the Froude number relative to gas, and of the ratio of the Froude number to the Reynolds number of liquid.

In the experimental tests made with a model one sixth of the industrial scale, one should keep constant the numbers $\frac{V}{\sqrt{gl^5}}$, by acting on the gas flow, and $\frac{\mu}{\rho\sqrt{gl^3}}$, by acting on the viscosity of the solution in order to simulate the footing; we therefore worked with solutions at 20°C and 30°Bx and, in order to simulate conditions half-way through a strike, with solutions at 20°C and 42°Bx.

The number $\frac{Q}{\sqrt{gl^5}}$ being considered as a dependent variable of the other two groups, experimental measurement with the model of the velocity of circulation of the solution representing the massecuite

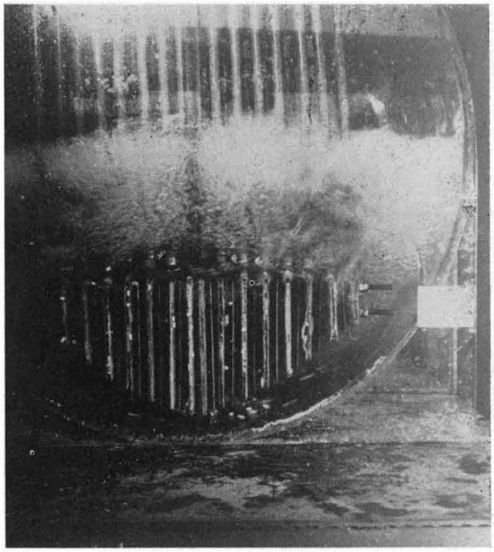


Fig. 1. End view of the model

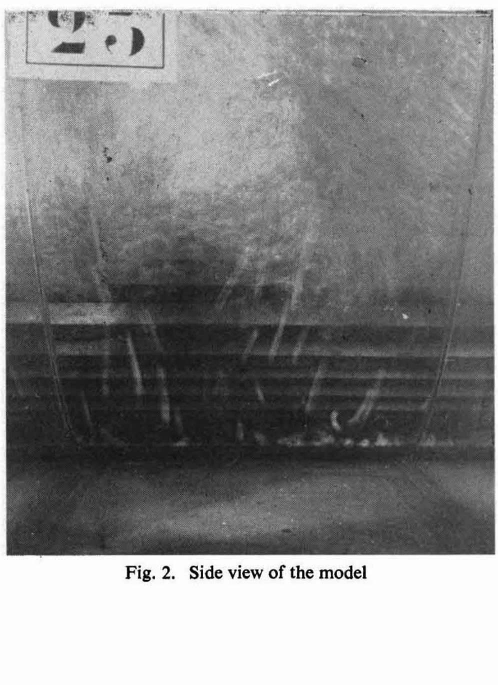


Fig. 2. Side view of the model

permits deduction of the characteristics corresponding to industrial boiling. Thus it can be concluded immediately that velocities obtainable in a commercial pan should be those obtained in the pilot plant × the square root of the scale.

To secure the dimensional analysis against criticism, we still had to show that the phenomenon is independent of the surface tension of the liquid—the initial hypothesis. To this end, two models were built of a single-tube pan, one on unity scale and the other on a 1/6th scale, and it was verified that the results predicted by dimensional analysis were in conformity with experimental data.

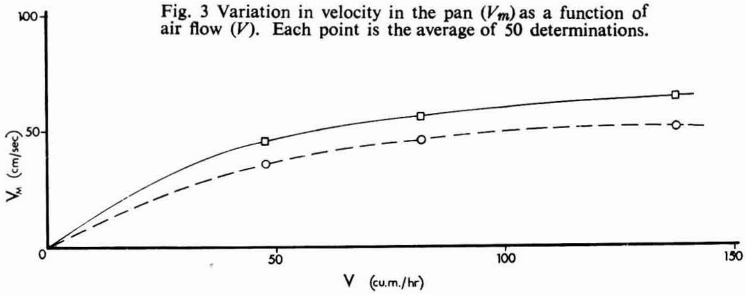
As in the dimensional analysis experiments bearing on our new pan, only the Froude numbers relative to gas and the Reynolds numbers relative to liquids were maintained constant by acting on the gas flow and the viscosity of the solutions. To produce bubbling, the 1/6th scale model was fed with air at the bottom while the unit scale model, filled with a sugar solution of the same viscosity as that observed in the strike, was heated with steam.

Under these conditions, the Webre numbers (characterizing surface tension) of the solutions from the two models were clearly different (by 1 : 70).

The experiments consisted in measuring the circulation velocities in the two models and in verifying that those obtained in the 1/6th scale model corresponded to the theoretical values deduced from the velocities obtained in the unit scale model; the differences between the theoretical and experimental velocities were always less than 5%, which confirmed our initial hypothesis.

We therefore built a model, one sixth the size of a commercial pan; the heating element, made up of parallel hollow plates at variable intervals, could be moved easily in the space surrounding it; the heating steam was replaced by air the flow of which was calculated to conform to dimensional analysis —this air escaped from the plates through holes drilled for this purpose in suitable positions.

Fig. 3 Variation in velocity in the pan (V_m) as a function of air flow (V). Each point is the average of 50 determinations.



—□— Feeding with 42°Bx sugar solution (as halfway through the a strike).

– –○– – Feeding with 30°Bx sugar solution (as when boiling is started).

Our tests consisted:

in varying the interval between plates,

in varying the position of the assembly in its calandria, and

in varying the level of "massecuite", that is to say the solution, above the assembly, and, in each case, in measuring with the aid of tracers and with a camera the velocity of the solution in the return circuit (Figs. 1 and 2), which was possible because the calandria of the pan was made of clear plastic ("Perspex", "Plexiglass").

We retained the best solution, i.e. the one permitting the highest circulation velocity, and for this solution we plotted the variation of velocity of the liquid in the tank versus the air flow at different massecuite levels in the pan.

Examination of the curves obtained (Fig. 3) shows that:

(1) For a given volume of solution, the circulation velocity increases with gas flow until it reaches a fairly extended plateau.

(2) The usual point at which a commercial pan operates is well ahead on this plateau; we can therefore confirm that massecuite circulation velocity in the pan will be maintained even if the rate of operation of the pan has to be reduced for one reason or another; the curves show that the margin of stability is very high.

(3) For the same gas flow rate, the circulation velocity increases according as the levels of solution in the model increase, in spite of the rises in viscosity of the test solutions corresponding to the rise in concentration of the mother liquors in the commercial pan.

This is easily explained. While the level rises above the heating element (up to a certain limit, of course), the massecuite flow sections in the return circuit, located above the heating element, increase too; all other things being equal, this permits the return of flow to be increased.

In this connexion, it should be noted that in commercial pans circulation is feeble during graining; this is often explained by saying that the viscosity of the massecuite is then very high. In fact, it is also due to the almost total interruption of the return circuit of the massecuite, the level of massecuite above the heating element being practically nil.

The method that consists in fixing the volume of footing at a small height above the heating element is thus all the poorer as it is essential to have, during graining, intense stirring of the massecuite.

The curves show further that the circulation velocities obtained in the models are of the order of 0·4 metres/sec. While the crystals are small in size, it is necessary to reach velocities of the order of 1 metre/sec in the case of rapid boilings.

From the results obtained with a hydraulic model, the principal data of the pan were determined, notably

the distance between plates: 45 mm,

the ratio between the downward and upward cross-sections at the upper level of the heating element: 0·8,

the profile of the flow sections, particularly in the downward massecuite path, and

the height of the heating element relative to the bottom.

A pilot plant was then made one-sixth the size of a 300 hl commercial pan; the heating element was however designed so as to reduce the heat transfer surface as the cube of the scale (and not the square as would be the case with geometrical similarity). Further, the size of the massecuite flow areas between the heating plates and in the return circuits was the result of an unavoidable compromise between geometrical and hydraulic conditions, a compromise which, moreover, could only be disadvantageous to the pilot plant as compared with the commercial pan.

Under these conditions, for the same duration of operation, the vapour velocities, the useful heat differences, and the return velocities were of the same order of magnitude with the model as with the prototype. An approximate similarity is thus secured, while rigorous similarity cannot be demonstrated. The pan thus designed was tested successfully on high remelt strikes and first low-grade refinery strikes.

(*To be continued*)

SOLVENT SEPARATIONS IN SUCROSE SOLUTIONS

By F. H. C. KELLY
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OVER the past few years attention has been drawn by RAU[1] to the possibility of extracting cane juice with solvents employing butanol followed by acetone, whereas UHDE[2] has used ammonia in juices from sugar beets. The objectives of these two approaches seem to differ in that RAU has been mainly concerned with the extraction of non-sucrose substances from the juices as a means of purification whereas UHDE has sought to obtain a sucrose-rich extract, carrying out in effect a concentrating process. It is considered pertinent to draw attention to the importance of phase equilibrium relationships in studies of this character which can usefully save trial experiments and make possible a better appreciation of the scope and economics of applying such techniques. To date we have not endeavoured to obtain fundamental information on the sucrose-water-ammonia system, but, provided problems of technique can be effectively surmounted, such information should throw interesting light on the possibilities of ammonia utilization.

The sucrose-water-acetone system has been known for many years to include a range of concentrations through which two liquid phases can exist in equilibrium with each other, one of which contains a higher ratio of sucrose to water (up to 170 parts of sucrose per hundred of water at 30°C) and the other a lower (down to 47 sucrose per 100 of water). Attention was drawn to the two liquid phases by HERZ and KOCH[3] in 1904, and in 1940 VERHAAR[4] published the full phase equilibrium diagram for this three-component system at 30°C. A copy of the diagram is included by the author in a review of the solubility of sucrose in impure solutions[5]. Acetone however has a relatively high volatility and possible applications appear to be somewhat restricted for this reason. On the other hand the utilization of butanol seems to be encumbered with less troublesome techniques and its usefulness as an extractive agent has here been given primary consideration.

There are four isomers of butanol—*normal*, *secondary*, *tertiary* and *iso*-forms. The *tertiary* form is miscible with water in all proportions and its main use in extractive processes would appear to be as a modifier of solubility characteristics of one of the other isomers. The *normal*, *secondary* and *iso*-forms each have a quite wide range of concentrations over which two liquid phases exist in equilibrium in an aqueous sucrose system and with their relatively lower volatility a useful application might well be developed. Furthermore the effective separation of butanol from water by azeotropic distillation is well known and would seem to have useful application for butanol recovery from the system.

[1] Indian Patent, 60, 403; *Indian Sugar*, 1960, **10**, 205–214.
[2] German Patent 1,076,049, Gr. 11.8.60.
[3] *Zeitsch. Anorg. Chem.*, 1904, **14**, 315.
[4] *Archief Suikerind. Ned en Ned. Indie*, 1940, **48**, 464.
[5] "Principles of Sugar Technology" Vol. II. Ed. P. HONIG. (Elsevier, Amsterdam.) 1959. p. 110.

The addition of butanol to natural sugar juices has three main effects: (1) the extraction of non-sucrose substances, (2) the removal of water, and (3) the development of new surface effects at the interface between the water-rich layer and the butanol-rich layer. In order to simplify the system we have commenced with a separate study of the second aspect and determined equilibrium phase relationships in the three-component systems of sucrose, water and one of the four possible butanols. The properties of the water-butanol systems are very similar for the *normal*, *secondary and iso*-forms, each having a limited solubility in water and a limited solubility of water in butanol (all of the order of 5–15% w/w). The *tertiary* butanol, as well as being miscible with water in all proportions, has a melting point of +25°C compared with —89°, —89° and —108°C for the other three. The boiling points are 118°, 100° and 108°C compared with 83°C for the *tertiary* with some minor variations being recorded by different workers.

In Fig. 1 are illustrated phase equilibrium relationships which have been determined for the system sucrose:water:*n*-butanol at 60°C[6]. Tie lines are drawn for the two liquid-phase zones to indicate the compositions of water-rich liquid phase (L_1) and butanol-rich liquid phase (L_2) which are in equilibrium with each other. From this diagram we can estimate the condition for either batch extraction or continuous countercurrent operation.

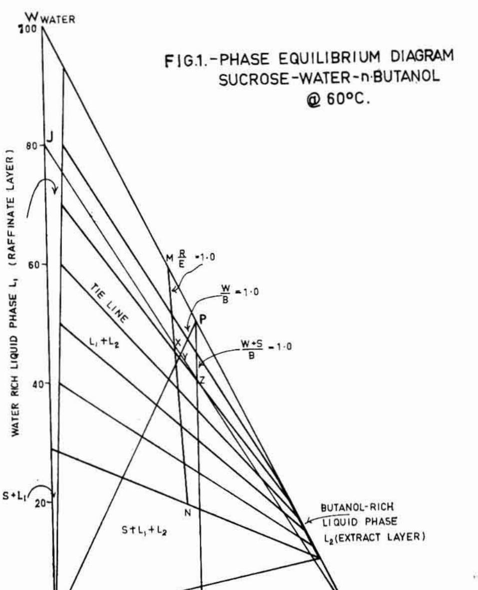


FIG.1.-PHASE EQUILIBRIUM DIAGRAM SUCROSE-WATER-n-BUTANOL @ 60°C.

If we commence with a sucrose solution of 20% concentration this will be represented on the diagram by point J. When butanol is added to this solution the composition of the mixture will appear somewhere along the line JB depending upon the proportion of butanol present. There are different ways of specifying the proportion of butanol, and the method adopted will be largely determined by the circumstances of the particular situation. Three different methods of specification are illustrated in Fig. 1. The first shows point X along the line JB selected by specifying the ratio (w/w) of water-rich liquid phase (L_1)—known sometimes as the Raffinate phase (R)—to the butanol-rich liquid phase (L_2)—known sometimes as the Extract phase (E). Any two-phase mixture with the same ratio of R/E will lie at an appropriate point on line MN. The second specification illustrated is for a constant ratio of water to butanol in the mixture, and any two-phase mixture with the same ratio of W/B will lie at an appropriate point on line PS. The third method specifies the ratio of sucrose to butanol in the mixture, and mixtures of the same $\frac{W + S}{B}$ ratio will lie at an appropriate point on the line PQ. In each case the line for a ratio of unity on a weight/weight basis has been drawn; any other ratio might equally as well have been selected for the purpose of illustration. The points X, Y or Z at the intersection of JB and the particular line of specification and the ratios of BX/XJ, BY/YJ or BZ/ZJ will represent the ratio of solution J to added butanol. The two liquid phases which will separate will have compositions at the extremities of tie lines passing through X, Y or Z and the corresponding compositions of L_1 and L_2.

If the two phases are separated a further quantity of butanol may be added to the L_1 phase and more water extracted. This procedure may be continued until a saturated solution of sucrose is obtained and the surplus water has all been removed in the successive amounts of butanol added to the system. Approximately 2% of the saturated sucrose solution will however be dissolved in the butanol, and this will have to be removed by evaporation using a surface type condenser for its recovery. This would be economically necessary as the amount involved would be approximately one ton of butanol for every 14 of sucrose. On the other hand there would be a small quantity of sucrose in the L_2 extracts removed but probably not more than ½% of the total sucrose involved depending upon the amount of solvent employed.

An alternative method of graphical representation is shown in Fig. 2(a) for the extractive technique just described, i.e. one of a batch character with introduction of fresh butanol to each successive L_1 fraction. The line AB defines the equilibrium relationships between the L_1 and L_2 phases, being a plot of composition at tie-line extremities. The conditions

[6] KELLY & ROLLS: *J. Applied Chem.*, 1963 **13**, 496–498.

which would be obtained from successive batch extractions employing a raffinate/extract ratio of 0·5 to 1 have been drawn in and show that five stages would be required to concentrate an aqueous sucrose solution with 80% water to one with 31%.

In figure 2(b) are illustrated the conditions which would result in a continuous countercurrent extraction system. Here we again have the tie line equilibrium line but also the operating line joining the conditions at the terminal points of the system. This is the type of extraction which could be carried out in a column provided with suitable means for dispersing the two fluid phases to provide optimum contact conditions. Steps have been drawn as in the conventional technique for specifying the number of theoretical transfer units which correspond to any particular type of behaviour. Several alternatives are illustrated for the fixed conditions of 80% water in the dilute sucrose solution and 31% in the concentrated solution. The concentration of water in the extract is varied by varying the ratio of butanol to aqueous-sucrose feed and terminal conditions for 1, 2, 3, 4 or n transfer units are shown. The lower the ratio of butanol to aqueous-sucrose feed (i.e. the more dilute the extract) the greater will be the number of transfer units required or the longer will be the extraction column. In any practical extraction column the height of a transfer unit will depend on the effectiveness of inter-dispersion of the two liquid phases and this is the subject of current study. However there are sufficient data in the tie-line equilibrium curve to enable a preliminary study to be made of the economic feasibility of a system of this character.

Continuous countercurrent extraction of water as a concentrating process has much in its favour, but there are practical difficulties with currently studied solvents. We could specify the properties for a solvent required for ideal application to an extraction process, seek a solvent which approximates to these specifications and then modify the properties until they approach more closely to the desired specifications. This modification of properties may be done by altering the chemical constitution of the solvent or by adding to it a minor amount of one or more compounds which would effect the desired modification of the properties. Unfortunately some of the desired properties are mutually incompatible hence a certain amount of compromise will be necessary.

We can define as our first requirement a solvent which will remove the maximum amount of water and the minimum amount of sucrose whilst at the same time is itself insoluble in a concentrated sucrose solution. Secondly the temperature coefficient of solubility of water in the solvent-rich phase should be high enought to permit a useful separation of water from the solvent-rich phase merely by reducing the temperature of this phase, the most useful temperature range for operation being between 50 and 30°C. The length of the extraction column (i.e. number of theoretical transfer units) would appear to be related to the range of concentration and to the degree of association of water in the solvent-rich phase. For example, if the equilibrium line in Fig. 2(b) is steeper, then fewer transfer units are required for comparable equilibrium conditions at the two ends of the column.

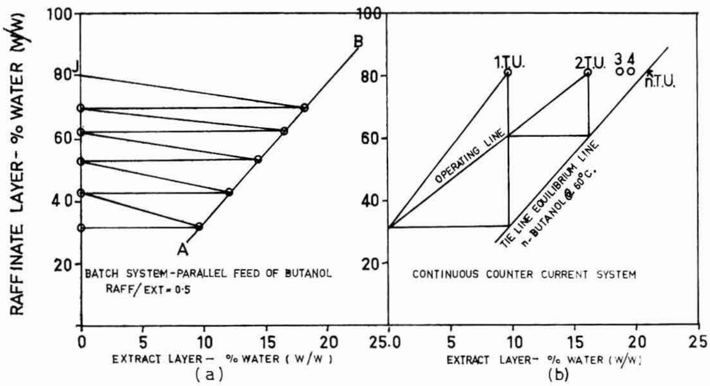


FIG. 2. TRANSFER UNIT ANALYSIS.

On the other hand the equilibrium line should be as far away from the ordinate axis as possible, i.e. be a good solvent for water in order to minimize the solvent:solution ratio for removal of the required amount of water. This is unlikely to be compatible with the requirements of no sucrose in the solvent-rich layer and no solvent in the concentrated sucrose solution.

In this particular system the equilibrium line is very close to a straight line on Fig. 2(b). If this line were to be curved—concave upwards then the number of transfer units would be progressively reduced as the curvature increases provided the terminal conditions are not altered. In this case there would also be no change in the solvent:solution ratio for a particular water removal. A change of this character in the shape of the equilibrium line would be expected with an increase in the degree of association of the water in the solvent. This may be observed by studying the distribution coefficient in the relationship:

$$D = \frac{C_b}{C_a^{1/n}}$$

where D is the distribution or partition coefficient and C_a and C_b are the concentrations of solute in the two liquid phases. The value of n will be the degree of association. This may be deduced from the slope of the plot of log D against log C_a.

If the solvent removed the water in large amounts (i.e. with a high degree of association) it would be reasonable to expect a column with fewer transfer units to be required than if the water is removed in an unassociated form. Temperature change can also have an important influence on degree of association.

Three of the butanols (*n*, *sec*- and *iso*-) approximate reasonably closely to several of the specifications and *n*-butanol provides a useful starting point. The main specification which it fails to meet is the temperature coefficient of water solubility. This is quite low over the temperature range of interest and hence an evaporation process would be needed to separate the water and butanol-rich phase. As this involves essentially an evaporation of butanol which has approximately one quarter of the latent heat of vaporization of water, there would only be an advantage in using butanol extraction if the butanol evaporation process could be carried out with better steam economy than a quadruple or quintuple effect evaporator operating on water removal alone. This would indicate the desirability of suitably modifying the temperature coefficient of solubility of water in the solvent.

There are other properties which are also important —for example the solvent should not be volatile, costly, of obnoxious odour, nor should it be toxic on either a short term or long term basis.

ACCOUNTING FOR PROFIT ON SUGAR

Recent Improvements in Accounting Techniques rival those of Continuous Processing in Sugar Engineering

By J. A. R. TAINSH, B.A.(Cantab.), A.M.I.Mech.E.
(International Business Consultants Ltd.)

"DO a thing once—but properly" is a sound policy to follow when the alternative is to do it in bits until eventually the job is entirely completed. Development in chemical engineering follows this policy in converting rather involved series of batch processes into continuous processes easily and frequently controlled at each stage. Typical examples are continuous diffusion and clarification, rotary vacuum filters, and continuous centrifugals.

This trend towards continuous and controlled plant operation has a close parallel in the great improvements made in the last twenty years or so in the data for factory managers, now prepared at relatively short intervals by some accounts offices. These data provide the factory managers with some of the technical as well as all of the financial controls, fully co-ordinated, which cut out much of the previous need for numerous but unco-ordinated reports from many sources. The purpose of these regular controls is to assist managers in making cheaper sugar; exactly the same purpose lies behind the improvements in chemical engineering.

Traditional Accounting

The accountant used to be the scorer attached to the factory management team. He is now becoming a playing member as well, who actively collaborates with the executive heads of departments. Traditional accounting, or book-keeping, is a batch process of great antiquity. Once a year the financial effects of all the innumerable and mostly small transactions which occur continually in any industry, were totted up as the balances of a few score account heads. The trial balance, being the comparison of the total debit as against the total credit balances, probably did not balance at first. A time consuming search began for arithmetical errors, made perhaps as much as a year earlier, and the final results of the year's operations were usually published some months after the end of the year. Company tax could then be calculated with the help of the auditors and was duly paid later, after the tax officials had studied the accounts.

One primary, but inescapable, objective of the work done in the accounts office had been achieved. The achievement had, however, been carried out in such a manner that comparatively little useful information reached the manager during the year. The many thousands of pieces of paper, in fact almost everything on paper that affected the company's finances, had been treated as a single annual batch as far as the end product—the main accounts—was concerned.

This traditional way of accounting can be regarded as the counterpart, in the sugar industry, of treating the thousands of tons of beet or cane fed into the factory each year as a single batch, information on which only comes to light again, after the end of the season, as the amount of sugar manufactured. No sugar factory now operates without frequent and regular controls over its physical operations.

Modern Accounting

Modern accounting is organized with a totally different primary objective in mind—the supply of financial and technical cost data to the manager as a continuous routine throughout the year. The final profit figure arrived at is just the same as that reached by traditional accounting, but the figure is only one of the many useful products of modern accounting.

Another illustration of the difference between the old and the new accounting is the two ways of building a dozen houses a year: one way is to build all twelve simultaneously, so that none is fit for occupation till after the end of the year. That is like traditional accounting. The other way is to complete one house a month for early occupation—the new method. The total amount of work done in a year is the same for either method.

However, the sugar industry only operates for some months each year, and one is naturally entitled to query the value of monthly accounting. What can be the use to anyone of accounts prepared during the off-season? Expenses are then nearly all related to overhaul and maintenance, there is no manufacture of goods for sale, and therefore no costing is necessary. Nevertheless, even the most conventional presentation of the Profit & Loss Account will provide the manager with the sales of sugar and by-products from his stocks, and with the current expenditure on maintenance. The Balance Sheet keeps him informed about his various stock balances, his debtors and creditors, and his liquidity. These are vital items which he should watch even during the off-season, and he will have to obtain them from a series of *ad hoc* reports from various sources, if he does not receive up-to-date accounts regularly. The danger of these *ad hoc* reports is that they do not necessarily relate to the same time. Sugar sold or stores accepted may be physical transactions just completed and reported directly by the store-keeper, but their financial implications may not have as yet appeared in the summary of debtors and creditors, also received as an *ad hoc* statement. The manager's composite picture is often misleading.

The beauty of a set of accounts is that all the figures relate to the same instant—the midnight of the last day of the accounting period. All the figures are co-ordinated automatically by the routine of the mechanism, so that physical actions, such as stock alterations, are shown reflected as changes in stock values, and debtors or creditors, or cash, expenses or income. No multiplicity of *ad hoc* reports to the manager can be as reliable and useful as one set of suitably designed and up-to-date monthly accounts, which "do the thing once, but properly." It must be stressed that the key-words are "up-to-date." Old traditions die hard, and accounts staff, brought up virtually to ignore some of the account heads, except once a year, may find it difficult to accept the need to adjust their working methods to the requirements of full accounts each month. Even with the simplest of office machinery, and with clerical staff of no more than average ability, full monthly accounts can be produced before the middle of the following month.

Of great help in quicker production of really reliable costs are the fresh ideas on standard costing techniques.

Integrated standard costing with accounting

Very recently, integrated standard costing has been extended to the sugar industry. Here "integrated" means that standard costing is built into the accounting mechanism, and its effects appear in the main accounts. It is not "separate", a word which indicates that it is a distinct new branch of the accounting system, with its own staff and range of reports. Standard costing integrated with accounting calls for no more routine accounting effort than traditional accounting in the sugar industry, largely because this industry has such a limited range of products to be costed. Just as modern monthly accounting enables many unreliable *ad hoc* reports to be abolished, the integration of standard costing with accounting in the sugar industry provides the managers with a whole new range of useful cost data to replace odd bits of information and calculations, which lack sufficient solid facts behind them to be accurate. These cost data are made available with only relatively minor expenditure of time and effort, which is offset by the elimination of the *ad hoc* reports. The improvement in the supply of data is mainly due to handling the same thousands of bits of paper, from which all accounts are built up, in a slightly different manner, but still within the rules of double entry. The other source of improvement is the introduction of a handful of new bits of paper, the standards.

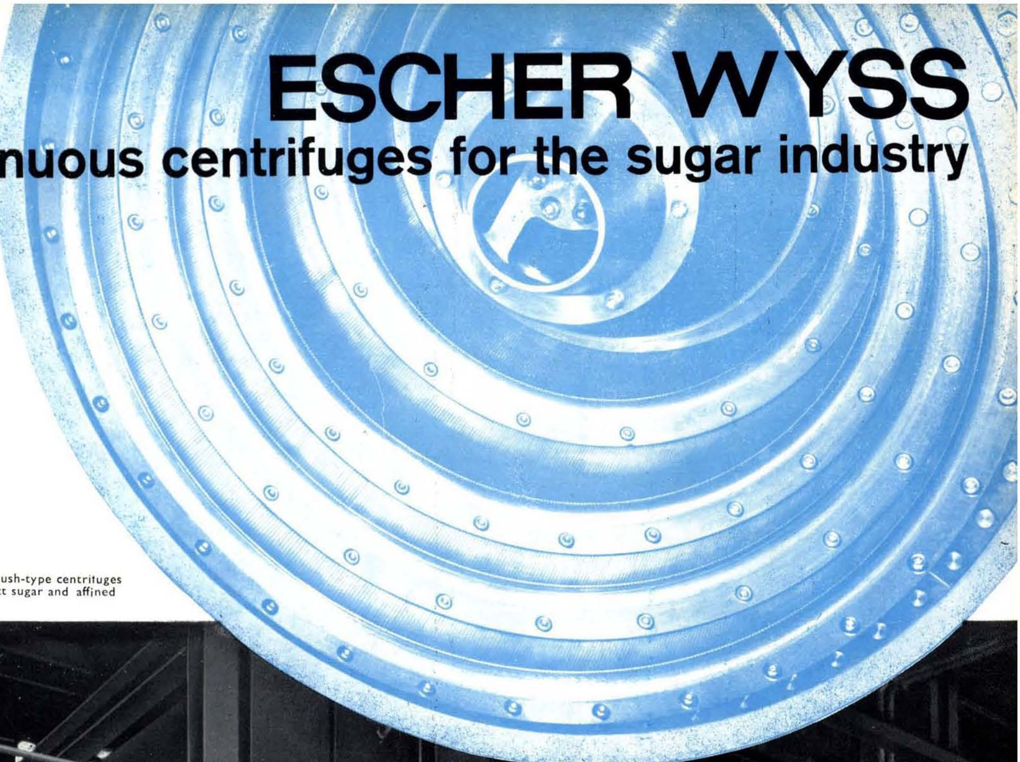
Budgets and Standards

Budgets are essential to modern systems of financial control, and the production and maintenance budgets are the sources of the standards used in accounting integrated with standard costing. The maintenance budget gives, say, a figure of £20,000 for personnel and £22,000 for spares and general stores. These figures form the bases of the standards used by the accounts office, which spreads these totals over the accounting periods of the off-season.

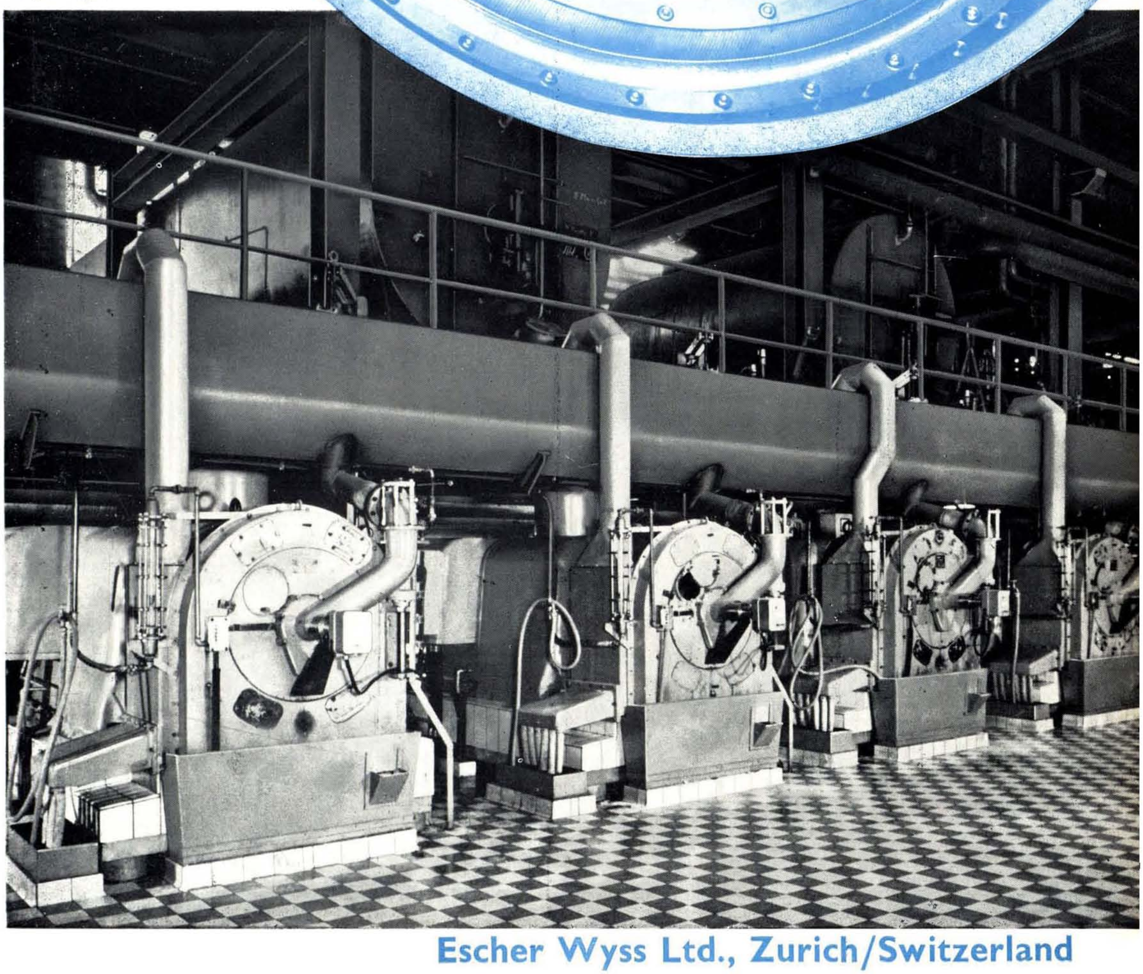
During the off-season, the monthly standard amounts for maintenance are shown as debits in a special suspense account. For monthly accounting this suspense account balance is treated as an asset accumulating in the balance sheet, while actual spending margins above or below the monthly standards (i.e. the variances) appear as items in the monthly Profit and Loss Accounts. The monthly accounts therefore provide full control over maintenance expenditure, and in as much detail as is deemed necessary. Without integrated standard costs, special reports have to be prepared to show how maintenance expenditure is running against the budget, but the accounts office still has to work on the numerous pieces of paper representing actual

ESCHER WYSS

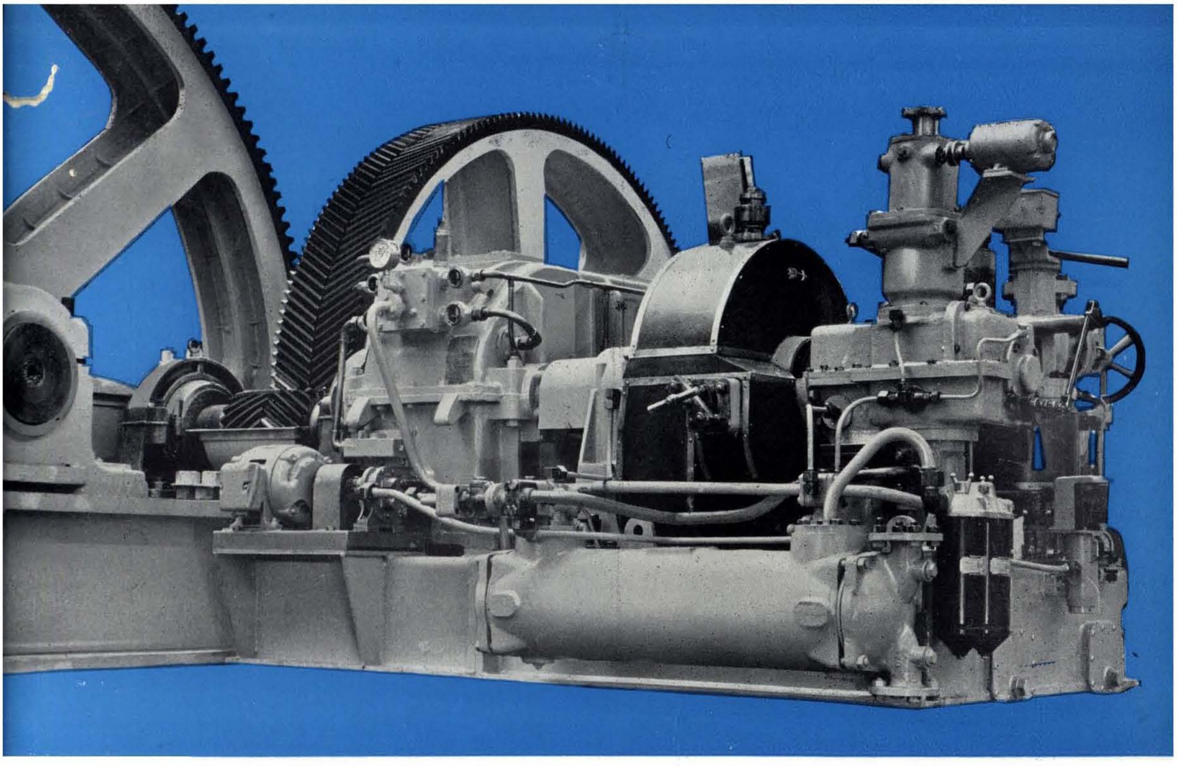
continuous centrifuges for the sugar industry



A battery of four push-type centrifuges for medium-product sugar and affined low-grade sugar.



Escher Wyss Ltd., Zurich/Switzerland



These two views show one of Five 400 B.H.P. Horizontal Single Stage Steam Turbines driving a 34 in. × 66 in. Fifteen Roller Mill supplied to Argentine.

spending on maintenance. The modern integrated system cuts out this duplication, and, once again, "does it once, but properly".

During the crushing season, or campaign, the accumulated maintenance expenditure is written off at a standard rate per ton of sugar made. This standard can, of course, be adjusted to any revisions in the harvest prospects, so that the whole of the maintenance expenditure is fairly debited to the sugar while that sugar is being manufactured.

It is possible that local tax laws may not allow off-season maintenance expenses to be treated as a short-term asset. If the end of the financial year occurs during the off-season, the balance of the maintenance suspense account, duly corrected for variances up to the year end, can be treated as an expense. If the end of the financial year occurs during the crushing season or campaign, only part of the maintenance expenses will have been written off in the monthly accounts. Local law may insist on the residual amount being written off. In each instance, local laws can be complied with, but monthly accounting for the manager's control can still treat maintenance as a short-term asset to be written off throughout the sugar making season. It is all a matter of setting up the account heads with this double objective clearly in mind.

The cost of sugar

The result of monthly allocations of past maintenance expenses to sugar while it is being made enables the stocks of sugar being built up to be given a pretty accurate total cost, and including both manufacturing and off-season expenses and on-costs. This is an enormous advance on the series of approximations required to calculate the cost of sugar *while it is being manufactured*, even with monthly accounting, but without integrated standard costing.

In fact, with full integrated standard costing, the sugar stock being built up is held at standard cost for monthly control purposes. (This does not prevent its value being adjusted to meet market conditions in the annual published accounts.) It is necessary to set standards for each main stage of the sugar manufacturing process—cane crushing or beet diffusion, juice purification and evaporation, sugar boiling, drying, weighing, packaging and storing. The standards have to be particularly flexible for the first processing stages to allow for the varying compositions of the cane or beet throughout the season. It is no good using fixed standards for yields based on 14% sucrose and 13% fibre in cane while the daily averages range within the limits of 12 to 14·5% sucrose and 12 to 15% fibre, depending on the stage in the season and weather. Juice purity also cannot be ignored in setting the standards.

Standards for the process stages also have to cover, for each stage, all items of direct cash expense occurring at that stage. In accounting terminology, a process stage such as sugar boiling (including sulphitation, filtration, centrifuging and crystallizing) is a cost centre. The actual cost of full-time personnel, raw material (thick juice), chemicals, perhaps power and steam, are debited to the cost centre each month, and it is credited with its standard cost, calculated from the granulated sugar expected at standard yield and at a standard value per ton. The difference shows whether the process has beaten the budget cost per ton or exceeded it; and the reasons for either are clear to see. It is then up to the manager to take any appropriate action; he has already approved his own budgets, so that the standards used are really his own.

To complete the picture for a sugar factory, all on-cost centres, such as stores, workshops, power station, garages, the administrative, factory and agricultural offices, housing estates, etc., are very simply controlled through the main accounts each month, using the budget standards as datum levels. All these expenses have to be accounted for anyway; no extra work is created by dealing with them in a manner that provides control over them and also enables sugar to be fully costed during manufacture: yet again, "doing it once—but properly".

The cost of sugar cane

In many countries sugar mills grow all or most of their cane, thousands of acres to a mill. A common practice appears to be to assume that all the cane fields and all the farm managers are equal, and therefore total tonnage into total expenses gives one average price per ton. Nothing in other agricultural industries, tea for example, indicates that costs are, in fact, uniform, even where no discernible difference exists in soil and climate. The human element, management particularly, does create appreciable variances in unit costs between the sub-divisions of a large cropped area. The accounts office is obliged to record all items of expenditure on cane cultivation and harvesting for the main accounts; with minor changes in routine, and using agreed standards for the various field operations, per acre or per ton harvested, simple standard and actual costs can be made available, still within the main accounting system. These figures will show the relative performance of each farm manager against the agreed standards, and why one manager produces cheaper sucrose for his mill than another manager is doing. Once again local tax laws may create the need for different ways of valuing a crop of cane, but accounting techniques similar to those dealing with off-season maintenance can be used to provide realistic crop costs and also acceptable figures for local taxation.

This use of the existing accounting personnel to provide comparative costs to the mill's agronomists as a by-product has obvious attractions; particularly so because cane cost is by far the greatest single component in the cost of cane sugar.

The choice—traditional or modern?

Many sugar factories are fortunate in that they sell their sugar at a guaranteed price, and buy their beet or cane, or even their sucrose, at a set price.

The difference between operating a sugar factory with only traditional accounts and with modern accounting methods is the difference between merely hoping that the annual cycle will show some profit, and the taking of active measures continuously throughout the season and the off-season so that a pre-determined profit will be achieved between the upper and nether mill-stones of fixed buying and selling prices.

Acknowledgment.

The author wishes to acknowledge with gratitude the assistance received from Dr. R. R. BAJPAI, D.Phil., Director of Ibcon (Pvt.) Ltd., Calcutta, in preparing this paper.

THE SUGAR INDUSTRY IN THE SUDAN

By Dr. H. KAMPF, Dr.Tech.Sc. (Vienna), F.R.I.C.
(Factory Manager, Guneid Sugar Factory, Hassaheisa, Sudan.)

IN the Sudan the year 1963 was notable for the successful opening of the very first cane sugar factory which was set up at Guneid in the Blue Nile Province, about 80 miles south of Khartoum, at a cost of approximately £S10 million*. The capacity of the mill is 4000 metric tons of sugar cane per 24 hours. The modern factory was designed and equipped by a combine of the two German firms, Buckau R. Wolf A.G., Grevenbroich, and BMA, Braunschweig.

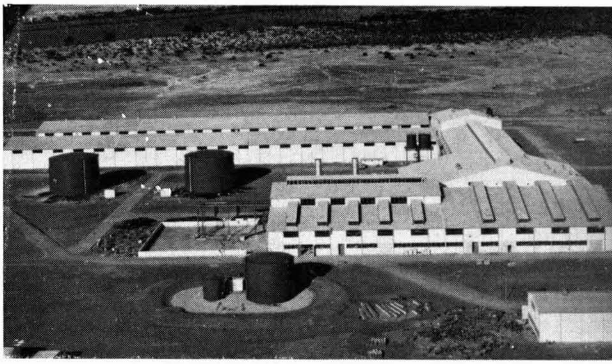


Fig. 1. Aerial view of the Guneid Sugar Factory

During the first cane crushing season, which lasted from the 11th December 1962 to the 25th April 1963, the factory produced 13,272 metric tons of white sugar from 146,252 tons of cane which was grown by the Agricultural Division of the sugar scheme on a fully mechanized estate comprising 30,000 feddans‡. The sugar factory uses the "defecation-melt" process using imported, burnt lime. The second crushing season started on the 10th November 1963 and it is expected at least to double the previous season's production by bagging 25,000 tons of mill white sugar. Full production of about 60,000 tons should be achieved in 1965 when a sufficient supply of cane will become available.

Sugar consumption in the Sudan was 134,020 tons during the financial year 1962/63 against 124,054 tons in the previous financial year. Sugar is a monopoly in the Sudan and the net profit from sugar reached £S9,674,684 in 1962/63 and £S10,383,887 in 1961/62. As the world prices of sugar have risen enormously in 1963 the Government of the Sudan has recently increased the retail price of sugar by one piastre per lb, which will yield £S2·8 million for the sugar monopoly in a full year.

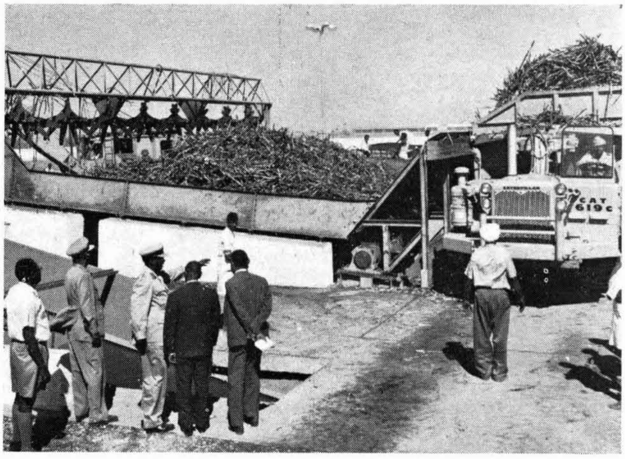


Fig. 2. Cane Feed Table with Hilo Cane Transporter; third man from left is Brigadier IBRAHIM ACHMED OMER, General Manager of the Guneid Sugar Factory.

The country's 10-year development plan covering the period 1961–70 includes provision for the establishment of a second

* £S1 = £1. 0s. 6d. Sterling.
‡ 1 feddan = 1·038 acres.

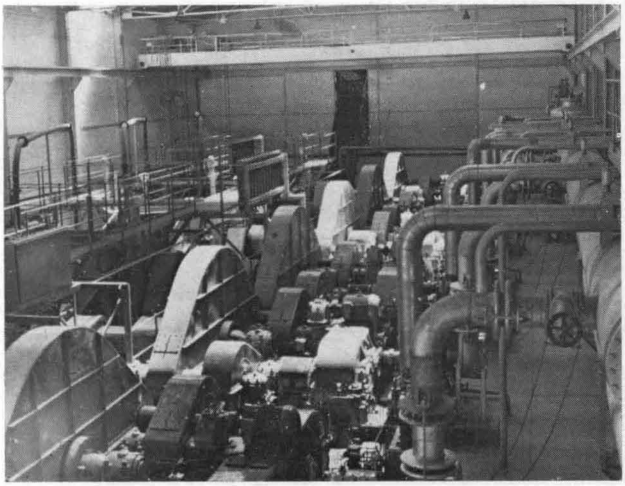


Fig. 3. 18-roller 36 in × 78 in turbine-driven sugar cane mill, Guneid Sugar Factory.

sugar cane scheme and a sugar factory at Khashm El Girba. The contract for this second sugar mill was awarded to the same German firms which built the Guneid Sugar Factory. When both factories are in full operation it is expected that the combined output of 120,000 tons of white sugar will cover the larger part of the domestic consumption.

The population of the Sudan at the time of the last census in 1955/56 numbered some 10·3 million but it is increasing rapidly at an annual rate of around 2·8%. The demand for sugar will continue to grow as the population and the per caput income increase and the building of a third white sugar factory in the Mongalla area of the Equatoria Province is under active consideration. Land lying along the east bank of the White Nile could readily be made available to a competent sugar enterprise. Irrigation water could be lifted from the river; according to the report[1] of an American team who investigated this area in 1958, "the pumping lift is relatively small and would remain fairly constant throughout the year".

The two areas where sugar cane is being cultivated on a large scale are situated entirely within the tropical zone. The average annual rainfall is only about 11 inches at Guneid and only 3 inches at Khashm El Girba. Without the previous large scale development of irrigated pumping schemes it would have been impossible to establish a sugar industry in these almost rainless parts of the country. At Guneid three modern electric pumps by Mather & Platt Ltd., Manchester, were installed at the bank of the Blue Nile last year and the foundations for a fourth one are ready. This pumping station doubled the capacity of the old Guneid pump scheme which was completed in 1956 and comprised four diesel engine pumps.

At Khashm El Girba a large dam project costing about £S15 million is nearing completion. This dam on the Atbara river will make water available for the development of about half a million feddans of land of which 45,000 feddans are reserved for the cultivation of sugar cane. The erection of the sugar factory at Khashm El Girba will be completed in December 1964 but the first sugar cane for the trial run will not be mature before late autumn in 1965. The resettled people of Wadi Halfa, who are being displaced by the floods of the High Dam Project of the Aswan reservoir, will provide the required labour force for the cane fields and the factory. The sugar industry in the Sudan had to face a difficult situation as far as there was and still is a general shortage of skilled technicians. The Guneid Sugar Factory had to import 42 competent foreign technicians to train the Sudanese staff and labour. But as a second sugar factory has to be started up the need for expatriate technicians will continue for some years to come.

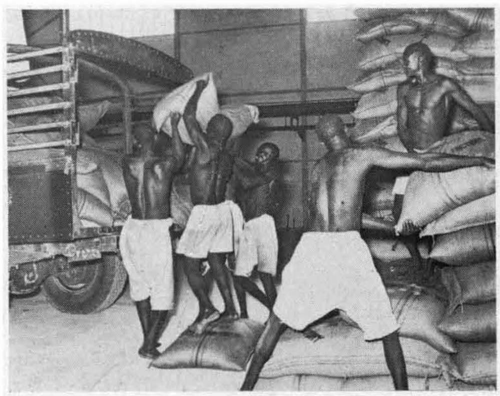


Fig. 4. Despatch of white sugar from the godowns of the Guneid Sugar Factory; each bag contains 100 kg of white sugar.

Puerto Rico mill closures[2].—Central Juanita, Bayamon, Puerto Rico, has been sold to a farmers' cooperative and is to be dismantled in the first half of 1964. Industrial and other development in the area have reduced cane supplies and made cane transport to the mill difficult and slow. During 1963, in addition to Central Juanita, Centrals Plazuela and Guamaní also ceased to operate. Cane from the areas previously supplying the three mills will go to Central San Vincente which has been expanded to the required capacity.

[1] "Sugar Production Potentials in the Republic of the Sudan", *Rpt. U.S. Operations Mission to Sudan*, 1958, page 69.
[2] *Sugar y Azúcar*, 1964, **59**, (1), 45–46.

SUGAR HOUSE PRACTICE

Technology in sugar manufacture. H. W. KERR. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 845—847.—A brief review is made of technological advances over the 40 years of existence of the I.S.S.C.T. and the contribution of the Society towards them.

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An evaluation of sludge removal from A- and B-molasses. D. H. FOSTER. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 847–856.—Sludge in *A*-molasses was found to consist mainly of potassium and calcium sulphates, with a variable amount of aconitate. Removal lowered the viscosity of the molasses and experiments were made using a Westfalia SKIG 10006 separator to treat *A*-molasses for further processing. The insoluble solids were reduced from 1·52% to 0·20% and the *B*-sugar contained about 0·06% less ash and was easier to cure. It was concluded, however, that use of such separators was uneconomical unless the proportion of insolubles was higher. A similar SKIG unit and a SAMN 15037 desludger were used to treat *B*-molasses; they were of similar efficiency but the SAMN unit gave a thicker mud discharge and operated continuously. The treatment of *B*-molasses (3% insoluble solids) increased recovery (by 0·2% on cane) and low-grade capacity (by 5%) and lowered final molasses purity (by 1·11 units on average).

* * *

Removal of sludge from B-molasses by centrifugal separation. C. W. DAVIS and W. B. CLARKE. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 856–865. Experiments were made on the centrifuging of *B*-molasses, varying the Brix (67° and 73°Bx), temperature (170°F, 200°F), flowrate (300 g.p.h., 600 g.p.h.) and also examining the effect of adding 10 p.p.m. of modified Dow ET81 polyelectrolyte. None of these factors affected the efficiency of the 50 cm-diameter disc-type separator, which removed about 40% of the insoluble solids at 5000 r.p.m. The viscosity of the molasses was reduced but not in proportion to the fall in total solids. *C*-sugar was boiled in alternate strikes from the same molasses, treated and untreated, and results indicated that a true purity lower by 0·5 units after centrifuging and a reduction of 6–10% in *C*-massecuite quantity.

* * *

Centrifugation of B-molasses and its clarification effect. F. PROSKOWETZ and J. C. P. CHEN. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 866–869.—Centrifuging of *B*-molasses after dilution to 65°Bx reduced its ash content by about 20%, some of this being a true clarification effect since some inorganic material was precipitated on dilution and was removed by centrifuging, together with other insoluble material present originally in the molasses as a sludge. The purity rose by about 4 units and an effective rise of 0·275 on average occurred in the glucose:ash ratio; this produced a *C*-sugar of higher purity and lower ash content.

Raw sugar filtrability. K. DOUWES DEKKER. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 869–878. Filtrability is a characteristic of raw sugar which the producers try to improve in order to make their product more acceptable to refiners, although their efforts are limited by the fact that their extra costs will not be met by an increase in the price paid for their sugar. It is suggested that cooperative evaluation of improved quality in raw sugar, between refiner and raw sugar producer, might permit the latter to adopt improved techniques to produce better sugar which would be easier to refine, the price being adjusted so that both parties gain. Techniques possible are: sulphitation—costing about eight shillings a ton, double carbonatation—which is more expensive in spite of increased recovery and greater efficiency, and remelting of low-grade sugar—which would be of interest where higher fibre cane provides fuel for the extra steam needed. In South Africa, the presence of starch in cane juice results in poor filtrability and its elimination is under investigation. The growing of starch-free cane may be associated with ample available potash, while the enzymatic starch destruction method of NICHOLSON & HORSLEY[1] is accompanied by a loss of 0·3% of the sucrose present. Treatment of juice by a "Dorrclone" to remove sand and then an Alfa-Laval QX 214-31 centrifugal separator removes 88% of the starch at a flow rate of 2000 g.p.h., although this is reduced to 26% at the full flow of 17,000 g.p.h. and so has to be improved. Use of a test filter technique similar to that of NICHOLSON & HORSLEY[2] in South Africa has shown significant relationships between "filtrability" and performance in both carbonatation and lime-phosphate refineries; hence it is considered that "filtrability" is a meaningful characteristic of the raw sugar. Analyses were made of starch, wax, gums, silica and phosphate; no close correlation was found with the filtrabilities of the sugar. However, where these factors were below limits of 250 p.p.m., 150 p.p.m., 1500 p.p.m., 100 p.p.m. and 30 p.p.m., respectively, filtrability was usually excellent or very good, deteriorating as one or more of the levels was exceeded. A boiling scheme recommended for South Africa involves remelting of *B*-sugar and double-cured *C*-sugar and boiling an A_1 strike, only the *A* and A_1-sugar being sold.

* * *

The use of (water-cooled) crystallizers for the cooling of high-grade strikes in raw sugar manufacture. J. P. LAMUSSE, H. F. WIEHE and M. RANDABEL. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 885–893.—The literature on the cooling of massecuites in crystallizers is reviewed briefly, indicating the variations of opinion on its desirability. Examination of the technique in five Mauritius factories indicated a greater purity drop between massecuite

[1] *I.S.J.*, 1958, **60**, 260–263.
[2] *Proc. 9th Congr. Int. Soc. Sugar Cane Tech.*, 1956, 271–287; *I.S.J.*, 1957, **59**, 105.

and molasses (6·7 on average for *A*-product and 4·7 for *B*-product) with cooling, while the crystal content increased (by an average of 7·7% for *A*-product and 5·5% for *B*-product). It was not possible to relate the rates of increase of purity drop or crystal content with fall in temperature. It is calculated that without cooling, 16·9% more *A*-massecuite would have to be boiled for the same molasses exhaustion, entailing for a 100 t.c.h. factory additional pan capacity of 432 cu.ft., an extra 42 × 24 in centrifugal and additional steam consumption of 1 ton per hour. Against this, cooling of *A*- and *B*-massecuites requires 6 1000-cu.ft. crystallizers.

* * *

Experiments on the curing of low-grade massecuite in high-speed centrifugals. J. Dupont de R. de St. Antoine and H. F. Wiehe. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 893–901.—Installation of a battery of ASEA-Landsverk centrifugals for *C*-massecuite at Mon Loisir, two running at 1700 r.p.m. and three at 1450 r.p.m., permitted comparison of the use of these speeds and also general conditions for the use of such high-speed machines with Ward-Leonard drive. Acceleration to top speed in 3 minutes (230 amp surge) produced no adverse effect on *C*-sugar quality compared with 4 minutes (150 amp surge) and is recommended where the power is available, since it permits a higher throughput or increased time at top speed (giving a better quality *C*-sugar). A shorter acceleration time might cause compaction in the basket. The higher top speed resulted in a 23·7% increase in capacity when producing *C*-sugar of 80 pol, and a 29·7% increase when producing 82 pol sugar. With equal curing times the higher speed produced sugar of pol about 6 units higher, while it purges more efficiently molasses of higher viscosity, which may therefore be reheated to a lower temperature so lessening the danger of re-solution of sugar. The higher pol *C*-sugar reduces boiling-back of molasses when it is used as a footing for *A*- and *B*-sugar.

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Effect of temperature on the coagulation of colloids by surface-active agents—application to cane juice clarification. N. A. Ramaiah and R. D. Srivastava. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 928–932.—A number of surface-active agents were used to treat cane juice; all but one were anionic and had no effect. The cationic material, "Fixanol C", was used in various amounts to determine the optimum amount and a process evolved in which mixed juice was heated to 65–70°C, limed to pH 5·5–7·0, 0·15% on juice of "Fixanol C" added and the juice heated to boiling. After filtering the clarified juice was evaporated and sent to the pans without sulphitation. No sulphitation was necessary because, as shown by absorption spectra measurements, all colloidal and colouring matter was precipitated, the "Fixanol C" also being completely precipitated at the same time. The precipitate itself was gummy and did not settle well but had good filtering properties and was easily washed off the cloths.

Control of crystallization in vacuum pans. D. H. Foster and P. G. Wright. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 940–950.—Proofsticks fitted with thermocouples were located at various points in three test pans of different design and samples obtained during boiling so as to obtain the pattern of temperatures and supersaturations in the massecuite. The variations are discussed, with particular reference to the harmful effects of poor heat distribution in a calandria pan; the observations lead to a number of points for consideration in pan design so as to avoid these effects and to promote rapid and uniform massecuite circulation and vapour disengagement. Laboratory studies on crystallization rate variation with temperature indicated the likelihood of definite advantages from high temperature (about 70°C) boiling as opposed to normal temperature (60°C). Manual and automatic feed control systems were examined for a large calandria pan; the first is frequently associated with considerable fluctuations in supersaturation and fine grain formation. It was found difficult to set a boiling-point-rise (B.P.R.) instrument to boil a satisfactory strike although instability due to inflation of B.P.R. can be largely eliminated by installing and locating the massecuite thermometer in a small reservoir in the vapour space, massecuite being pumped to this by a small reciprocating pump from above the calandria. Because no allowance is made for crystal content the strike can have a wide variation in this, giving either an excessive crystal content with consequently sluggish boiling and fine grain formation or light crystal content with a small surface area for crystallization during feeding so that most of the crystallization takes place during heavying-up. It is therefore recommended that an auxiliary crystal content sensing device be used, operating off the set point of the B.P.R. instrument. Conductivity control was inherently stable with respect to crystal content and supersaturation and was very satisfactory so long as some simple rules were obeyed. The theory of pan feed control is developed and applied to conductivity control relationships to explain the interactions of supersaturation and crystal content, and the reactions of the controlled system to changes in these and other variables.

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Processing of sugar cane into juice and fibre. J. H. Payne. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 971–991.—An account is given of results obtained during the two seasons in which an experimental Silver-DdS cane diffuser was operated at Kekaha sugar mill in 1959–60, treating over 22,000 tons of cane.[1]. Cane from the cleaning plant was cut into 3–4 inch pieces by a Rietz Prebreaker and sent to a storage hopper from which it was discharged by a variable speed conveyor controlled by a Merrick belt scale. It passed through a Reitz Disintegrator before entering the diffuser. Extraction varied from 95 to over 99 and dilutions from 20 to over 100;

[1] *I.S.J.*, 1959, **61**, 63, 142.

however, the governing factor was the state of cane preparation. With good preparation high extraction followed even at low dilutions while large amounts of water were ineffective where preparation was poor. There was little difference between the juice and sugar obtained from the diffuser and those from cane milled at the same time, except that the diffuser sugar was somewhat easier to decolorize and of better quality. Details are given of the equipment and miscellaneous tests during its operation. It is estimated that capital costs for a diffuser plant would be some 20% lower than for comparable milling plant, while maintenance and power requirements are also less. An increase of extraction from 96 to 98 is anticipated and although a dilution of 45% on absolute juice is at present required, compared with 35% for milling, this will certainly be reduced in equipment of improved design. It is concluded that an ideal mode of cane processing would involve initial complete breaking of the juice storage cells followed by displacement of the juice by a minimum of water and without mixing or squeezing.

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The Kelvin continuous sugar cane diffuser. A. F. DE LA CALLE. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 991–1003.—Experience over seven years with two early models of the Kelvin diffuser installed in Mexico is reported, and an account given of the design and operation of the modern unit[1]. A modified Gruendler slicer has been developed for preparation of the cane to be diffused. Laboratory tests carried out to obtain diffuser design data are described and data are provided on units of a range of capacities, as well as comparative h.p. requirements of the diffuser and a milling train. Advantages are listed and results given for the 1959/60 crop at Ingenio Zapata.

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Investigations on extraction in a commercial milling tandem. W. S. HAINES and R. H. HUGHES. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 1013–1030.—The effect of various factors on extraction in a commercial milling tandem was investigated and it was found that: (i) hot imbibition water was more effective than cold although there appeared to be little benefit in maintaining water temperature much above 150°F, (ii) pol extraction at the mills of the tandem to which imbibition was applied increased linearly with water rate up to a maximum attainable at normal last-mill operating conditions, (iii) the attainable imbibition rate was sharply reduced as the fibre rate through the mill was increased, while last mill top roller wear also limited the attainable imbibition rate to some extent, (iv) substantial increases in attainable imbibition rate were brought about by reducing top roller loading, by increasing roller speed and, to a lesser extent, by increasing the discharge opening, (v) the effectiveness of additional water became less as the season progressed, (vi) this reduced effectiveness was a result of mill wear which led to less efficient preparation and thence reduced ability of the water to reach equilibrium with the residual juice, (vii) the effectiveness of high imbibition water rates was poor, in terms of the ratio between pol and juice extraction, (viii) addition of a surface-active material "Extrapol" to the imbibition water did not increase pol extraction, (ix) pol extraction was independent of fibre rate except in so far as the latter limited attainable imbibition rate, (x) last mill juice purity fell as pol extraction rose but the rate of decrease was not enough to have a major effect on the value of the increased extraction, and (xi) application of the knowledge obtained from the experiments has brought about substantial increases in pol recovery in the milling plants of Hawaiian Commercial & Sugar Co. factories.

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Maceration, roller loads and juice extraction in the bagasse mill. W. R. CRAWFORD. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 1030–1039.—The experimental bagasse mill at the Sugar Research Institute was run under conditions comparable with normal factory practice to examine the mechanism of juice expression. It was shown that the percentage of juice expressed was independent of fibre rate at all levels of maceration rate and roller load. Percentage juice expression and % pol extraction are both single valued functions of the juice:fibre ratio at all roller loads investigated and, if mill feeding is not affected, there is no optimum value of maceration for which extraction would be a maximum. Juice expression increased with roller loads but there seems little object in raising the load beyond the equivalent of 80–90 tons/ft in a mill with 36-inch rollers. Milling power increases with roller load but is not influenced by maceration quantity, and maceration is, in general, a more effective method of increasing extraction than is increasing roller load. However, mill feeding problems and the evaporator capacity set a practical limit to maceration quantity.

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Some practical confirmation of experimental milling results. D. S. SHANN. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 1040–1046.—Investigations at Kalamia Mill confirmed that trends observed in relation to mill extraction and power consumption at the experimental mill of the Sugar Research Institute applied on the factory scale. One factor shown was that, owing mainly to lack of discrimination by the Killer plate control of cane blanket thickness, a mill with a freely-floating hydraulically loaded top roller gave better performance on average than a mill with a fixed top roller.

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Practical methods of finding optimum settings for automatic controllers. F. LE GUEN. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 1116–1125. The simplest and more intricate types of controllers are described, viz. on-off controls, proportional, proportional-plus-reset response, and proportional-plus-reset-plus-rate response controllers. The three commonly-employed methods to find out optimum controller settings are discussed.

[1] U.S.P. 2,953,485; *I.S.J.*, 1961, **63**, 60.

Infection in diffusion and methods of determining it. I. JANUSZEWICZ. *Gaz. Cukr.*, 1963, **71**, 145–147. Results of tests made by a number of authors to establish the extent of sugar lost during diffusion through infection are discussed and some methods of determining infection in diffusion are described. Nineteen references are given to the literature.

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Flocculating agents in the sugar industry. II. Basic conditions for the application of flocculating agents in production. R. OSVALD and H. KRATOCHVÍLOVÁ. *Listy Cukr.*, 1963, **79**, 154–161.—The effect of flocculating agents on 1st carbonatation turbid juice subjected to various purification methods was determined and the results found to confirm laboratory tests described earlier[1]. The purification method used (or the composition of the mud aggregates in the saturated juice) had a varying effect on the flocculant efficiency. While the best values of filtration coefficient (F_k) were obtained when the amount of milk-of-lime added was greatest, the effect of the latter on the flocculant efficiency was such that the settling rate (S) and sediment volume (V) were reduced. Increase in juice alkalinity raised the values of F_k and V, but reduced that of S, the effects being the same with the control as with the flocculant-treated juices. The optimum point at which to add flocculant was found to be between the 1st carbonatation muddy juice filters and the clarifiers. The temperature of the solvent used to prepare a solution of flocculant was found to have no effect on the flocculating efficiency and no difference was found between the effects of water and juice solutions of polyelectrolytes. The tank for making-up the flocculant solution should be equipped with an effective mixer.

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Possibilities of reducing heat consumption in raw sugar factories. O. BÖHM. *Listy Cukr.*, 1963, **79**, 168–170.—Ways in which steam consumption can be reduced are discussed, with reference to data supplied by other authors on practices in different countries. The list includes: using condensate heat to heat raw juice or for expansion; utilizing vapour thermo-compression; evaporating thick juice to high Brix; and pre-heating boiled feed-water. Attention is also drawn to the subjects of scaling, insulation, coal storage and boiler efficiency.

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Larissa sugar factory (Greece). H.-J. BOHN. *Zucker*, 1963, **16**, 407–416.—Full details with illustrations and plans are given of the 2000-ton beet sugar factory erected at Larissa, capital of Thessaly, and which ran a trial campaign in August-September 1961 (27,300 tons of beet were processed). Three German firms participated in the completion of the factory: Buckau R. Wolf, BMA and Lucks & Co.

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Laboratory determination of the time taken to heavy-up low-product massecuite. K. WAGNEROWSKI, D. DABROWSKA and C. DABROWSKI. *Gaz. Cukr.*, 1963, **71**, 179–182.—A 78 purity, 92·72°Bx artificial massecuite composed of sugar containing 5560 crystals/g and molasses with a non-sugars:water ratio of 2·80 was used in laboratory experiments to determine the average crystallization rate of low-grade massecuite at what the author considers to be the upper safe supersaturation limit (1·2) and to determine the minimum period of heavying-up. The solubility of sugar in the molasses was determined using a previously described test[2]. The crystallization rate at 75°C (which temperature corresponds to conditions during the final phase of pan boiling) was determined by cooling a massecuite of 28·96% crystal content at the rate of 10°C/hr and 12°C/hr from 80 to 70°C; the average rate was calculated to be 427 mg/sq.m./min; the shortest heavy-up period from an initial Brix of 90 to a final Brix of 94 was found to be 122·6 min.

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Method of rapid calculation of the evaporator station. E. MANZKE. *Zuckererzeugung*, 1963, **7**, 158–159. Evaporation can be determined from the difference between the juice Brix before and after the evaporator. However, while all other required factors are easily determined, the Brix of the juice sample withdrawn from the evaporator may be higher than that in the evaporator as a result of flash evaporation caused by the pressure reduction in the sampling cock. However, the Brix may be corrected by referring to a graph showing the Brix correction factor for a given boiling temperature and a given Brix. This graph has been drawn from campaign data and from actual Brix measurements, and covers a range of 15–70°Bx at juice boiling temperatures of 100–145°C. A juice purity of 95 and an external air pressure of 760 mm Hg are assumed. Good agreement was found between values determined with the proposed method and those given by a heat balance.

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Electric power supply in sugar factories. W. SCHERER. *Zucker*, 1963, **16**, 416–421, 443–448.—A detailed report is given on electric power generation and distribution in sugar factories. The two factors of greatest importance in economical power supply are considered, viz. power output and short-circuit conditions.

[1] OSVALD & TLUCHOŘ: *I.S.J.*, 1964, **66**, 25.
[2] *I.S.J.*, 1962, **64**, 115.

The factory layout also plays a significant rôle. The selection of generators, switchgear, cable and motors is dealt with in detail. Three types of power plant are described, each being that actually set up in a German sugar factory.

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Steam consumption in a white sugar factory. W. VON PROSKOWETZ. *Zeitsch. Zuckerind.*, 1963, **88**, 441–445. An attempt is made to separate the beet end from the sugar end as regards steam consumption. While most factories calculate steam usage on the amount of beet processed, i.e. on the raw material and not on the finished product as in most other industries, calculation on a white sugar basis is considered more satisfactory, particularly in view of marked fluctuations in beet pol. A table is presented showing how the steam consumption on white sugar can vary for different sugar outputs at constant steam usage % beet. The only problem in the separation of the two factory sections is presented by the evaporator station, since vapour is bled to both the beet end (diffusers and juice heaters) and to the sugar end (vacuum pans). The consumption of vapour in the vacuum pans is governed by the solids content of the product to be boiled; the moisture content of the thick juice is the most significant factor here. It is considered better to relate the amount of massecuite boiled to the white sugar output rather than to the amount of beet processed. An example is presented showing how to calculate the separate steam consumptions using the method of "direct" steam consumption or that of "indirect" steam consumption. Data from 36 European factories are used in an attempt to determine statistically the effect of various factors on the steam consumption of each of the four groups of factories, the steam consumptions of which are expressed on beet and on white sugar.

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Coordinate geometrical solution of sugar technology calculations. H. HAUCKE. *Zeitsch. Zuckerind.*, 1963, **88**, 445–449.—Sugar technology calculations can, according to the author, be solved graphically by means of analytical geometry, the measuring values being converted to the coordinates of a Cartesian system, giving 1st degree equations. All yield (profit) and utilization (loss) values can be treated in this manner, and examples are given showing how to calculate the solids yield in diffusion and in the centrifugals, and the CO_2 usage in carbonatation and sucrose loss in the centrifugals. A device is described which may be used for simple determination of each utilization factor; it has two pointers, one rotating about the point of 100% concentration and 100% utilization, while the other rotates about the coordinate initial point of concentration = 0% and utilization = 0%. The division mark on pointer A is placed at the point on the abscissa corresponding to the lowest concentration (the CO_2 content of the gas after carbonatation or the purity of the run-off from the centrifugals). At the point of mean concentration, a perpendicular is drawn on the abscissa (the CO_2 content of the gas before carbonatation or the purity of the massecuite entering the centrifugals). The division mark of pointer B is placed against the point at which the perpendicular and pointer A intersect, and the required value is read off the perpendicular above the 100% concentration point. Instructions are given on how to make such a device.

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Sugar beet storage and the economics of beet sugar manufacture. S. VAJNA. *Zeitsch. Zuckerind.*, 1963, **88**, 450–456.—Apart from beet sugar content and the molasses yield, manufacturing costs should also be considered in the evaluation of beet. After deducting the beet price and the processing costs from the sugar and molasses sales returns, a gross profit remains which is characteristic for each factory and each year. A reduction in the processing value and consequently in the gross profit occurs during beet storage. Also important are the questions of how to calculate the price of beet and who bears the storage losses. The actual level of the storage losses is seldom known since the loss in weight is usually not determined. To evaluate the storage factor on the basis of values that can be measured in the factory and determine part of the losses, the author introduces the concept of "the monetary value of polarization sugar", i.e. the fixed and proportional costs are deducted from the obtainable white sugar and molasses sugar that are both calculated on the amount of "polarization sugar" at the slicer. With the aid of numerical examples, the author uses two methods of calculation to show how storage affects the economics of sugar manufacture. Modern storage requirements are enumerated. Calculation of the beet price in Germany and neighbouring countries shows that the industry must always bear a considerable part of the monetary losses due to storage. As the lifting period becomes shorter and shorter, the sugar industry must provide for the storage of greater volumes of beet and must adopt economical storage methods.

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Fundamentals and structure of modern cost accounting in the sugar industry. W. LEIBIG. *Zeitsch. Zuckerind.*, 1963, **88**, 377–382, 456–461.—Details are given of a new costing system that corresponds to modern factory techniques and which utilizes the punched card system. Full details are given of the system and its advantages are discussed.

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Contempory development of the Czechoslovak sugar industry. J. PUCHERNA. *Czechoslovak Heavy Ind.*, 1963, (9), 38–41.—Various aspects of the Czechoslovak sugar industry are discussed, starting with the contributions made by certain sugar technologists to the world industry. The three basic trends in the development of the industry are considered, viz. the introduction of mechanization, of continuous processes (and ultimately automation), and simplification of processes. More specific mention is made of beet reception and decolorizing with synthetic resins.

NEW BOOKS AND BULLETINS

The Gilmore Louisiana-Florida Sugar Manual, 1963. F. I. Meyers and C. O. Dupuy, Jr. 232 pp; 8 × 10½ in. (The Hauser Printing Co. Inc., 720 Poydras St., New Orleans, Louisiana 70130, U.S.A.) 1963. Price: $10.00.

The latest edition of the Gilmore Louisiana-Florida Manual follows the same pattern as previous editions, giving a very comprehensive picture of the mainland cane industry of the United States. As before, it provides up-to-date information on addresses and officers and members of the various organizations concerned with cane growing, sugar production and marketing, as well as professorial staff at Louisiana State University, group ownership of sugar companies, etc. A directory of personnel is again included, as are crop statistics and manufacturing reports for the 1961/62 and 1962/63 crops. Maps are provided of the Louisiana and Florida sugar areas, with the location of each factory and refinery clearly indicated. In addition production figures for each of the Florida factories in 1962 are tabulated. The last two sections are a Buyers' Guide of the products of the various manufacturers advertising in the Manual, and an index to their displays.

The major part of the book, however, is as usual the remarkably detailed description of each of the sugar processing plants in the two mainland cane areas. This provides information on executive and staff personnel, general information on the operating Company, details of agricultural procedures and factory information, including the principal machinery —cane handling, mills, steam plant, boiler feed pumps, clarification, evaporation, vacuum pans, syrup and molasses tanks, spray pond, pumps, crystallizers, centrifugals, etc.—and a résumé of manufacturing results in 1961 and 1962.

This tremendous amount of information is so complete and useful that the hackneyed phrase "an indispensable work of reference" is, in this case, completely justified for anyone concerned with the sugar industries of Louisiana and Florida.

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Activated Carbon. J. W. Hassler. 397 pp; 5½ × 8½ in. (Chemical Publishing Co. Inc., 212 Fifth Ave., New York, N.Y. 10010, U.S.A.) 1963. Price: $10.00.

This work is the revised edition of a book originally published in 1951 since when many new industrial uses have been found for activated carbon. Refining of sugar, however, is one of the oldest applications, yet even here there have been new developments, particularly in the expanded use of granular carbons.

The use of carbon for sugar refining is treated briefly, and with little reference to modern studies; however, there is much in the other sections which are of interest to the technologist concerned with carbon purification of sugar syrups. Such are the chapters on the elements of adsorption by carbon, and the unit operational techniques, the evaluation, manufacture and nature of activated carbon. A useful glossary is provided as is an index.

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Les Données de la Consommation du Sucre en France Métropolitaine. (Data on Sugar Consumption in Metropolitan France.) 87 pp; 7 × 9¼ in. (Bureau Interprofessionnel d'Etudes Statistiques Sucrières, 15 rue du Louvre, Paris 1er, France.) 1964.

This statistical study of sugar consumption in Metropolitan France has been undertaken in order to obtain a better "definition" of the sugar consumer, and from his basic buying trends to predict the approximate consumption pattern of the future. The book is divided into 8 chapters, containg data on population, the position of sugar relative to other foodstuffs, the position of sugar in the family budget, the structure of sugar and sugar products distribution by Départements (analysis by shops, cafés, etc.), consumption of different types of sugar by campaign, month and year, sugar price trends, comparative tables (sugar consumption *vs.* population, prices of sugar and other foodstuffs and non-food products, sugar consumption *vs.* price), and future prospects.

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Caroni Limited in Trinidad. 24 pp.; 8 × 10½ in. (Caroni Ltd., Bucklersbury House, Walbrook, London E.C.4.) 1963.

This booklet is a brief record of the history of Caroni Ltd., a Tate & Lyle Ltd. subsidiary. The firm was created by the purchase, by Tate & Lyle, of Caroni Sugar Estates (Trinidad) Ltd., and Waterloo Sugar Estates (Trinidad) Ltd., 26 years ago. The Island's sugar industry is traced back to Gregor Turnbull, a Glasgow merchant and pioneer in tropical agriculture, who founded what was later to become the Trinidad Estates Co. Ltd. (absorbed in 1924 by the Caroni Sugar Estates (Trinidad) Ltd.), and to a chemist named Carlee, employed by the Waterloo Estates, who became General Manager of the company and who first saw the real possibilities of expanding the local sugar industry. In 1807 over 300 sugar factories were in operation, the average production per mill being about 35 tons of sugar and the factories being operated by mule, wind or water power. The four factories operated by Caroni Ltd. now produce approximately 90% of the total sugar manufactured in Trinidad (in 1963 227,345 tons were produced), while the bulk terminal at Goodrich Bay handles well over 90% of the sugar exported from the Island. Details are given of the various acquisitions by Caroni Ltd., including the Woodford Lodge Estates, Ste. Madeleine Sugar Co. Ltd., and Gordon Sugar Estates Ltd., and brief outlines are given of the people of Trinidad and of the processes involved in cane sugar production. Eleven pages of coloured illustrations are presented, showing various aspects of Trinidad life and of sugar manufacture.

LABORATORY METHODS AND CHEMICAL REPORTS

Preliminary investigations on the presence of osmophilic yeasts in Mauritian raw sugars. R. ANTOINE, R. DE FROBERVILLE and C. RICAUD. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 878–884.—See *I.S.J.*, 1963, **65**, 27.

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The expected sugar loss in final molasses. R. NOEL. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 901–905.—Based on a statistical study of molasses produced in Mauritius factories, the non-sucrose in molasses % cane was found to be related to non-sucrose in clear juice % cane by a factor of 0·625, this value giving a standard deviation of $\pm 0{\cdot}03$ with a probable error of 0·2, the correlation coefficient being 0·95. Using this relationship and other formulae, an expression is derived for the "expected sucrose loss in molasses % cane" (S_m):

$$S_m = \frac{0{\cdot}625N(11{\cdot}2C - R)}{13{\cdot}8C + R},$$ where N = non-sucrose in clear juice % cane, C = sulphated ash % molasses and R = reducing sugars % molasses. A similar formula is also derived for the "expected molasses % cane" $= \frac{1562NC}{M(13{\cdot}8C + R)}$, where M = dry matter in molasses. Comparison of actual and expected values indicates the standard of work of the factories concerned.

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Amino acids in Hawaiian cane syrup. W. S. KUWABARA, J. H. PAYNE and T. MORITSUGU. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 906–919.—Examination of cane syrup amino acids by paper chromatography after ion exchange isolation and purification revealed a number of acids which were identified by their colour reactions with a number of reagents, and the identities confirmed by co-chromatography with known acids. The acids identified were lysine, histidine, asparagine, aspartic acid, glutamic acid, glycine, serine, alanine, γ-aminobutyric acid, tyrosine, valine and leucine. It is presumed that glutamine, which was identified in cane juice by MARTIN[1], was destroyed during clarification and that phenylalanine, proline and threonine, also identified by MARTIN, were absent or present in such small amounts that they were retained by the ion exchange resin or otherwise undetected by paper chromatography.

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Development and application of a laboratory clarification test. I. G. BURGESS, R. H. BEARDMORE, G. E. FORTESCUE and C. W. DAVIS. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 920–928.—Examination of an old-established laboratory clarification test procedure was made to determine the effects of variations in delay after sampling, in heating the juice, degasification, mixing of lime and juice and settling. From the results it was found that the best results were obtained by obtaining a representative sample of unlimed mixed juice from between the mixed juice tank and primary heaters, heating 600 ml within 5 minutes of collection and bringing it to the boil for 2 minutes, adding a predetermined quantity of lime (in the form of saccharate, milk-of-lime, etc. as required) below the surface near a 1½-in stirrer blade rotating at approx. 1200 r.p.m.; after mixing for 45 seconds with gentle boiling, the slurry is transferred to a preheated tube (graduated in % of total volume and surrounded by a boiling water jacket) and allowed to settle for 30 minutes. The volume of sediment is recorded and the turbidity of a sample of the supernatant is measured. Statistical analysis of comparative results with the test and factory results, using the same juice and lime and operating under ideal conditions showed no difference (0·1% level); hence the test gives a true measure of the optimum results obtainable. It can thus be used (i) to locate the causes of poor factory clarification (juice quality, incorrect process conditions or inadequate clarifier capacity), (ii) to determine the effect of additives or altered process conditions, and (iii) to determine clarifier capacity requirements.

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Quantitative investigations on the production of organic acids during alkaline destruction of reducing sugars—a mechanism for caramelization. N. A. RAMAIAH, S. K. D. AGARWAL and M. B. KUMAR. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 932–940. A conductimetric technique was used to assay "organic acids" in solutions of reducing sugars heated with alkali at various pH levels and temperatures for various times. It was shown that, at a constant temperature, the amount of reducing sugars destroyed reached a constant level fairly quickly after which no more loss occurred although alkali remained. Initially, all or most of the reducing sugar destroyed was converted into organic acids but with time the proportion fell. It is argued that this is because the organic acids react with reducing sugars to form caramel precursors and it is shown that alkaline decomposition of glucose (and colour formation) is much faster in the initial presence of lactate since there is no lag phase in which only acids are formed.

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Colour and related factors in the raw sugar crystal. C. C. TU, K. ONNA, R. OKAMOTO and J. H. PAYNE. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 950–959.—The effect of various factors on the colour of the commercial raw sugar crystal was investigated. It was shown that, although all sugars in solution show an increase in colour with increase in pH, the extent varies. Since, of the two principal types of colour substances present—the thermal degradation products of carbohydrates and melan-

[1] *Sugar J.* (La.), 1960, **22**, (11), 11–20; *I.S.J.*, 1960, **62**, 287.

oidins—only the former show this pH effect, pH-colour measurements are of value in relating the quantities of the two present. Light scattering was shown to be a major factor in measured colour values for some sugars. Substances responsible for attenuation, probably by light scattering, were shown to be partially removed by ultracentrifugation. A relationship between light scattering and filtrability was established. Measurement of internal moisture in the sugar crystal showed that the quantity increases with increase in crystal size. Crystal colour also increases with crystal size, but that the presence of colour within the crystal involves more than simple inclusion of mother liquor was demonstrated by the internal moisture-colour relationship.

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A rapid method for the determination of moisture in raw sugars. R. R. TROTT and SIR JOHN SAINT. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 959–966.—See *I.S.J.*, 1962, **64**, 374.

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Cell-breakage determination in prepared cane and bagasse. B. I. ALDRICH and P. C. RAYNER. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 1004–1013. A method of determining the proportion of broken cells uses a "tumble-washer" in which a 1½-lb sample of cane is leached with 6 lb of water and the pol content of the extract is measured after lead clarification. A second 5-lb sample is treated in a disintegrator with 15 lb of water to determine the total available pol. The proportion can then be calculated from the pol values so obtained. With bagasse, air has been introduced into the cells and cannot readily be removed, some 60–120 minutes being needed to attain equilibrium. In the YOUNG[1] method, a vacuum was applied in stages to the slurry of bagasse in water to remove this air, but the method has a number of defects. A new method was developed in which a 225-g sub-sample is added to a 4-ft welded stainless steel tube of 2 inches i.d. with 1800 ml of water and subjected to such a combination of vibration frequency and amplitude that audible cavitation occurs as a loud chattering noise, e.g. 2550 c/min and ½-in or 3000 c/min and ¼-in, for 30 seconds. The air bubbles are released and the slurry is withdrawn and mixed before sampling the liquid. The pol after lead clarification is used with the pol obtained after disintegration to determine the fraction of unbroken cells. The results of such determinations may be used, e.g. to determine the degree of cane preparation, the pattern of cell breakage through a tandem or the effect of preparation on the scope for maceration.

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Sucrose crystallization. H. E. C. POWERS. *Gaz. Cukr.*, 1963, **71**, 155–156.—See *I.S.J.*, 1963, **65**, 29.

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The restraining influence of invert sugar on crystal nucleation in supersaturated sucrose solutions. Z. NIEDZIELSKI. *Gaz. Cukr.*, 1963, **71**, 156–157.—See *I.S.J.*, 1963, **65**, 29.

Rapid laboratory flow method of evaluating decolorizing exchange resins. J. PŘÍHODA and A. SVOBODA. *Listy Cukr.*, 1963, **79**, 161–168.—Linear conversion of values measured by a photocolorimeter to Stammer units is possible only up to a certain level of colour. For each type of colouring substance, syrup, juice or melt, a special calibration curve must be drawn. Langmuir's isotherm has been found valid for description of decolorization using ion-exchange resins in flow evaluation at a specific loading of 10 volumes of solution to 1 volume of resin per hr. A formula has been derived for calculation of B_c, the amount of colour substance not absorbed by a resin, viz. $B_c = \frac{a.E_o.V'_r{}^2}{d + E_o.V'_r}$. The values of constants a and d may be obtained from a graph of B_o/E_c *vs.* B_o' where B_o is the amount of colour in the original solution and E_c is the concentration of colour in the treated solution; $E_c = \frac{a.B_o}{d + B_o}$, so that a, the concentration of adsorbed bodies after saturation of the adsorbent surface, may be found from the slope of the curve, and d found from the abscissa on the vertical axis. E_o, also a constant, is the extinction of the original solution, and V'_r is the volume of solution passed per unit volume of ion exchanger. Thus, a and d serve as guides to the quality of a particular resin. Calculated values of B_c and resin capacity were found to agree well with experimental results. The decolorizing capacity of a resin can thus be determined quickly by measuring the colour of a solution after treating 300 and 800 ml of the solution.

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Extraction ratio. T. FOURMOND. *Proc. 36th Congr. S. African Sugar Tech. Assoc.*, 1962, 42–43.—Since cane contains Brix-free water which is not separable from the fibre in the milling process, the author considers the expression of milling efficiency in terms of lost absolute juice % fibre to be incorrect, since Brix-free water is a part of the absolute juice. Thus, the absolute juice is never completely extracted but only part of the undiluted juice, while all the Brix-free water remains in the bagasse. The significance of Brix-free water in the determination of bagasse moisture content is underlined, it being pointed out that a variation of 5% in bagasse moisture may be due to variation merely of Brix-free water rather than to deficient milling or laboratory work. (In a subsequent discussion it was considered that a 5% variation in bagasse moisture content is rather too high to be attributed just to Brix-free water.) The variation in purity and Brix of successive juice fractions expressed from cane indicate the desirability of using a sucrose basis for measurement of milling efficiency. In comparison with the conventional South African practice, the Extraction Ratio as determined in Hawaii, Queensland and Mauritius is shown to give more accurate results, since it assumes only one factor that is incorrect and not two. Comparative data show the similarity between the lost absolute juice % juice and the Extraction Ratio.

[1] *Proc. 32nd Congr. S. African Sugar Tech. Assoc.*, 1958, 44–55; *I.S.J.*, 1959, **61**, 377.

BY-PRODUCTS

Utilization of by-products. A. G. KELLER. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 1155–1156. A brief review is made of certain applications for utilization of bagasse and molasses and extraction of cane wax.

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Investigations to determine optimum methods of producing bagasse-fibre boards in the soft board, particle board and hardboard density ranges. D. E. LENGEL. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 1156–1174.—During 1959 and 1960 Columbia Engineering Co. conducted a bagasse-fibre investigation for Tablopan de Venezuela S.A., to determine optimum methods of manufacturing bagasse fibre boards in the soft board, particle board and hardboard density ranges, using a dry process. It was demonstrated that plant could be constructed which could economically manufacture bagasse fibre boards to compete in the markets for these boards. The proposed plant design is patterned on a dry-process hardboard system with identical initial preparation and general flow for all types of board products. The degree of fiberization, resin percentage and panel density are varied to achieve the desired characteristics. A comparison of the cost of the semi-prepared bagasse fibre at the point in the board-plant process at which it is ready for resin blending indicates that the depithing, cleaning, fiberizing and storage methods developed in the pilot plant versus conventional bagasse baling and storage methods will result in approx. 25% lower fibre costs based on 75 tons per day operation, in addition to producing a superior fibre for dry-process board production. Further confirmation was expected early in 1963 when the Tablopan production plant was to go into operation.

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The manufacture of hardboard from bagasse. H. S. WU. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 1174–1185.—A detailed description is given of the preparation of bagasse, its digestion, refining and pressing for manufacture of hardboard at the Chang-hwa bagasse board plant of the Taiwan Sugar Corporation.

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Bagasse becoming a major raw material for manufacture of pulp and paper—background, present status and future possibilities. J. E. ATCHISON. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 1185–1205. A review is made of the history of bagasse utilization for pulp and paper production, together with recent trends, e.g. toward "humid" and/or wet-depithing, rapid continuous methods of digestion. Existing bagasse pulp and paper mills are tabulated. It is believed that because of the necessity for control of sources of supply, cane factory owners will necessarily play an important part in the ownership of the pulp-and-paper mills. The importance of the cost of replacement fuel is emphasized and a comparison made of the bleached pulp from bagasse and wood; quality is as good but since the bagasse pulp is more economical to produce and process in the area where it is manufactured, this is where it is most likely to be used.

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A new inexpensive continuous process for obtaining high-quality homogeneous bagasse cellulose pulp. E. J. VILLAVICENCIO. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 1205–1211.—Raw bagasse from the cane mill is passed through a depithing unit which comprises a number of swinging blades in a screw conveyor; the fibres rub against each other and pith is loosened, to be collected pneumatically using a cyclone. This separated pith (15% on bagasse) is used in cattle food while the fibre is baled and sun-dried for 40 days. Fermentation starts on the third day, raising the temperature and accelerating the drying process. The bales are taken to the mill where half is processed and the rest sorted for processing between crops. The bales are collected by a conveyor-weigher unit and fed to a bale-breaker, and thence to another depithing machine. The depithed fibre passes over a magnet to remove any scrap iron content and hence to a pneumatic elevator where non-magnetic impurities separate by gravity. The fibre then is compacted, dampened and fed to a continuous digester where, by incremental increases in pressure and temperatures, the lignin content is reduced. The pulp then passes to a classifier and a screen. Part of the product is dried and sold as unbleached pulp while the remainder is submitted to a standard bleaching process. Advantages of the process include low initial investment, 40% lower production costs than the usual, and cellulose pulp of high quality.

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Hemicelluloses of sugar cane bagasse fibre. S. R. PATHAK. *Proc. 11th Congr. Int. Soc. Sugar Cane Tech.*, 1962, 1211–1216.—Bagasse fibre was continuously extracted with 1:2 alcohol:benzene and then with boiling water, and with 1% and 0·5% ammonium oxalate solutions. The residue was extracted twice with 50% alcohol containing 1% sodium hydroxide. The residue was then extracted six times with 4% NaOH at room temperature in the absence of air and the extracts brought to pH 3·2 with acetic acid, yielding a hemicellulose precipitate. Further precipitates were obtained by adding half and one-volume amounts of acetone and the three fractions then divided into two each by forming copper complexes with glycerol and copper sulphate, followed by decomposition with acetic acid and precipitation with acetone. The six fractions were hydrolysed with sulphuric acid and the sugars produced identified by paper chromatography. All contained xylose and arabinose, five contained glucose and the sixth galactose. One of the five contained xylulose and galacturonic acid while the remaining fractions showed the presence of uronic acids.

UNITED STATES

(Hydraulic) Drives for centrifugals. R. C. GOODWIN, *assr*. THE WESTERN STATES MACHINE CO., of Hamilton, Ohio, U.S.A. **3,081,598.** 18th October 1960; 19th March 1963.—The hydraulic drive system includes a positive-displacement, reversible, rotary hydraulic motor adapted to be direct-coupled to a centrifugal basket. A pump, driven by a prime mover, delivers hydraulic fluid to the motor from a tank to a control valve and thence by way of two alternate conduits for forward and reverse rotation of the motor. A return pipe is fitted from the valve to the tank so that it provides a return circuit from the motor to the tank, hydraulic fluid passing from the motor to the valve by way of the conduit not being used to drive the motor. Thus, when the control valve connects the pump with the motor by way of the first conduit the motor is driven in a forward direction and hydraulic fluid returns to the supply tank by way of the second conduit, control valve and return pipe. When the control valve is positioned appropriately the second conduit connects the pump to the motor and the latter is braked and reversed, and when the first and second conduits are interconnected the centrifugal is coasting or at rest. Pressure relief valves in the system ensure dumping or feeding of fluid to achieve the required braking torque, reversing speed, etc., and to prevent cavitation in the motor, etc.

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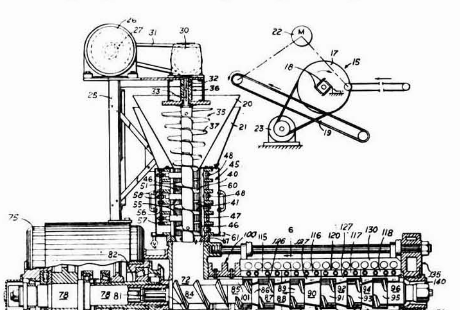
Apparatus for recovery of juice from sucrose-bearing materials (sugar cane). A. W. FRENCH, *assr*. THE FRENCH OIL MILL MACHINERY CO., of Piqua, Ohio, U.S.A. **3,086,452.** 9th July 1957; 23rd April 1963.



Cane is brought along a carrier to the chopper 15 where the blades 18, driven by motor 23, cut it into pieces which are then conveyed by carrier 19 to the hopper 20. This is mounted on a framework 25 which also carries the motor 26 which drives gearbox 30 by a belt 31. The output shaft 32 is connected by a spline 36 to the screw conveyor 35. This carries the cane into a cage formed by spaced bars 46 inside a chamber 51. The screw becomes an interrupted screw 40 with breaker bars 55, and as a result of the restricted throat formed by split cone 65 clamped by ring 67, juice is expressed through the gaps between bars 46 to collect in chamber 51 and drain through the exit 61. The cane passes into the expansion chamber 72 through which passes the feeder screw 84 in the form of a sleeve carrying an interrupted scroll and driven by a motor through gear 77 and sleeve 82 at a higher speed than shaft 80 which it surrounds. Shaft 80 is itself driven by the same motor through gear 76, engaging through splines 81. The cane is brought by screw 84 into an initial expression chamber 101 inside cage 100 and thence into the principal expression chamber formed by screw flights 85, 87, 89, 91, 93 and 95 and pressure collars 86, 88, 90, 92, 94 and 96, attached to shaft 80 and located inside the pressure cage 120 formed by screen bar sections 115–118 surrounding drainage bars 125 separated by spacers. Breaker bars 126 and lugs 127 cause the motion of the cane to be primarily along the press without excessive rotary movement. The pressed cane is discharged through the opening 140, the size of which is governed by cylinder 136, while expressed juice is collected in chamber 146 and discharged through outlet 147. The press will express approximately 80–85% of the juice from the cane, reducing bagasse moisture to e.g. 30–37%.

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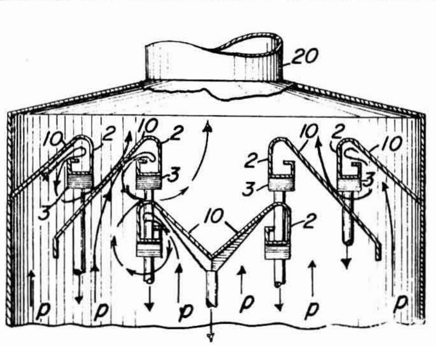
Entrainment separators. J. DIAZ-COMPAIN, of Havana, Cuba. **3,092,480.** 17th September 1958; 4th June 1963.—Characteristics of the entrainment separator are that it comprises upstanding walls defining the sides which laterally contain the moving vapour stream and entrained liquid, six deflection baffles extending across a substantial proportion of the cross-section flow area within these walls and having a flat section inclined upwards from the separator inlet to its outlet. Two of the baffles immediately adjacent to each other and attached to one side of the separator are inclined in the opposite direction to the inclination of the two baffles adjacent to each other and attached to the other side of the separator. The two central baffles are inclined in opposite directions to each other and to the next adjacent baffles. The uppermost inclined portion of each



baffle merges into a downward-projecting flange which forms an acute angle with the baffle and has an inwardly-turned channel section at its lower end to collect and carry off separated liquid.

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Centrifugal machines. H. F. IRVING, *assr.* BAKER PERKINS INC., of Saginaw, Mich., U.S.A. **3,092,580.** 13th December 1954; 4th June 1963.—See U.K. Patent 808,376[1].

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Water soluble non-ionic surface active agents of mono- and polysaccharides. M. J. ROSEN and I. A. KAYE. **3,092,618.** 7th July 1960; 4th June 1963. The surfactants are mono- or polysaccharides (D-glucose, sucrose, dextrin) in which at least one hydroxyl group is replaced by a group $-OCH(OR_1)R_2$, where R_2 is H or a hydrocarbon radical (CH_3 or C_6H_5) and R_1 is an aliphatic or *cyclo*-aliphatic hydrocarbon radical [containing 4–18 C atoms (*cyclo*-hexyl, chloesteryl)] the aggregate number of C atoms in R_1 and R_2 being 4–19 (10–19).

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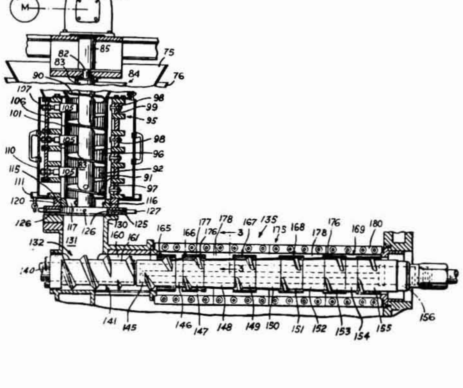
Method of recovery of juice from sucrose bearing materials (bagacillo). A. H. BURNER and R. T. SYMES, assrs. THE FRENCH OIL MILL MACHINERY CO., of Piqua, Ohio, U.S.A. **3,093,064.** 19th October 1961; 11th June 1963.—Juice from a milling train is screened



and the separated bagacillo conveyed to a press where its juice content is separated. The press comprises a hopper 75 delivering to an expression chamber formed by cage 95 comprising vertical spaced screen bars 96, held by wedge bars 97. Bagacillo is fed into the chamber by the continuous spiral 90 on shaft 85 which is driven by motor 80 through gearbox 81. Inside the chamber the shaft carries an interrupted scroll 91 which, with breaker bars 105, carries the bagacillo to the restricted throat formed by the split cone 115 clamped by ring 120. Expressed juice passes through the cage and into trough 111 from which it is discharged.

The ring manifold 125 has a number of inwardly-directed radial nozzles 126 and maceration water is supplied through pipe 127; it is thus applied continuously to bagacillo discharged from the vertical press, and the moistened bagasse then falls into chamber 131. The driven shaft 140 carries a feed screw 141 which takes the bagacillo into the horizontal press 135. This comprises an expression cage 175 made up of screen bars 176. Inside this cage the shaft carried a series of screw flights 145, 147, 149, 151, 153, 155 and pressure collars 146, 148, 150, 152 and 154 which, in cooperation with the breaker bars 177 carrying lugs 178, convey the bagacillo to the discharge outlet of the press while subjecting it to increasing pressure. The expressed juice flows out through the spaces in the cage and is collected.

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Fermentation of sugar to ethyl alcohol in the presence of proteolytic enzymes. E. W. COATES and J. CASTRO C., *assrs.* CENTRAL ANEJADORA GUATEMALTECA, of Guatemala City, Guatemala. **3,093,548.** 3rd August 1961; 11th June 1963.—Sugar in the form of molasses, cane syrup or pieces of cane, is fermented to ethyl alcohol by means of *Saccharomyces ellipsoideus* yeast, either grown on pineapple and capable of elaborating bromelin or grown on papaya and capable of elaborating papain, and accustomed to a concentration of 10–20% of alcohol by volume. The fermentation medium is maintained at 7–16°Bx by replacement at intervals of the sugar consumed by the yeast and at a temperature of 30–38°C. Fermentation of sugar and hydrolysis of protein continue until less than 1% of the sugar remains.

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Cane harvester. S. A. THORNTON, of Jeanerette, La., U.S.A. **3,095,680.** 5th November 1959; 2nd July 1963.

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Sugar esters. R. H. GOINS and H. E. DAVIS, *assrs.* EASTMAN KODAK CO., of Rochester, N.Y., U.S.A. **3,096,324.** 24th August 1960; 2nd July 1963.—A sugar (sucrose) is reacted with an excess of a lower fatty acid anhydride or anhydrides in the presence of 1% of a Ba salt of an organic acid (which may be that corresponding to the anhydride), yielding an ester or mixed esters. The ester product may be isolated by vacuum distillation to remove excess

[1] *I.S.J.*, 1959, **61**, 186.

acid and anhydride, followed by steam distillation to reduce residual acidity, filtration to remove the Ba salts, and centrifugal molecular distillation of the filtrate to give a distilled ester.

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Process for purifying sugar. G. ASSALINI, of Genoa, Italy, *assr.* ROHM & HAAS CO. **3,097,114.** 9th August 1960; 9th July 1963.—Raw cane or beet juice at extraction temperature is treated with a cation exchange resin which has on its exchange sites group II metallic cations (Ca, Mg), which will react with soluble alkali metal and ammonium hydroxides, phosphates and carbonates to form a flocculent precipitate. The treated juices are then heated even further and treated with a soluble hydroxide, phosphate, carbonate or bicarbonate of ammonia or an alkali metal [NaOH, $Ca(OH)_2$]; the precipitate of mineral compound and organic complexes is removed and the purified juice evaporated and crystallized to sugar.

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Beet thinner. J. CRACKNELL, J. C. CRACKNELL and D. N. COOPER, of Sudbury, Suffolk. **3,097,702.** 2nd June 1961; 16th July 1963.

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Method of clarifying cane sugar juice. J. DELFIN, of Alvarado, Ver., Mexico, *assr.* DOW-CORNING CORP. **3,097,970.** 8th December 1960; 16th July 1963. Clarification of cane juice is improved by adding to it, before other clarifying chemicals, at least 0·5 p.p.m. of a fluid organosiloxane polymer (a benzene soluble dimethyl siloxane polymer) in the form of an aqueous emulsion, admixed with silica.

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Sugar refining adsorbent. A. P. ALLEGRINI and T. A. CECIL, *assrs.* MINERALS & CHEMICALS PHILIPP CORP. **3,098,045.** 1st March 1960; 16th July 1963. A uniform mixture is made of fine uncalcined bauxite aggregates with a small amount of an alkali metal hydroxide (0·5–10% of NaOH) and a small amount (5–30%) of a clay (colloidal attapulgite clay, colloidal sepiolite clay), together with water sufficient to give a plastic consistency. The mixture is granulated and the granules calcined at a temperature between 1600°F and the melting point of the mixture (1650°–2000°F) for a time sufficient to dehydrate the mixture. The calcined granules are washed with an aqueous liquid to remove soluble salts. The product is a hard granular adsorption agent for sugar decolorization and ash removal.

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Process for clarifying sugar juices by addition of a buffer. P. R. PAYET, of Combuston, France. **3,098,766.** 3rd May 1960; 23rd July 1963.—The juice (beet or cane juice or refinery liquor) is heated with lime and phosphoric acid subsequent to the addition of a buffer system for coagulating albuminoid matter. The buffer system acts to maintain the pH at its "natural value" of 5·5–7·0 and comprises a mixture of Na_3PO_4, NaOH or Na_2CO_3 with H_3PO_4.

Process for agglomerating brown sugar. F. BUSH, of Philadelphia, Pa., U.S.A., *assr.* THE AMERICAN SUGAR REFINING CO. **3,098,767.** 18th April 1960; 23rd July 1963.—Brown sugar is pulverized to form a flowable material of which 90% will pass through a 200-mesh Tyler screen. This is agitated while being exposed to a humid atmosphere at room temperature until the moisture content has risen to a predetermined level (2–5%). This treatment produces agglomerates while retaining the free-flowing characteristics; the agglomerates are then maintained in a flowable condition by agitating while being dried to not more than ½% moisture.

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Extraction of sugar juice with a screw press. S. G. SMART, of London, *assr.* ROSE, DOWNS & THOMPSON LTD. **3,100,725.** 13th October 1959; 13th August 1963.—Cane is crushed to rupture a substantial proportion of its cells, and the prepared cane passed through either a cane mill or a screw press, when juice is expressed. The residual first bagasse is treated with dilute juice and passed through a second mill or press producing a second bagasse which is alternately treated with dilute juice and pressed in either mills or screw presses, eventually yielding a final bagasse which is treated in a screw press to reduce its water content.

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Beet thinner. L. W. SCHMIDT, of Rio Vista, Calif., U.S.A., *assr.* BLACKWELDER MANUFACTURING CO. **3,101,123.** 22nd August 1960; 20th August 1963.

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Polyoxyethylene derivatives of esters of sucrose with long-chain fatty acids. S. KOMORI and M. OKAHARA, of Osaka, Japan. **3,102,114.** 3rd April 1961; 27th August 1963.—These derivatives, solubilizing and emulsifying agents for foods, medicine and cosmetics, are polyoxyalkylene adducts of one or more sucrose fatty acid mono-or di-esters (or a mixture of these) where the fatty acid contains 8–22 carbon atoms and the polyoxalkylene moiety is polyoxyethylene or polyoxypropylene containing 5–150 units of the oxyalkylene group. They are prepared by reacting the alkylene oxide with the sucrose fatty acid ester at a pressure of 0–50 kg/sq.cm. (gauge) and at 80–160°C in the presence of an alkali metal hydroxide, alcoholate or carbonate or tertiary amine as a catalyst.

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Process and machine for forming and cleaning quarter-drains in sugar cane growing squares. B. C. THOMSON, of Thibodaux, La., U.S.A., *assr.* LAMB INDUSTRIES INC. **3,102,349.** 9th November 1961; 3rd September 1963.

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Sugar cane harvester. R. A. DUNCAN, E. R. BOLLES, T. ADACHI and L. H. ANDERSON, of Honolulu, Hawaii, U.S.A., *assrs.* HAWAIIAN DEVELOPMENT CO. LTD. **3,103,091.** 27th March 1961; 10th September 1963.

Sugar esters. K. KNOEVENAGEL, of Kleinkarlbach, Grunstadt, Germany, *assr.* C. F. SPIESS & SOHN CHEMISCHE FABRIK. **3,103,507.** 23rd February 1960; 10th September 1963.—The esters are of mono- or di-saccharides (e.g. glucose, fructose, galactose, xylose, arabinose or lactose) one or more molecules being attached to a radical having 1–4 valencies, the remaining valencies being satisfied by lower alkyl or aralkyl radicals. The acid radical may be sulphuric, phosphoric, phosphorous, pyrophosphoric, tetraphosphoric, boric or sulphonic acids, a methyl sulphate group, a *p*-toluene sulphonate group, a dialkyl phosphate or phosphite, or a dialkyl borate. They are prepared by reacting the sugar with the lower alkyl or aralkyl ester of the acid, in the substantial absence of water, at 20–90°C for 30–2 hr (under sub-atmospheric pressure) and in an inert organic solvent (e.g. dimethylformamide, pyridine, quinoline, etc.).

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Preparing an ester of an α,β-unsaturated acid and a sugar. E. E. FISHER and J. L. HARPER, of Decatur, Ill., U.S.A., *assrs.* A. E. STALEY MFG. CO. **3,103,508.** 23rd May 1960; 10th September 1963.—The diketal of a sugar having 6 carbon atoms (diacetone glucose) is reacted with a lower hydrocarbon ester of an α,β-unsaturated polymerizable acid (acrylic acid, methacrylic acid) having up to 5 carbon atoms in the presence of a vinyl polymerization inhibitor and tetra *iso*-propyl titanate as a catalyst, and distilling the hydrocarbon alcohol from the mixture as it is formed.

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Sugar cane crushing mills. W. M. LIVIE, of Seaforth, N.S.W., Australia. **3,103,874.** 18th October 1961; 17th September 1963.—See U.K.P. 925,606[1].

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Beet harvester transfer mechanism. E. J. HAMMER and O. H. HAMMER. **3,103,979.** 6th March 1961; 17th September 1963.

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Method of producing citric acid. M. T. TVEIT, of Lund, Sweden, *assr.* SVENSKA SOCKERFABRIKS AB. **3,105,015.** 31st October 1960; 24th September 1963. Citric acid is produced by submerged fermentation of beet molasses with mycelium of citric acid-producing *Aspergillus niger*, this mycelium being prepared beforehand in the form of pellets which are added to the substantially neutral diluted molasses and allowed to acclimatize for some time during which the pH falls to 4·5–5·5, owing to citric acid formation. The pH is brought to below about 3·0 with HCl to prevent formation of oxalic acid and the fermentation carried out while supplying gases rich in oxygen at a pressure resulting in an increased pressure of oxygen in the solution.

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Sucrose ester of 2,2,4-trimethyl-3-oxo-valeric acid as an extender. W. E. WRIGHT and C. H. CONEY, of Kingsport, Tenn., U.S.A., *assrs.* EASTMAN KODAK CO. **3,106,477.** 14th December 1960; 8th October 1963. The title sucrose ester is used as a plasticizer for cellulose ester film, in the proportion of 1–400% on weight of cellulose ester (5–90%, 1–38·9%, 17·6–400%).

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Composition comprising polycarbonate and sucrose ester and cellulosic web coated therewith. E. A. WOLFF, *assr.* CHAMPION PAPERS INC., of Hamilton, Ohio, U.S.A. **3,108,977.** 18th November 1960; 29th October 1963.—Solid plastic compositions or solid plastic film or at least one surface of cellulosic webs (e.g. for use in production of films, coatings, mouldings, etc.) contain 1–120 parts by weight of at least one sucrose ester having at least 4 (8) aliphatic acyl groups which are either acetyl, propionyl, butyryl or *iso*-butyryl groups (2 acetyl groups and 6 *iso*-butyryl groups), and 100 parts by weight of a polycarbonate of the formula—$[C_3H_4\text{-}C(CH_3)_2\text{-}C_6H_4\text{-}O.CO\text{-}O)]_n$— where n is at least about 50.

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Cane sugar processing. P. W. ALSTON, of Berkeley, Calif., U.S.A. **3,113,043.** 17th March 1961; 3rd December 1963.—Cane juice which has been limed and settled is brought to a pH below about 9·5 by adding (0·05–0·15% on cane of) lime and carbonatated (at a high temperature below about 160°F) to a pH of 6·8–7·8. The juice is (treated with 50–150 p.p.m. of SO_2 and) evaporated to 50–75°Bx without separating the precipitate and the thick juice filtered before boiling to sugar.

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Sugar beet processing. P. W. ALSTON, of Berkeley, Calif., U.S.A. **3,113,044.** 17th March 1961; 3rd December 1963.—Diffusion juice is limed in increments until a readily filtrable precipitate is obtained. The juice is filtered and carbonatated to reduce the pH to 9·5–10, and approx. 0·10–0·20% on beet of lime is added, followed by carbonatation to pH 8·8–9·5. The juice is (treated with SO_2 to inhibit colour formation and) evaporated without separating the precipitate to 50–75°Bx and the thick juice treated with 0·5–1·0% lime on beet, followed by carbonatation to a pH not higher than 10·8. A further amount of lime (bringing to 1·0–1·5% the amount added to the thick juice) is added in increments, carbonatating to a pH of 8·8–9·5. The thick juice is then filtered before boiling to sugar.

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Purification of cane juice by liming with gentle stirring. P. W. ALSTON, of Berkeley, Calif., U.S.A. **3,113,045.** 17th March 1961; 3rd December 1963.—Lime (0·05–0·25% on cane) is added in increments (at one-minute intervals) to cane juice (bringing it to pH 10·8–11·4) while stirring gently at a rate below that at which the precipitate breaks up. The juice is then heated to a temperature not substantially higher than 125°F and filtered. The juice is treated with CO_2 (after adding more lime) to precipitate additional impurities and the precipitate separated.

[1] *I.S.J.*, 1963, **65**, 310.

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.

Cane car tippers. Link-Belt Company, Prudential Plaza, Chicago 1, Ill., U.S.A.

All cane crushed at the Bryant Sugar House of the U.S. Sugar Corporation in Florida is brought to the factory in specially built rail cars which are of the gondola type, having three sections each holding 10 tons of cane. The cane supplies are arranged in a continuous stream, each car passing over a track scale to a platform on which is is clamped. The car is then tipped through an angle of 45° by two Link-Belt hydraulic cylinders, and each section is unloaded in turn by loosening the brackets holding the hinged side. This prevents choking of the cane carrier at the base of the hopper into which the cane falls. The dumper unloads 7–18 carloads per hour (210–540 tons per hour) depending on the crushing rate.

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Low-cost bulk storage bins. Simon Engineering Ltd., Cheadle Heath, Stockport, Cheshire.

At present available in sizes of 20, 32, 48 and 96-ton (flour) capacities, the "Unibulk" range of storage bins is designed for low cost and quick erection. Each bin is a free-standing unit consisting essentially of a vertical prefabricated one-piece cylindrical steel container, the lower part forming a supporting skirt which houses a discharge hopper with pneumatic conveying equipment. The cylinder is clad with fire-proof insulation board and an outer skin of ribbed aluminium giving thermal insulation better than a cavity-walled brick building. Air in the inter-space between the container and cladding is warmed by waste heat from the discharge equipment; this can be augmented by a small electric heater. Other items in the "Unibulk" range include compressors, seals, airlocks, valves, spouting, piping, conveyors, weighers, dust filters, sieves, control panels, etc.

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Dust collector. Dunford & Elliott Process Engineering Ltd., 143 Maple Road, Surbiton, Surrey.

The Dunelt panel filter, developed by Lühr of Germany, is made up of one or more sections each comprising a steel housing for rectangular frames covered with the filter media. The air enters at the top of the unit and deposits dust on the outside of the frame, clean air flowing through the filter media and via slots into the clean air duct.

The frames are isolated automatically in turn and subjected to a pulsating return supply of clean air which gently removes the dust which drops into a collection chamber from which it is withdrawn, e.g. by a worm conveyor or rotary valve. The cleaning time and interval are governed by an adjustable timing mechanism. There are no vibrating parts so that the unit is silent. Maintenance is negligible and servicing simple so that operation is economical.

Impeller flowmeter integrating unit. Meter-Flow Ltd., North Feltham Trading Estate, Feltham, Middlesex.

A new integrating unit for use with the Meter-Flow range of impeller meters has the facility for matching any flowmeter (bore size $\frac{3}{16}$ in—16 in) in units of gallons, litres, cubic metres, etc., with an overall accuracy of 0·1% or better. The unit is completely transistorized and suitable for use on 230 volts or 110 volts 50/60 c/s supply. Other systems are at present under development for applications on road tankers, etc., suitable for use on 12 and 24 volt batteries with the extra facility of ticket print-out.

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PUBLICATIONS RECEIVED

FIRE FIGHTING EQUIPMENT. Nu-Swift International Ltd., Elland, Yorks.

This, the 3rd Edition of the Nu-Swift catalogue, is not only a list of the types and sizes of extinguishers made by the Company but also discusses the principles and construction of portable fire extinguishers and the methods of extinguishing fires and classification of fire risks. The appropriate Nu-Swift appliances for the various types of fire are listed and then each is described in detail with an account of its use.

* * *

PUMPS. Albany Engineering Co. Ltd., Lydney, Gloucestershire.

A new leaflet illustrates the Albany A.P.13 3-inch rotary pump which incorporates a reduction gearbox and hand-operated control valve for direct drive through the power take-off of a road tanker vehicle. It is fitted to a large molasses road tanker of 16 tons (2500 gal) capacity which it can discharge at the rate of 2400–3500 g.p.h., depending on the viscosity and head conditions. Pumps are available to handle any liquid carried in bulk.

* * *

THE LARGEST POWER TRANSMISSION ENGINEERS IN THE WORLD. Crofts (Engineers) Ltd., Bradford 3, Yorkshire.

This claim is made in a folder, DM 2/63, which illustrates and briefly describes the Crofts variable speed pulley drives, vary-speed controls, and variable speed gears and motor units described in greater details in other Company publications.

* * *

MECHANICAL HANDLING. Strachan & Henshaw Ltd., Ashton Works, P.O. Box 103, Bristol.

Examples of the equipment supplied by Strachan & Henshaw Ltd. for handling bulk raw materials include; rail wagon marshalling, tippling and transporter equipment, bucket wheels, furnace charging and billet handling equipment, trash gantries and screen hoists, skip hoists, blast furnace screens, etc.

* * *

Filtration. This is the name of a new technical journal to be published bi-monthly, the first issue of 70 pages containing articles on polish-filtration, filter aids, immiscible filters, etc. It will cost £2. 10s or $7.00 for twelve issues and is published by Uplands Press Ltd., 10 Peaks Hill, Purley, Surrey.

WORLD SUGAR PRODUCTION

(First estimates by F. O. Licht K.G.[1])

(metric tons, raw value)

BEET SUGAR

Countries	Campaign	(*Estimate*) 1963/64	1962/63	1961/62
Western Europe				
West Germany*	Sept./Jan.	2,050,000	1,521,197	1,471,327
Austria	Sept./Jan.	310,000	269,318	215,630
France	Sept./Jan.	1,980,000	1,664,065	1,741,612
Belgium-Luxembourg	Sept./Jan.	348,000	334,750	454,000
Netherlands ..	Sept./Jan.	432,500	466,118	601,243
Denmark......	Sept./Jan.	383,000	209,000	217,000
Sweden	Sept./Jan.	240,000	218,196	299,616
Italy	July/Oct.‡	864,350	947,489	995,072
Spain	July/Feb.	322 200	462,213	570,186
Yugoslavia	Sept./Dec.	340,000	251,702	250,383
Greece	July/Jan.	40,000	26,667	2,975
Switzerland ..	Sept./Jan.	41,000	30,109	36,320
U.K.	Sept./Jan.	825,000	774,996	858,067
Ireland........	Sept./Jan.	138,000	136,823	125,913
Finland*	Sept./Jan.	55,500	44,271	69,386
Turkey........	July/Jan.	490,000	433,638	469,548
Total		8,859,550	7,780,552	8,378,278
Eastern Europe				
East Germany .	Sept./Jan.	750,000	668,014	538,888
Czechoslovakia	Sept./Jan.	1,025,000	881,700	910,000
Hungary	Sept./Jan.	430,000	398,000	386,417
Poland	Sept./Jan.	1,325,000	1,335,000	1,665,000
Albania	Sept./Jan.	11,000	9,000	13,000
Rumania	Aug./Jan.	355,000	312,085	419,376
Bulgaria ..	Aug./Jan.	180,000	156,667	213,666
U.S.S.R.	Sept./Jan.	5,500,000	6,667,000	6,800,000
Total		9,576,000	10,427,466	10,946,347
Europe, total ..		18,435,550	18,208,018	19,324,625

* Including sugar production from foreign beets.

Countries	Campaign	1963/64	1962/63	1961/62
Other Countries				
United States ..	July/Jan.	2,725,000	2,347,300	2,180,861
Canada	Oct./Dec.‡	155,000	143,000	125,318
Uruguay	Nov./March	40,000	40,000	39,800
Chile	April/June §	105,600	109,643	68,307
Azores	June/Oct.‡	13,000	12,000	12,722
Japan	Oct./Feb.	166,000	171,646	143,967
China (Mainland)..	Jan./Dec. §	390,000	350,000	300,000
Pakistan		5,000	5,000	5,500
Iran	Oct./March	150,000	147,500	97,100
Iraq		40,000	30,000	—
Afghanistan ..	Nov./Feb.	8,500	5,500	5,000
Israel	April/June §	41,700	34,491	29,491
Syria	Nov./July §	13,000	9,000	12,000
Total		3,852,800	3,405,080	3,020,066
World Beet Sugar Production		22,288,350	21,613,098	22,344,691

CANE SUGAR

Countries	Campaign	(*Estimate*) 1963/64	1962/63	1961/62
Europe				
Spain	Dec./June	30,000	29,377	33,837
North and Central America				
Cuba	Jan./June §	3,300,000	3,820,323	4,815,234
United States ..	Oct./April	1,065,000	773,825	778,360
Puerto Rico ..	Jan./June§	975,000	900,042	915,296
Hawaii........	Jan./Dec. §	1,000,000	997,898	1,016,052
Trinidad	Jan./June §	217,000	230,984	204,308
Barbados......	Jan./June §	200,000	193,748	160,993
Jamaica	Jan./June §	484,000	497,840	440,934
Antigua	Jan./June §	28,500	26,689	20,865
St. Kitts	Jan./June §	34,000	40,199	43,549
Other West Indies......	Jan./June §	2,500	2,556	3,956
Virgin Islands..	Jan./June §	14,500	14,362	9,759
Dominican Republic**	Dec./Nov.	861,800	793,782	901,904
Mexico	Nov./June	1,825,000	1,731,659	1,518,702
Martinique	Jan./June §	75,000	97,000	89,484
Guadeloupe ..	Feb./July §	190,000	186,025	170,090
Haiti	Dec./June	69,000	69,027	69,735
Guatemala	Dec./June	130,000	127,000	119,860
El Salvador**..	Nov./March	69,000	58,617	63,879
British Honduras	Dec./June	32,000	25,000	26,230
Honduras	Dec./June	24,000	23,000	23,630
Nicaragua	Dec./June	81,000	84,000	80,739
Costa Rica	Dec./June	98,000	95,000	92,000
Panama	Dec./June	40,000	37,000	28,363
Total		10,815,300	10,825,576	11,593,922
South America				
Argentina	May/Nov.‡	1,088,900	815,295	709,216
Brazil†	June/May	3,330,000	2,226,284	3,535,826
Peru	Jan./Dec. §	820,000	750,000	777,300
British Guiana	Oct./June	335,300	314,960	331,239
Uruguay	July/Oct.‡	7,500	7,000	6,100
Surinam	Oct./Jan.	12,000	11,000	10,000
Venezuela	July/June	305,600	283,333	255,555
Bolivia	May/Sept.‡	67,700	54,648	45,724
Ecuador	June/Jan.	155,000	150,000	161,111
Colombia	Jan./Dec. §	415,000	420,000	410,284
Paraguay	July/Nov‡.	38,900	36,511	31,929
Total		6,575,900	6,069,031	6,274,204

† Since 1961/62 raw value (before 1961/62 *tel quel*)

Countries	Campaign	1963/64	1962/63	1961/62
Africa				
Egypt	Dec./June	372,000	358,518	323,846
Sudan		20,000	14,666	—
Ethiopia and Eritrea	Nov./June	68,000	65,791	41,573
Mauritius** ..	July/Jan.	675,000	532,817	553,259
Réunion	Aug./Jan.	225,000	181,209	262,481
South Africa** (inc. Swaziland)	May/Feb.	1,263,400	1,155,338	1,065,103
Mozambique **	May/Nov.‡	187,000	186,322	165,134
Angola	May/Oct.‡	75,000	73,233	62,067
Kenya, Uganda and Tanganyika..	Sept./Aug.	210,000	200,000	165,505
Madagascar ..	May/Nov.‡	87,000	87,200	87,832
Congo (Brazzaville)	Oct./April	18,000	18,000	15,000
Congo (Leopoldville)	Nov./May‡	35,600	44,400	31,600
Rhodesia	May/Nov.‡	129,900	82,553	81,646
Madeira	Dec./Feb.	3,000	2,700	5,880
Total		3,369,900	3,002,747	2,860,926
Asia				
India— White sugar	Nov./July	3,300,000	2,400,000	3,002,219
Khandsari ..	Nov./July	280,000	300,000	300,000
Indonesia** ..	April./Dec.‡	650,000	591,930	634,953
Pakistan	Nov./July	300,000	287,949	208,656
Burma	Nov./July	52,000	50,000	50,000
Philippines	Nov./July	1,787,000	1,554,820	1,468,176
China (Mainland) ..	Jan./Dec. §	1,050,000	950,000	900,000
Taiwan**	Oct./May	730,000	760,000	723,747
Thailand**	Oct./April	130,000	125,000	151,000
Viet Nam	Oct./April	28,000	20,000	17,000
Japan	Nov./June	65,000	55,246	38,548
Ceylon		13,000	9,500	4,100
Total		8,385,000	7,104,445	7,498,220
Oceania				
Australia	May/Dec.‡	1,720,000	1,885,000	1,360,000
Fiji Islands	May/Dec.‡	300,700	253,000	146,000
Total		2,020,700	2,138,000	1,506,000
Cane Sugar Production		31,195,800	29,169,176	29,767,188
Beet Sugar Production		22,288,350	21,613,098	22,344,691
World Sugar Production		53,484,150	50,782,274	52,111,879

‡ 1963,1962, 1961 § 1964, 1963, 1962 ** *tel quel*

[1] *International Sugar Rpt.*, 1963, **95**, (Supp. 22), 291–294.

BREVITIES

St. Kitts (Basse Terre) Sugar Factory Ltd., 1963 report. Crop started on the 2nd February and finished on the 27th July with an outturn of 39,586 tons of commercial sugar (equivalent to 39,925 tons on a 96 pol basis), produced from 350,658 tons of cane. In the 1962 season 43,167 tons of sugar on a 96 pol basis were made from 416,206 tons of cane.

* * *

Indian sugar cane research. A technique for growing sugar cane in alkaline soils and a novel nursery technique for raising planting material in the cold and arid sub-tropical areas of the world are among the several important researches noted in the report of the Indian Institute of Sugarcane Research, Lucknow, for 1961/62.[1] A survey showed that nematodes attacked cane crops in many areas of India, and experiments have been conducted on the diagnosis and treatment of the soil. Among new implements designed and fabricated during the year are a furrower for cane planting and a stripper for rapid de-trashing of cane stalks at harvest. A technique of mechanized cane cultivation by strip tillage is being evolved with the object of economizing field operation and helping in soil conservation. Physiological research showed that by a single defoliation in mid-September, cane crops which normally end their growth as a result of flowering could be made to suppress their flowering and continue to grow right up to the harvesting.

* * *

Sugar beet experiments in India[2].—The Indian Institute of Sugarcane Research, Lucknow, has conducted experiments to see if sugar beet could be grown successfully in Northern India. It was shown that cultivation could be successful, yields obtained being about 15 to 20 metric tons per acre and sugar content 14 to 17%. Indications were that by employing improved techniques the yields of beet could be increased to 25 tons/acre.

* * *

Mexican sugar crop, 1963.[3]—Cane crushed in Mexico in 1963 totalled 17,719,597 metric tons, harvested from 316,237 hectares. Sugar produced totalled 1,618,139 metric tons. The cane crop was almost two million tons greater than in 1962—an increase of 6%—while the yield of sugar was also higher at 5067 kg/ha, compared with 4720 kg/ha in the previous season, an increase of 7·4%. New factories are in construction including the Plan de Ayala mill in San Luis Potosí, Panuco mill near Tampico, Veracruz, another mill near Villa Hermosa, Tabasco, and others[4]. A number of factories are to be relocated in more suitable parts of the country where the soil is more favourable and where there is less competition for cane.

* * *

Sugar refinery for Libya[5].—Construction of a sugar refinery in Libya has been under consideration for some time and it has been decided to approach several international firms specializing in this type of equipment. Technical studies will be made and it is hoped that the refinery will be in production in about two years.

* * *

U.S. beet sugar expansion[6].—The U.S. Dept. of Agriculture commenced public hearings on the 10th December in connexion with the assignment of sugar beet acreages, etc., from the National Sugar Beet Acreage Reserve as provided for in the Sugar Act as amended in 1962. At the hearings applications were expected for the building of 23 additional new beet factories in the states of Arizona, Illinois, Indiana, Kansas, Maine, Missouri, Minnesota, New Mexico, New York, North Dakota, Oklahoma, Tennesee, Texas and Virginia, although indications are that no more than three additional factories will be authorized by the Department. Previously the Department authorized five sugar factories of which two were later revoked. The three remaining authorizations were for the Spreckels Sugar Co. plant at Mendota, California, which went into operation in 1963, the Holly Sugar Corporation factory near Hereford, Texas, scheduled to commence operations this year, and the American Crystal Sugar Co. plant near Drayton, North Dakota, scheduled to operate in 1965.

White sugar futures market in Paris[7].—The French Government has agreed to the opening of a futures market in white sugar in Paris. Ministry of Finance sources said the Government has approved the proposals submitted by the Paris Chamber of Commerce for the opening of a futures market[8]. The Decree is expected to be published shortly in the *Journal Officiel.*

* * *

Polish sugar factory exports[9].—According to reports from Poland, the export of eight sugar factories is provided for in 1964/65. During the last five years twenty sugar factories have been exported to China, Iran, North Vietnam, Ceylon, the U.S.S.R., Morocco and Greece. Two of the fifteen factories ordered by the U.S.S.R. have been put into operation while a further ten are still under construction.

* * *

New Turkish sugar factory[10].—A new sugar factory was recently put into operation in Kastamonu in Turkey. It has an annual slicing capacity of 120,000 tons of beets, with a production of 18,000 tons of sugar and 5000 tons of molasses.

* * *

New East German sugar factory[11].—The newest sugar factory in East Germany—that located at Güstrow, in Mecklenburg—cost DM.72 million. During the 1963/64 campaign it was to process 1750 tons per day of beet, 75 tons of raw sugar being remelted.

* * *

Dutch beet crop, 1963/64[12].—Sugar beet production in Holland has been finally estimated at 2,690,923 metric tons, obtained from a harvested area of 69,168 hectares for the current crop. In the previous campaign 2,934,100 tons were obtained from 77,439 hectares.

* * *

The late A. L. Webre. ALFRED L. WEBRE, the distinguished engineer whose studies on evaporator and vacuum pan operation have brought him a world-wide reputation, died at the end of last year at his home in Merion, Pennsylvania. As well as writing an important treatise "Evaporation", Mr. WEBRE was a leading exponent of forced circulation of massecuite in vacuum pans, and introduced the AC-system of pan boiling in Cuba, where he was an Honorary Life President of the Asociación de Técnicos Azucareros de Cuba. He contributed the completely re-written chapter on pan boiling for the recently published 9th Edition of the Spencer-Meade Cane Sugar Handbook.

* * *

Corrigendum.—We are advised that information given in *Taiwan Sugar* and reprinted in our February issue[13] concerning the sugar industry of Israel is incorrect. The two sugar factories at Afula and Ramat Gan (that latter not in the north but near Tel-Aviv) produce direct consumption beet sugar, not refined sugar while the third sugar factory at Kiriat-Gat is larger and better equipped and produced 12,500 tons of white sugar in its third campaign in 1963, the capacity at present being enlarged by 50%. We are further advised that the trials with cane are unpromising.

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[1] *Indian Sugar*, 1963, **13**, 361.
[2] *Indian Sugar*, 1963, **13**, 362.
[3] *Bol. Azuc. Mex.*, 1963, (172), 36–37.
[4] *Sugar J.* (La.), 1963, **26**, (6), 7.
[5] *Overseas Review* (Barclays D.C.O.), December 1963, p. 46.
[6] *Lamborn*, 1963, **41**, 262.
[7] *Public Ledger*, 14th December 1963.
[8] *I.S.J.*, 1963, **65**, 252.
[9] F. O. Licht, *International Sugar Rpt.*, 1963, **95**, (12). 185.
[10] *Zeitsch. Zuckerind.*, 1963, **88**, 692.
[11] *Zeitsch. Zuckerind.*, 1963, **88**, 691.
[12] C. Czarnikow Ltd., *Sugar Review*, 1963, (643), 18.
[13] *I.S.J.*, 1964, **66**, 36.

BREVITIES

Sugar in Northern Rhodesia[1].—Rhodesia Sugar Refineries Ltd. have announced their interest in developing a primary sugar industry in Northern Rhodesia. Field surveys and experimental work have already been started in the Kafue basin area and trial plots of sugar cane have been planted. If results from these trials are successful and the economics of large scale production appear satisfactory, then a self-contained estate (likely to be of the order of 10,000 acres) with its own factory, may be established. The company expect to be able to make a final decision on this project in 1965. Initial production could amount to about 25,000 tons per annum which could be readily expanded as the requirements of the company's sugar refinery in Ndola increase.

* * *

New projects for Florida[2].—The Atlantic Sugar Cooperative is starting construction of the eleventh Florida sugar factory; it is to be ready for the next crop. A new project is also being studied for a sugar mill in Hillsborough Plantation which comprises 30,000 acres.

* * *

Mauritius sugar production[3].—The 1963 sugar crop in Mauritius ended on 7th December with a yield of 5,697,327 metric tons of cane from which was produced 680,000 metric tons of sugar. Of this production 322,070 tons had been shipped to the U.K., 57,709 tons to Canada, 57,776 tons to the U.S.A. and 10,250 tons to Italy.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 17th February* **1964**)	s d
Anglo-Ceylon (5s)	24/3
Antigua Sugar Factory (£1)	12/6
Booker Bros. (10s)	22/10½
British Sugar Corp. Ltd. (£1)	33/6
Caroni Ord. (2s)	4/–
Caroni 6% Cum. Pref. (£1)	15/9
Demerara Co. (Holdings) Ltd.	8/4½
Distillers Co. Ltd. (10s units)	25/7½
Gledhow Chaka's Kraal (R1)	32/6
Hulett & Sons (R1)	96/6
Jamaica Sugar Estates Ltd. (5s units)	5/6
Leach's Argentine (10s units)	17/10½
Manbré & Garton Ltd. (10s)	53/–
Reynolds Bros. (R1)	35/6
St. Kitts (London) Ltd. (£1)	21/6
Sena Sugar Estates Ltd. (10s)	8/4½
Tate & Lyle Ltd. (£1)	53/3
Trinidad Sugar (5s stock units)	3/9
United Molasses (10s stock units)	39/4½
West Indies Sugar Co. Ltd. (£1)	27/9

CLOSING MIDDLE

New York Stocks (*at 15th February* 1964)	$
American Crystal ($10)	75½
Amer. Sugar Ref. Co. ($12.50)	24
Central Aguirre ($5)	35
North American Ind. ($10)	17⅜
Great Western Sugar Co.	46½
South P.R. Sugar Co.	37½
United Fruit Co.	21

The late R. E. Stedman.—The death occured on the 1st February of Dr. R. E. STEDMAN, C.M.G., Executive Director of the International Sugar Council. He was 60. After a distinguished academic career in which he lectured in philosophy and logic at a number of British Universities, he became a senior civil servant with the Ministry of Food, later the Ministry of Agriculture, Fisheries and Food. He was appointed Executive Director of the International Sugar Council in 1960 since which time the world sugar markets have been subjected to the severe strains resulting from the U.S.-Cuban estrangement and subsequent violent fluctuations in sugar prices. Dr. Stedman's efforts in maintaining collaboration between parties to the agreement have been largely successful and he found it possible to persuade members to agree on a formula whereby the Agreement could be extended beyond its 5-year term under conditions which would help rather than hinder the settlement of problems in achieving stability for sugar producers and consumers.

* * *

Tanganyika sugar development[4].—An agreement has been reached on the establishment of a mixed Polish-Tanganyika enterprise for the building and operation of a sugar cane plantation and factory.

* * *

New Ecuador sugar factory[5].—A new company has been formed in Guayaquil with the intention of building a sugar factory having a capacity of 5000–6000 tons of cane per day and an annual sugar production capacity of 60,000–75,000 tons.

* * *

Bookers expansion in Jamaica.—The Booker Group announced at the end of January that their Jamaican sugar producing company, Innswood Estate Ltd. had acquired the share capital of Holland Estate Ltd. Holland Estate has its own factory and covers 5000 acres, of which one-third is at present under cane, producing some 6000 tons of sugar a year. Hartlands, a 1500-acre farm adjoining Innswood, has also been bought recently and is to be planted to cane for processing at the Innswood factory which is being enlarged. The current production of Innswood is 22,000 tons of sugar a year.

* * *

Hawaii sugar production, 1963[6].—Sugar production in the Hawaiian islands in 1963 totalled 1,100,768 short tons 96° raw value, compared with 1,120,011 tons in 1962. The total was made up of 223,654 tons from Oahu, 242,812 tons from Maui, 373,483 tons from Hawaii, and 260,819 tons from Kauai.

* * *

U.K. sugar crop, 1963/64.—The 1963/64 beet campaign in the U.K. is now completed and provisional figures for the crop have been released. Throughout the season favourable weather conditions have brought considerable benefit to the roots, in particular in developing sugar content. The eighteen factories manufactured 733,000 tons of sugar, white value, from 5,253,000 tons of beet as compared with 5,313,000 tons of roots yielding 686,000 tons of sugar in the previous season. The quantity of roots recovered per acre this year, however, at 12·86 tons, differed only fractionally frcm the 12·99 tons of 1962/63.

* * *

Louisiana sugar production, 1963/64[7].—Sugar production from the 1963/64 crop in Louisiana has been provisionally placed at 759,000 short tons, raw value. During the season 9,055,468 tons of cane were harvested for sugar production purposes. In the previous crop 471,601 tons of sugar were obtained from 5,315,415 tons of cane.

1 *Overseas Review* (Barclays D.C.O.), January 1964, p. 29.
2 *Sugar y Azúcar*, 1964, **59**, (1), 46.
3 *Overseas Review* (Barclays D.C.O.), January 1964, p. 22.
4 *Overseas Review* (Barclays D.C.O.), January 1964, p. 34.
5 F. O. Licht, *International Sugar Rpt.*, 1964, **96**, (2), 14.
6 *Willett & Gray*, 1964, **88**, 53.
7 C. Czarnikow Ltd., *Sugar Review*, 1964, (647), 34.