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C'est un sommaire du rapport annuel (1967) du Bureau of Sugar Experiment Stations; il traite d'essais avec azote, phosphate, potasse et soufre; des études sur une manque de cuivre et de magnésium dans la canne; le désherbage; l'élévage de canne et des variétés nouvelles; des maladies de canne et des insectes nuisibles.

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Dans la seconde section de cet article les auteurs décrivent des essais sur l'incubation avec des échantillons de jus à partir d'une diffusion RT, en montrant les effets de H_2SO_3, formaline et sulfite de soude sur des changements de pH et de formaline et de Na_2SO_3 sur la formation de nitrite. On examine aussi des pertes de SO_2 dans jus brut à cause de réactions chimiques et le destin de SO_2 dans le chaulage et la carbonatation.

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La détermination de phosphates dans le jus clarifié. E. C. VIGNES. *p.* 333–334

L'auter présente une méthode colorimétrique pour la détermination de phosphate dans jus clarifié. On emploie l'acide ascorbique comme réducteur; la couleur bleue développant au point d'ébullition de la solution est plus stable et moins sujette à interférence que dans le cas ou l'on emploie la chlorure d'étain.

Nachgiebige Antriebe für Zuckerrohrmühlen. J. W. HILL. *S.* 323–327

Zwei Antriebeinrichtungen, die für Zuckerrohrmühlen anwenden werden können, werden beschrieben, und zwar ein direkt angeschlossener, hydraulischer Antrieb, wobei das ganze Reduktionsräderwerk ausgelassen wird, und ein besonderes Kardangelenk für eine bestehende Mühle.

* * *

Zuckerrohr-Forschungsarbeit in Queensland. *S.* 327–330

Dies ist eine Zusammenfassung des Jahresberichts (1967) des Bureau of Sugar Experiment Stations und betrachtet: Versuche mit Azot, Phosphat, Kali und Schwefel; Studien über die Mängel an Kupfer und Magnesium in der Zuckerrohr; die Unkrautbekämpfung; die Rohrzüchtung und neue Sorten; und Rohrkrankheiten und -Schädlinge.

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Vergleich von Schwefeldioxyd und Formaldehyd als Bakteriostate in der Saftgewinnung. Teil 2. J. F. T. OLDFIELD, J. V. DUTTON, D. GRIERSON, R. K. HEANEY und H. J. TEAGUE. *S.* 330–333

In der zweiten Sektion dieses Aufsatzes besprechen die Verfasser einige Inkubationsversuche mit von einem RT-Diffusionsapparat stammenden Saftproben; die Ergebnisse zeigen die Wirkungen von H_2SO_3, formalin und Natriumsulphit auf pH-Anderungen und von Formalin und Na_2SO_3 auf Nitritbildung. SO_2-Verluste in Rohsaft durch chemische Reaktionen und das Schicksal von SO_2 während der Scheidung und der Karbonatation wurden auch untersucht.

* * *

Die Phosphatbestimmung in Klarsaft. E. C. VIGNES. *S.* 333–334

Man beschreibt eine kolorimetrische Methode für die Bestimmung des Phosphats in Klarsaft. Ascorbinsäure wird als Reduktionsmittel angewendet, weil die beim Lösungssiedepunkt entstehende Blaufarbe mehr stabil und nicht so empfindlich gegen Störungen ist, als wenn man Zinnchlorur anwendet.

* * *

Accionamientos flexibles para molinos de caña. J. W. HILL. *Pág.* 323–327

Dos posibilidades conveniente para accionamiento de un molino de caña se describen, á saber un accionamiento hidráulico directo, en que se omite el engranaje entero, y un especial acoplamiento universal para un molino existente.

* * *

Investigaciones sobre caña de azúcar en Queensland. *Pág.* 327–330

Esto es un sumario del reporte anual de 1967 del Bureau of Sugar Experiment Stations. Se trata de ensayos con nitrógeno, fosfato, potasio y azufre; estudios de faltas de cobre y magnesio en la caña; control de malas hierbas; la crianza de caña y nuevas variedades; y enfermidades y plagas de caña.

* * *

Comparación de dióxido de azufre y formalina como bacteriostates en difusión. Parte II. J. F. T. OLDFIELD, J. V. DUTTON, D. GRIERSON, R. K. HEANEY y H. J. TEAGUE. *Pág.* 330–333

En la segunda sección de este artículo se presentan detalles de experimentos en que muestras de jugo de un difusor RT se incuban. Estos muestran los efectos de ácido sulfuroso, formalina y sulfito de sodio sobre cambio de pH y de formalina y sulfito de sodio sobre formación de nitrito. Se examinan también las perdidas de dióxido de azufre en jugo crudo por reacciones químicas y el destino de dióxido de azufre en el tratamiento con cal y en carbonatación.

* * *

Determinación de fosfatos en jugo clarificado. E. C. VIGNES. *Pág.* 333–334

Se describe un método colorimétrico para determinar fosfato en jugo clarificado. Acido ascorbico se usa como agente reductor, siendo el color azul desarrollado al punto de ebullición de la solución más estable y menos sujeto á interferencia que cuando se usa cloruro estañoso.

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Notes & Comments

International Sugar Conference.

The United National Sugar Conference resumed in Geneva on the 23rd September in an atmosphere of hope tinged with anxiety because of the difficulties which remained to be overcome in order to achieve an agreement for regulation of supply and demand on the world free sugar market. Delegates from 71 countries attended, under the chairmanship of the Hon. R. C. LIGHTBOURNE, of Jamaica, and during the first two weeks acted as committees to study the outstanding problems. On the 9th October, Dr. PREBISCH, Secretary-General of UNCTAD, presented his report to the Conference on the progress achieved. The difficulty raised by the EEC position seemed to be insoluble, and he presented a package of proposals for an agreement which could be operated without the EEC, but which would allow its accession at a future date.

Negotiations continued on the other problems which remained, and Dr. PREBISCH submitted his final report to the Conference on the 17th October. This included detailed quotas which, with the application of cuts provided for in the package, would bring supply and demand for sugar into balance. The "hardship fund", previously limited to 25,000 tons, would be raised to 150,000 tons and the Soviet Union's demand for a larger quota for re-export of Cuban sugar was to be granted by increasing it to 1,050,000 tons, at the same time cutting the re-export quotas from East Germany and China to 350,000 tons; Cuba is to ensure that these levels are not exceeded.

Japan rejected the price range proposed—3·25 to 5·25 cents per pound—and stood out for a long time for a minimum of 3 cents. Australia, on the other hand, argued that, in accepting the largest quota reduction, she had relied on offsetting reduced exports by higher prices, and wanted a minimum of 3·50 cents. Fortunately, a compromise proposed by a Brazilian delegate was accepted by both sides, whereby the 3·25 cents minimum will be accepted for the first three years, with the possibility of fresh negotiations after then. When the price falls to 3·50 cents, 10% quota cuts will be put into operation, and a further 5% if the price falls to 3·25 cents per lb.

A final plenary session of the Conference was held on the 24th October and the new International Sugar Agreement adopted. It will be open for signature at the UN headquarters in New York until the 31st December, and is scheduled to come into force on the 1st January 1969, and will extend for five year.

The new agreement is considered to be a considerable improvement on the 1958 agreement since quotas are more realistic, and the maximum cut of 15% is thought to be more acceptable than the former 20%. The price range is now transformed into a scale with several "reference points"; it is wider and provides for controls to be introduced or restored at various levels in the scale. The new agreement bans imports by members from non-members if the price falls below 3·25 cents per pound, a clause which could influence the EEC to join at a later stage.

Provision is now made for supply commitments; if the price rises above 5·25 cents, suppliers undertake to provide importers with sugar at the average price and amount of the previous two years up to a maximum price of 6·50 cents. The "hardship fund" will cushion cuts allotted to small developing producers, while importers are pledged to accept a proportion of their requirements from free markets and undertake to limit re-exports.

A number of delegations have expressed satisfaction at the achievement of the Agreement; the exporters would, of course, have preferred larger quotas and higher prices, while the importers would have preferred lower minimum prices, but it is the essence of an agreement of this sort that these directly-opposed interests should meet in a compromise mutually satisfactory to all.

During the period of the Conference, the estimates of a world sugar balance produced by F. O. Licht K.G. indicated a world stock figure some 600,000 tons higher than previously estimated, and it might be expected that this factor might have had a depressing effect on the sugar market. However, expressions of optimism from Geneva led to a slow rise from the pre-Conference level of £17 10s per ton at the London Terminal Market and culminating in a sharp rise to £24 at the end, illustrating the over-riding importance of sentiment and indicating how pessimism has kept the price of sugar unduly low for such a long time. As C. Czarnikow Ltd. remark[1]:

[1] *Sugar Review*, 1968, (889), 197.

"Values . . . are still well below the levels indicated at the Conference. Firm and rapid action will be needed on the part of the International Sugar Organization in administering the provisions of the Agreement and it is important that it should be able to count upon full support from member countries. The current optimism can evaporate and it is only by full adherence to both the spirit and the letter of the Agreement that the underlying weakness which has plagued the market for so long can finally be dispelled".

* * *

European beet sugar production estimates, 1968/69.[1]

The first estimate made by F. O. Licht K.G. of beet sugar production in the current campaign is for a total of 25,411,760 metric tons, raw value, which is 801,374 tons or 3·06% less than the 26,213,134 tons produced during the 1967/78 campaign. This is largely the result of decreases expected in the Eastern Europe estimates, and half of these is the single figure of the fall expected in the USSR crop. Such is the importance which the USSR figure has as being about 40% of the total European sugar output. As has been reported in *Pravda*, difficulties are being experienced in beet transport, yields are lower than in 1967/68, and the area has been cut by 300,000 ha. Against this, improved beet varieties have been planted, but to assess the outcome of these factors is very difficult, and Licht's figure is probably best considered as an "educated guess".

So far as Western Europe is considered, the wet weather experienced in September and October has caused difficulty in lifting and transport, and has raised root weights without increasing the total sugar contents. This involves the factories in higher operating costs and also causes the campaign to be extended, when the beets tend to deteriorate with a consequent lower recovery. Consequently it is possible that the estimates for certain countries will have to be reduced at a later date as more definite reports become available on the progress of the campaign. The details of the first estimate are reproduced elsewhere in this issue.

* * *

Mauritius Chamber of Agriculture Report, 1967/68.

The 1967 sugar campaign experienced climatic conditions similar to those of 1965 with the exception that in mid-January 1967 a cyclone (Gilberte) passed off the East Coast of Mauritius causing gusts of 70 to 90 m.p.h. which damaged the rapidly growing cane. With the exception of one wet spell of a month's duration during the vegetation stage, most of that period was dry but the maturation period was marked by heavy rains. The duration of the campaign, however, was unusually long, dragging on until the end of December, a time when the sucrose content of the cane drops appreciably. The total cane crop harvested was 5,814,467 metric tons and gave a 10·98% recovery to produce a total of 628,270 tons of sugar[1].

The first estimate of the 1968 crop, based on the fairly favourable weather at the start of the vegetation stage, was 685,000 metric tons. Thee cyclones which passed near the Island in February and March brought abundant rains and these further improved the condition of the standing crop. Subsequent weather conditions having been generally satisfactory, the Chamber has revised its estimate of 1968 production to 700,000 metric tons[2].

Exports during the calendar year 1967 amounted to 523,031 long tons, the lowest figure for the past five years. One reason for this was the availability of only a small carryover from the previous season. There was a heavy reduction of the quantity shipped to Canada but it is already known that sales to that country from the 1968 crop will resume their normal amount of about 125,000 long tons. Of exports during 1967, 98·2% were shipped in bulk.

The production of molasses in 1967 amounted to 154,404 metric tons; 21,000 tons more than in 1966; but exports fell sharply from 127,523 tons in 1966 to 96,913 tons in 1967. Production of alcohol also increased from 1,336,000 litres to 1,964,000 litres.

The Chamber of Agriculture has prepared a detailed and extensive programme for the development of food crop production on sugar estates and has published its proposals. The crops which the Chamber has selected as offering the most promising prospects for inter-cropping with sugar cane (which is considered the most practicable location in the preliminary stage because only on the sugar lands is the requisite organization available) are potatoes, maize, groundnuts, beans, onions and garlic. Initially it is recommended that efforts should be concentrated on potatoes as providing the best source of cheap food supply for the population.

Brevities

St. Kitts sugar crop, 1968.—The sugar crop in St. Kitts ended on the 4th August with 321,463 tons of cane harvested. From this tonnage of cane, the St. Kitts (Basse Terre) sugar factory produced 34,832 tons of commercial sugar. These figures compare with 327,752 tons of cane and 38,526 tons of sugar produced in 1967. The quality ratio in 1968 was 9·23 tons of cane to a ton of sugar compared with 8·38 tons in 1967. Drought conditions were responsible for the drop in tonnage of cane and wet conditions during one period reduced the quality ratio. The island had good rains in June and July but the effect of these was somewhat countered by the dry weather in August and September. So far, the hurricane season has not brought the usual amount of rain, but if this does occur there should be a heavier crop in 1969. Experiments on by-products of sugar cane continued during the 1968 crop and will be extended.

* * *

New Czechoslovakian sugar factory[3].—Construction of a sugar factory by CEKOP, of Poland, has begun this year at Hrušovany, in Czechoslovakia. The factory is scheduled to be finished in 28 months.

[1] F. O. Licht, *International Sugar Rpt.*, 1968, **100**, (27), 1–2.
[2] *Mauritius Sugar News Bull.*, 1968, (7).
[3] F. O. Licht, *International Sugar Rpt.*, 1968, **100**, (26), 7.

Flexible drives for sugar mills

By J. W. HILL, B.Sc., B.E., A.M.I.Mech.E., A.M.I.E. Aust.*

Introduction

THE well-known tailbar-and-muff coupling assembly has served the sugar milling industry well for a long time, but it is overdue for re-appraisal. With increasing mill loadings the contacting surfaces are frequently damaged owing to the enormous pressures generated. Another type of damage sometimes reported is the forcing apart of the coupled shafts as a result of "screwing action" of the tailbar, leading to dislocation of the mill frame. Moreover, as mills become bigger and the tailbar becomes thicker without any compensating increase in length, the whole assembly of gearing and mill shafts becomes stiffer and less able to accommodate the required lift of the top roller.

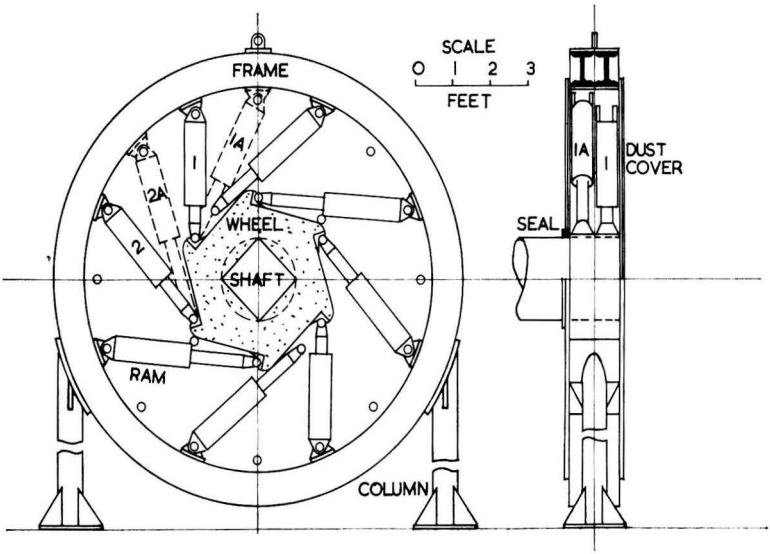

Fig. 1. Hydraulic drive to develop 300 ton-ft torque.

Top roller shaft breakages are a continuing feature of milling and are only to be expected to occur occasionally in view of the loads imposed. Stress levels are very high, as may be readily calculated from the known hydraulic loadings, treating the shaft as a beam supported at the bearing mid-points. Nevertheless breakages are far commoner at the driving end of the shaft than at the free end, so that tailbar influence is suspected also. Only lately has this been experimentally demonstrated by the Sugar Research Institute, Queensland[1]. Measurements by means of strain gauges attached to an operating shaft showed that stress at the driving end was extremely sensitive to the relative aspect of shaft and tailbar.

Such considerations must encourage the development of more flexible driving means. The ideal is to apply pure torque only to the top roller shaft, free from any force or bending moment, irrespective of shaft lift or tilt.

Direct hydraulic drive

One such approach is to dispense with the whole reducing gear train, and incorporate the top roller shaft into a special hydraulic motor. This could take the form of a ratchet wheel mounted on the shaft end, with the teeth driven by hydraulic rams set slantwise around the circumference and pivoted to a surrounding frame (Fig. 1). Each ram on reaching full extension would retract quickly and engage with the next wheel tooth. By using different numbers of rams and teeth, the rams would operate in sequence rather than all together so that the total torque output would be reasonably steady. By using even numbers of rams and teeth, opposite rams would work in unison giving an output of pure torque. The wheel would be free to lift and tilt within design limits without affecting operation.

Other benefits would accrue, notably easy overload protection, negligible kinetic energy (quick stopping in emergency), instant disconnexion when required, considerable space saving, and elimination of large gearing problems.

The details of this idea have been worked out in a previous paper[2] and need not be repeated here.

Univeral couplings

Instead, this paper is mainly concerned with a simpler and relatively cheap device, which might be fitted to an existing mill in place of the tailbar assembly without relocating either the mill or the gear train. This is a universal coupling of a special type.

Perhaps the commonest existing type of universal coupling is that formed from two Hooke's joints and a length of intermediate shafting, used for example in automotive and railcar power transmissions. A larger version of the same device is sometimes used for driving steel rolling mills, when facility is required for altering the roll heights quickly. In this case ample room is allowed for the intermediate shaft. It has also been applied to sugar mill drive, without

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[1] CULLEN: *Proc. 35th Conf. Queensland Soc. Sugar Cane Tech.*, 1968, 281–287.

[2] HILL: *ibid.*, 101–109.

apparently making much headway. HUGOT in his well-known textbook[3] shows such a drive, originally proposed by Soc. Fives Lille-Cail and subsequently developed by other manufacturers. However two basic difficulties show up clearly:

(i) the limited overall length available, especially where a short tailbar is to be replaced;

(ii) the radial compactness of the design, which leads to enormous bearing loads. For example, assuming the driving torque to be 300 ton-ft and the bearings to work on a 3-ft diameter circle, the bearing load must be 100 tons. This means heavy bearings, of a size by no means small compared with the whole coupling. The corresponding cost and developmental effort would appear to have deterred most manufacturers so far.

Various other large universal couplings have been built for special purposes, but for sugar mill drive all would seem to be subject to difficulty (ii) at least.

This proposal

Most textbooks on mechanism show Hookes' joint (Fig. 2A) and the Oldham coupling (Fig. 2B). The former permits only relative inclination of the shafts, and the latter only parallel displacement. Each device has two degrees of freedom, whereas a true universal coupling requires four. This is why two Hooke's joints are used in the common universal drive.

The present proposal is a hybrid of the Hooke and Oldham types, wherein two bearing elements are provided able both to turn and to slide. In this way

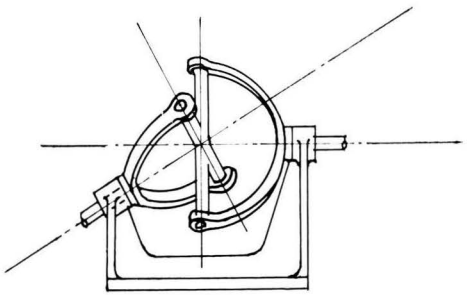

Fig. 2A. Hooke's joint.

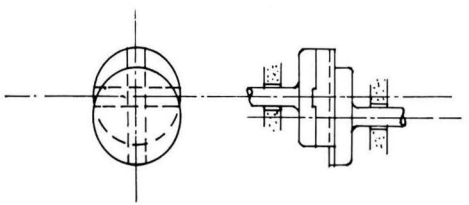

Fig. 2B. Oldham coupling.

the necessary four degrees of freedom are obtained. Since all of the action takes place in one plane, the coupling is essentially compact in length.

In the radial direction, so far as most sugar mills are concerned, there is plenty of room to spread out. By doing so, the bearing loads are reduced, as are also the forces developed in the central member. (Refer to Fig. 2A). The crossarm length and weight (but not its section) increase, of course, so that optimum overall proportions would no doubt be reached eventually, but at enormous radial size. In formulating a practical design, it is better to choose the greatest overall diameter which will not clash with other plant items nor require a deep running pit in the factory floor. This is taken somewhat arbitrarily as 10 feet between bearing centres.

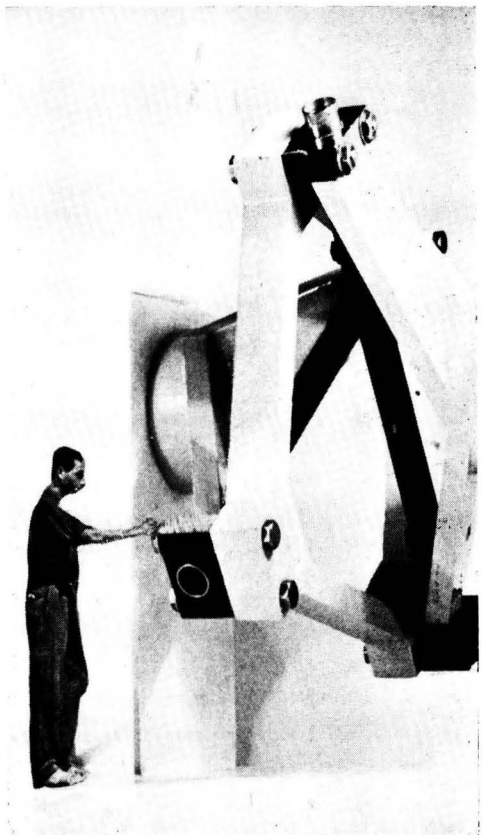

Fig. 3. 1:16 scale model of universal coupling. (The two black struts are an aid to modelling only.)

The central member is usually represented as a "cross" or "spider", but this form can be greatly improved upon. Irrespective of the actual shape of the member, the forces on its can be resolved into pure tension and compression forces acting between adjacent journals. Hence, by building the member as a square frame with journals at the corners, the frame sides are subjected to tension or compression with little bending, and so can be made comparatively light.

[3] "Handbook of Sugar Cane Engineering" (translated by G. H. JENKINS). (Elsevier, Amsterdam.) 1960. pp. 210–211.

The other possible objection to large coupling diameter, viz. excessive peripheral speed, does not arise with a sugar mill drive because of the extremely low rotational speed used.

A 1:16 scale model of the coupling, to replace a 17-in square tailbar assembly, is shown in Fig. 3. Here the bearings are attached to the frame instead of to the crossarms, but otherwise all the features are as already indicated. At first sign the coupling seems to be a "monstrosity" but paradoxically its extensiveness is the very means of keeping it light and simple. It should indeed weigh no more than the tailbar and muffs which it replaces.

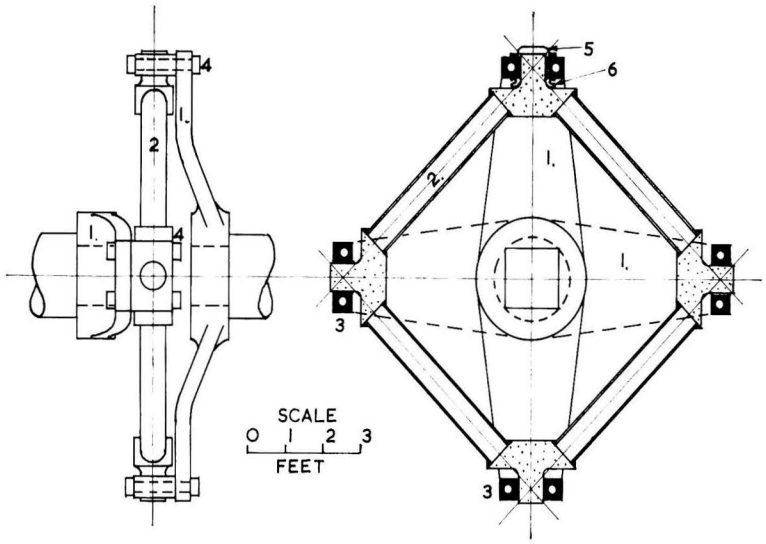

Fig. 4. Universal coupling to transmit 300 ton-ft torque.

Strength requirement

It is difficult to specify a torque level for which a sugar mill drive should be designed, in view of the extremely variable requirements encountered in practice. A figure of 300 ton-ft is suggested for a modern 42 in × 84 in mill[2]. However it would seem more rational to design for strength equivalent to that of the tailbar replaced, plus a contingency margin. Assuming a 17-in square tailbar, the ordinary formula for maximum shear stress in the bar gives

$$\frac{4{\cdot}5 \times 300 \times 2240 \times 12}{17} = 7400 \text{ p.s.i.}$$

Allowable shear stress is usually taken as 80% of allowable tensile or compressive stress. As against this, a margin of one-third is allowed on account of stress level fluctuations, which may be expected to reduce tensile strength proportionately more than compressive or shear strength. Hence a suitable tensile design stress would be

$$\frac{7400}{0{\cdot}8 \times 1{\cdot}33 \times 2240} \text{ or 3 t.s.i. say.}$$

This figure, in combination with a design torque of 300 ton-ft, is used in proportioning the various parts of the design shown in Fig. 4.

Crossarms and frame

Referring to Fig. 4, the crossarms 1 are seen as one-piece steel castings or forgings, but might conceivably be built up from such a central boss with cast, forged or fabricated arms attached. The arms are inclined forward to compensate for the length of the tailbar, and are suitably flanged and ribbed to save weight. If the central boss is thought of as half of a present-type muff coupling, the two arms are a fair exchange in weight for the other half.

The light central frame 2 might also be a casting, but is probably best fabricated. The sides are seen as standard steel tubes or rolled sections, welded to more rigid corner pieces from which the journals are turned after assembly. The whole frame complete with bearings should weigh about the same as an average tailbar.

Bearings

The two sets of bearings 3 are attached to the crossarms by means of bolts 4. Being the only moving parts of the design, they need special consideration. A plain journal bearing should be entirely suitable for the combination of turning and sliding actions required, although of course the actions might be separated and various forms of anti-friction element introduced if desired. From the particulars already given, the bearing load is $\frac{300}{10} = 30$ tons.

An 8-in diameter by 6-in long bearing gives a unit bearing load of 1400 p.s.i. which, for the extremely low rubbing speed involved, is conservative. Special cooling is not required.

On account of the small motions to be accommodated, the bearings may be prepacked with lubricant and permanently sealed, by means of an end cover 5 at the outer end and a bellows-type flexible sleeve 6 at the inner end joined to the frame. To dismantle the coupling, the bearings would be unbolted from the crossarms and the frame complete with bearings lifted clear and put aside. It should not be necessary to disturb the bearings except for occasional inspections.

It is important to reduce sliding friction to a minimum, since the overhang from the mill bearing is large and one main object of the coupling is to minimize shaft bending moment in the danger regions. Greatest friction may be expected after the coupling has been running in truth for some time, so that the bearings then have to be "unstuck". Higher than normal friction may also be expected when the sliding motion reverses, i.e. when a crossarm is vertical.

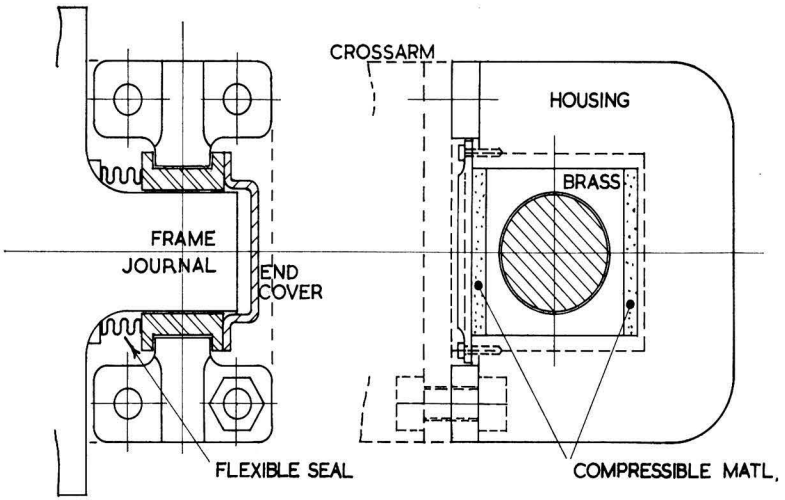

Fig. 6. Coupling bearing to permit end play.

Careful choice of lubricant and bearing material is required, also of the oil grooving pattern, in order to minimize friction at these and other times. Two other measures are worth considering:

(1) Deliberately providing some angular misalignment between the coupled shafts, in the vertical plane. The bearings are thereby kept "alive", and turning most rapidly at the instant of sliding reversal. Turning of itself produces negligible extra shaft stress.

(2) Installing a small cam-operated plunger pump at each bearing, to give the bearing a high-pressure charge of lubricant from its own supply each time it passes a fixed point.

End play

Among the mill shaft, coupling components and output gear shaft, it is desirable to provide axial freedom between any two points of fixed location. In present-type tailbar assemblies, both shafts are fixed and the coupling has to adjust itself to suit. This "compulsory adjustment" at the heavily loaded muff surfaces is indeed one of the causes of present troubles. If a fresh design approach permits, mill engineers will undoubtedly wish to fix the coupling bosses firmly to the shafts.

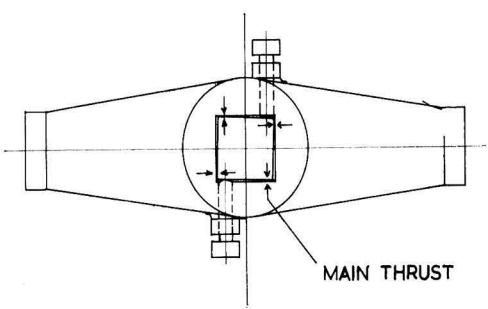

Fig. 5. Use of jacking screws for fixing cross arm to shaft.

With most existing mill drives, having plain spur gearing, there should be no difficulty. Both gear shaft bearings may be made free, instead of one fixed and one free as at present. In fitting the coupling crossarms to the shafts, the final gear wheel must be carefully registered to its pinion, and this registration periodically checked thereafter. Fixing may be merely by interference, using heat on the crossarm boss to assemble or dismantle. However, for the mill side of the coupling at least, jacking screws may be preferred to facilitate quick dismantling. These screws would bear on the non-working corners of the shaft square (Fig. 5).

Where the gearing is helical, or for some reason it is undesirable to modify the final gear bearings, end play may be built into the coupling itself. For example, one pair only of the coupling bearings may be made as in Fig. 6, where the "brass" (of whatever actual material) is free to slide in its housing parallel to the main shafts. The brass is retained in the housing by means of end flanges, and is assembled through the open side of the housing which is then bolted to the crossarm. In this way the journal is brought as close as possible to the crossarm, and the flanges are conveniently available for mounting the end cover and the flexible seal. The flanges should be closely fitted to avoid "slogging" of the brass under the sliding frictional force of the journal. The free spaces provided on either side of the brass for coupling end-play may be filled with compressible material such as foam rubber to exclude dirt. By choosing material of suitable stiffness, pre-loaded on either side, the brass is held centrally during assembly which should facilitate correct setting of the coupling bosses on the shafts.

Summary

Two possible methods have been described for eliminating the tailbar coupling from sugar mills, a direct hydraulic drive and an unorthodox universal coupling. The latter is intended to replace the tailbar in an existing installation, to be of equivalent strength, and to weigh about the same. The cost would no doubt be somewhat greater, but still only a small percentage of the value of the asset protected. Patent protection for both devices is being sought.

Acknowedgments

The first steps towards the development of the universal coupling were taken during the author's term with Sugar Research Institute, Queensland, whose interest and support are gratefully acknowledged.

The author is also indebted to Mr. J. H. NICKLIN of the Bureau of Sugar Experiment Stations, Queensland, for pointing out the importance of end play.

Sugar cane research in Queensland

(67th Annual Report, Bureau of Sugar Experiment Stations, 1967)

IN his introductory remarks the Director refers to the economic stresses that have faced the Queensland sugar industry owing to the vagaries of the world sugar market. He expresses his belief that, insofar as technical improvements may affect costs, they are reaching the limit of worthwhile reductions. Over a period of years the results of research have made contributions of considerable magnitude, and this is best illustrated by the raising of sugar-per-acre yield by thirty per cent in twenty years. The savings to be made in future by eliminating losses from pests and diseases, by more sophisticated plant nutrition, and by varietal improvement will not be of the same spectacular nature as in the past. Relatively minor cost reductions are still being made. Examples of these are a change from complete fertilizer mixtures to the use of cheaper, straight ingredients applied from partitioned distributors, and the planting of more than one cane variety in a block where two soil types demonstrate varying potential with specific varieties. But these are not industry-wide movements.

It is generally accepted that the major gains in acreage yields will continue to flow from varietal improvement. Cane breeding and selection data would still appear to support that view. Modern seedling varieties under test, but not yet commercialized, are outyielding the existing commercial varieties and the year-by-year trend indicates that the proportion of superior canes is increasing. Only time can tell whether their performance on small areas will be confirmed when grown in a district-wide fashion. The major proof of a variety's superiority is its ability to out-perform its predecessors and to raise sugar-per-acre yields over extensive areas.

A number of different projects have been actively pursued in the agronomy field, notable among them being the trials carried out in regard to nitrogen fertilization.

Nitrogen trials

Results are given of a nitrogen-potash-variety trial carried out at the Bundaberg Experiment Station. Two levels of potassium, viz. 60 and 240 pounds of potassium per acre, were applied, but the yields of these two treatments were almost identical, 48·4 and 48·8 tons of cane respectively. The sugar content of the cane was not affected by potassium application. There was no evidence of varietal influence on the effects of nitrogen on c.c.s., although the heavier nitrogen application reduced the sugar content of the cane of each of the three samplings. The application of 50 lb nitrogen per acre did not produce maximum yields of cane under the conditions prevailing and this is in agreement with previous trials on other irrigated farms on the same soil type.

Maturity samples from nitrogen trials and other observations have suggested that the depressing effects of nitrogen on c.c.s. become less as the season progresses. In order to examine the effect of heavy nitrogen applications very late in the season, a nitrogen trial was conducted on the Bundaberg Experiment Station and harvested in late November and early December. Results showed once again that about 100 lb nitrogen per acre is required to produce maximum yields of cane on these soils under irrigated conditions. They also showed the complete reversal of nitrogen effects on c.c.s. which takes place between the beginning and end of the season. While it is likely that the beneficial effects on growth due to heavy nitrogen application are more than outweighed by the adverse effects on sugar content if the cane is harvested early in the season, the overall increase in sugar yields late in the season at the higher nitrogen rates were very obvious. Results indicated that for maximum returns it is necessary to designate fields for late or early harvest and fertilize them accordingly.

Nitrogen variety trials were carried out in the far North during the year. These trials, which were designed to investigate the effects of nitrogen on the cane yields and the sugar content of rich land, "medium land" and "poor land varieties" grown in medium land, encountered severe moisture stress during the summer months as a result of which the rich land varieties produced very poor yields. Although results indicated large differences in yield due to variety, there was no significant evidence that the optimum level of nitrogen application was different for the varieties tested under the particular conditions which prevailed.

Phosphate and potash

Accounts are given of phosphate and potash trials carried out at Mackay. With phosphate a response

in cane growth obtained in three trials was due to the application of phosphate fertilizer, but there was no indication that varying amounts of phosphorus were affecting c.c.s. A significant response in sugar yield was recorded in only one trial. The soil phosphorus levels again gave a satisfactory indication of where a response to phosphorus fertilizer could be expected. A soil level of 17·5 p.p.m. of phosphorus is the threshold value above which a significant response to phosphorus fertilizer is not normally expected and, in this series of trials, there were only minor exceptions. In one trial with a soil level of 15 p.p.m. of phosphorus no response was obtained, while in another with a level of 30 p.p.m. a response in cane growth but not in sugar resulted.

With regard to potassium, five of the eight trials showed significant yield responses in cane and sugar per acre due to potassium fertilizer, but there were no effects on the levels of c.c.s. in any of the trials. The amount of potash fertilizer applied was reflected in the level of juice potassium, and even in those trials which did not respond to potassium there were marked increases in the level of potassium in the juice. This illustrates the wastage of fertilizer that can result from the luxury feeding habit of cane with regard to this nutrient.

Sulphur nutrition

Because of the increasing usage of "aqua ammonia" and urea as sources of nitrogen for the top dressing of sugar cane, and the replacement of superphosphate by ammonium phosphate in fertilizer mixtures, the possibility of sulphur deficiency arising cannot be overlooked. Several trials to study sulphur nutrition of sugar cane were set out on farms in the southern, central and northern areas of the State. These trials are intended as long term experiments and take the form of randomized blocks with three treatments and eight replicates. Gypsum was used as a sulphur source. Two plant crops harvested in 1966 in the Bundaberg district did not show any significant responses in tons of cane or sugar per acre due to the sulphur treatment. The effect of sulphur (or gypsum) application on leaf composition was more apparent in the ratoon crop than the plant crop. Techniques for estimating sulphur in rain water were investigated and it is proposed that estimates of sulphur supplied to the soil in this manner will be recorded in all districts.

Copper and magnesium deficiency

The total number of samples of cane tissue analysed for copper content was 305. These samples consisted of various leaves and leaf sheaths from two replicated copper trials in the Bundaberg area and from fields of cane where visually deficient and visually non-deficient plants were growing. Contrary to earlier indications the trend for an increase in copper content with increasing rank of tissue was not confirmed and it appears that none of the tissues examined was significantly superior to others as indicators of the copper nutrition status of the plants. Analysis showed that the copper content of the third leaf can vary considerably without any obvious copper deficiency symptoms being evident. In fields where visually deficient and apparently non-deficient cane was growing, the copper levels averaged 1·0 and 1·9 p.p.m. copper % dry matter respectively, while on soil types where copper problems are not encountered the average value was 3·8 p.p.m. copper.

Efforts are being made to investigate the optimum rate and frequency of copper applications in different areas. Some growers apply a single dressing of 40–60 lb copper sulphate per acre, others an initial dressing of 25 lb per acre followed by a regular dressing of 10–20 lb per acre on plant crops.

Further field work was carried out in magnesium deficiency in relation to "orange freckle", a malady widespread in northern areas of Queensland. Eight observation strip trials were set out in the Mossman-Babinda area while two replicated trials and several observation trials in the Innisfail-Tully area were commenced. To the strip trials, magnesium oxide and magnesium carbonate at rates varying from 160 to 600 pounds of magnesium per acre were applied to young cane showing magnesium deficiency symptoms. Responses to treatment were variable, particularly in the Babinda area, and although early responses in leaf colour, height and sometimes tillering were noted there, responses were not usually obvious once the boom growth stage had occurred. In one trial, however, while there was no orange freckling in any of the treated plots, symptoms remained very obvious in the control areas. In this trial although there were no obvious differences in height, the magnesium plots contained 25% more stalks than the adjacent untreated areas. A similar response was also observed in one trial at Silkwood in the Innisfail area. Leaf analyses showed that calcium and magnesium levels were affected by treatments and there appeared to be some interaction between the two nutrients.

Weed control

Trials of various herbicides on giant sensitive plant (*Mimosa invisa*) are recorded. In cane out-of-hand with the weed in one area the standard 2,4-D/2,4,5-T mixture was unsatisfactory in obtaining completely effective results. Of 15 treatments used, 4 herbicides gave full control and 3 were reasonably efficient (97%). All treatments were applied in 50 gal water per acre. The high cost of the only treatment at present available commercially—3 lb of "Karmex" (DCMU) + 0·5 gal of "Trysben 200" (TBA)—is economically unacceptable on account of high price.

Trials were also carried out with Para grass (*Brachiaria mutica*). The most effective treatment was two applications of 2,2-DPA each at 5·0 lb/acre of product two weeks apart. "Bromacil" ("Hyvar X") plus 2,2-DPA also gave good control but at much greater cost.

Satisfactory control of Johnson grass (*Sorghum halepense*) by fallow ploughing or discing combined with chemical weedkillers is reported. In an investigation on the control of Habana oat grass (*Themeda*

quadrivalvis) various herbicides gave good control. These are outlined. Satisfactory control of other minor weeds with modern herbicides is reported. These weeds included Blue heliotrope (*Heliotropium amplexicaule*), Merremia vine (*Merremia quinquefolia*), Flannel weed (*Sida cordifolia*), Billygoat weed (*Ageratum houstonianum*), Rattlepod (*Crotalaria* spp.), Summer grass (*Digitaria adscens*) and Giant pigweed (*Trianthema portulacastrum*).

Cane breeding

Good use was made in the crossing programme of the photoperiod room recently established. An innovation in the seedling raising work at Meringa was the use of the photoperiod room for the germination of seedlings. It was found that with the controlled temperature and high humidity very little attention to flats was necessary and germination was complete in 24 hours. The seedling flats were then transferred to the unheated portion of the glasshouse. The use of this room for germination as well as the heated portion of the glasshouse has enabled the large seedling raising programme at Meringa to be achieved in a shorter period than was possible before.

In the far North free arrowing occurred and most of the required proven crosses were made. During the crossing season (May-June) 554 biparental crosses were made as well as a large biparental area cross using Co 475 as the male parent. Good crossing results were achieved in the photoperiod room, 13 crosses being made with *Saccharum spontaneum* varieties that had been induced to flower. The same varieties growing outside the photoperiod room achieved far less flowering.

New varieties

There have recently been several changes in the leading varieties grown in Queensland after a period of relative stability for some years. Pindar, which has held pride of place since 1958, was displaced in 1966 by N:Co 310 which has now reached 18·2% of the total crop. This variety approaches a yield of one-and-a-half million tons in each of the central and southern districts. This is the first time that an imported variety has produced the greatest share in the State's tonnage since Badila was displaced by Trojan as premier variety in 1949. Pindar retained second position and produced the highest tonnage north of Townsville with a tonnage in that area exceeding two million. This variety is now the major cane in only four of the ten mill areas north of Townsville, while the third ranking variety in the State, Q57, is the leading variety in six of the districts north of Townsville. With the rapid increase in popularity of the new varieties Q78, Q82 and Q83, Pindar is gradually losing favour and only in the Ingham area still dominates the plantings. Trojan and Q58 have continued to occupy fourth and fifth positions, each about 8% of the total crop.

The most notable of the new varieties was Q82, now approved for all mill areas from Tully north. It gave an impressive performance under recent droughty conditions. A completely new release is Q86, bred from the famous N:Co 310 and Q58. It is also very drought-resistant and has more early sugar than several varieties at present grown.

During the year, work was conducted at Meringa in an effort to find a simpler method for determining fibre with new varieties of cane. Three methods were considered: the dry substance method, the hydraulic press method and a modified bag method. The dry substance method was found to be sufficiently accurate for the purpose, but the provision of enough suitable drying capacity for the number of canes being tested would prove a problem. Statistical analysis of results from previous hydraulic press tests revealed that the weight of the plug remaining after pressing a sample of cane was not a sufficiently accurate measure of fibre content for the purpose of this work. The modified bag fibre method which consisted at first of preparing the cane in a cutter grinder, cold water washing in a metal cylinder, transferring the washed material to a fibre bag and drying in the normal manner, showed considerable promise of giving a fibre figure of sufficient accuracy for the purpose of testing new varieties. A further modification of this method, using a washing machine to hot-water wash and spin dry the bags of fibre, has been proposed and is being investigated.

Cane diseases

Unusual weather conditions, drought in some areas and floods in others, affected the usual pattern of disease incidence in many areas. Some diseases were more prevalent and others less so than is normal. This applied to such diseases as bacterial mottle, chlorotic streak, leaf scald, eye spot, yellow spot, top rot, pokkah boeng and rind disease. Other diseases discussed in the report include Fiji disease, striate mosaic (probably a virus) and ratoon stunting disease.

A survey revealed the fact that there are now 22 units in operation for providing heat treatment of planting cane as protection against ratoon stunting disease. These units have been erected by local boards, usually in association with local mills. The average capacity of the tanks is over 3000 gallons and they take 3000 lb of cane in stalks or 2800 lb in setts, per load. Steam from the mill is used for heating in 19 tanks and electricity in 2; one tank has both. The heat is controlled automatically in 8 tanks, manually in 14 and some 10 keep records of all treatment batches with thermographs. Approximately 3000 tons of plant cane was treated during the short spring period when conditions for germination are at their best.

Results of an experiment are given in which several varieties of cane were knife-inoculated with juice from ratoon stunting diseased cane (diluted 1/100 and 1/1000). Disease developed from both dilutions in seven varieties but not in two, these being Q57 and Q61, although the plots of Q61 did show the uneven growth often indicative of the disease. Results showed that at least two varieties, Q57 and Q61, did not become readily diseased through the medium

of the cane knife. It was considered the variety Q57 acts in effect as a symptomless carrier.

A pineapple disease germination trial at the Pathology Farm was remarkable for the demonstration of the efficacy of a number of mercurials in controlling the disease. The mercurials used were the standard "Aretan" B.S.M. 11 (a phenyl mercury acetate formulation) "Elcide" (containing sodium ethylmercurithiosalicylate as active ingredient) and MEMMI (a "Heptachlor" derivative). Setts were dipped in the various solutions (adjusted to a mercury content of 0·03%) and the ends then sprayed just before planting with a suspension of spores from a range of cultures of *Ceratocystis paradoxa* the causal agent of pineapple disease.

Insect and animal pests

The two most serious pests during the year in terms of cane loss were the soldier fly (*Altermetoponia rubriceps*) and the greyback grub (*Dermolepida albohirtum*). Investigations into the habits of these two insects and means of control have been intensified. It is stated the soldier fly reduced the crop by 81,178 tons as compared with 13,740 tons in the previous year. The greyback grub destroyed 35,215 tons as compared with 3238 tons in the previous year—over ten times the amount of cane damage. The damage by grubs was evident chiefly in the central districts where the pest is sporadic and erratic in its occurrence and many growers have not yet recognized the value of BHC as a cheap form of insurance against crop destruction. Consequently the infestations raised no anxiety regarding the future but merely the hope that some growers will alter their attitudes. Damage caused by other grubs, such as the Frenchi grub, Childer's grub and Bundaberg grub, is discussed, being very much less than that caused by the greyback grub.

The discovery of a second soldier fly is referred to and the insect discussed. It has not yet been scientifically named but is commonly known as "yellow soldier fly" because of the body colour of the females. It appears to favour drier areas than the common soldier fly.

F.N.H.

Comparison of sulphur dioxide and formaldehyde as bacteriostats in diffusion

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PART II

Incubation experiments with fresh RT diffuser samples

Diffuser samples were taken at four factories at least one hour after formaldehyde addition had been stopped. This was to ensure than an active sample was obtained and that minimal residual formaldehyde would be present. The samples were taken from compartments situated about one third of the length of the diffuser from the juice end.

The effects of sulphur dioxide and formaldehyde on the activity of these samples were measured in two ways.

(i) 40 ml of sample was mixed with 360 ml of 67% sterile laboratory raw juice, treated with different levels of sulphite, sulphurous acid or formaldehyde and incubated directly at 65°C. pH and nitrite concentrations were measured at intervals for 5 hours.

(ii) Sulphite or formaldehyde was added to 360-ml aliquots of 67% laboratory raw juice and allowed to stand in a bath at 65°C for at least 30 min before the addition of 40 ml of diffuser sample. Incubations were then carried out at 65°C.

Experiments of type (ii) were included to allow for any chemical reactions between the bacteriostats and juice components to take place before the bacteria were added.

In fact, no significant difference between experiments of type (i) or (ii) was obtained. Therefore, both sulphur dioxide and formaldehyde were persistent under these conditions. However, it is demonstrated below that losses of sulphur dioxide occur under other conditions.

The results in Fig. 5 show that 100 p.p.m. of formaldehyde or 400 p.p.m. of sulphur dioxide, added as sulphorous acid, were about equally effective in controlling the pH but, as shown in Fig. 6, even 50 p.p.m. of formaldehyde controlled the pH whereas 100 p.p.m. of sulphur dioxide did not. 200 p.p.m. of sulphur dioxide as sodium sulphite or 400 p.p.m. sulphur dioxide as sulphurous acid were less effective than 50 p.p.m. formaldehyde.

Since the additives themselves affect the initial pH, the change of pH was of more interest than the absolute values. The pH changes after 5 hours were:

	pH
50 p.p.m. HCHO	+ 0·01
200 p.p.m. SO_2 as sodium sulphite	— 0·21
400 p.p.m. SO_2 as sulphurous acid	— 0·25

Similar results were obtained at the other three factories visited, showing that 50 p.p.m. of formaldehyde was equal to, or more effective than, 200 p.p.m. of sulphur dioxide in stopping acid formation.

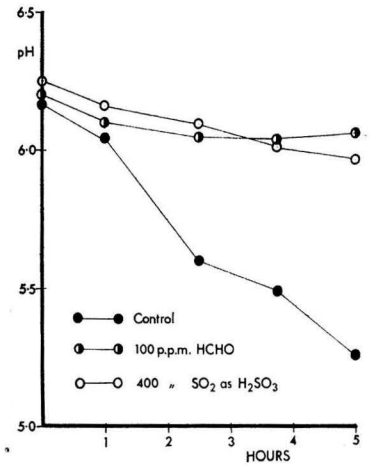

Fig. 5. Effect of direct addition of formaldehyde or sulphurous acid on pH change of incubated diffuser samples

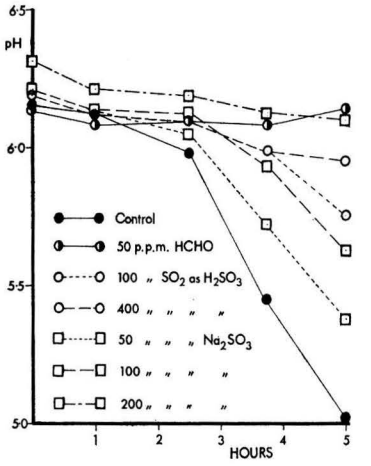

Fig. 6. Effects of formaldehyde, sodium sulphite and sulphurous acid, premixed with juice, on pH change of incubated diffuser samples

The observations on nitrite formation were similar. Fig. 7 shows the rate of nitrite formation in the same digests used for the pH measurements recorded in Fig. 6. 50 p.p.m. of formaldehyde or 200 p.p.m. of sulphur dioxide were effective in stopping nitrite formation but 100 p.p.m. of sulphur dioxide was not.

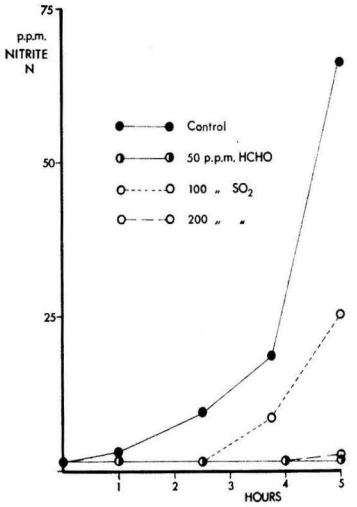

Fig. 7. Effects of formaldehyde and sodium sulphite on nitrite formation in incubated diffuser samples

It was concluded that formaldehyde was about four times as effective as sulphur dioxide as a bacteriostat.

Losses of sulphur dioxide in raw juice by chemical reactions

Effect of aeration

Sodium sulphite equivalent to 508 p.p.m. sulphur dioxide was added to laboratory raw juice at pH 6·65. Two aliquots of the treated raw juice were maintained at 65°C, one being gently aerated and the other being undisturbed. The residual sulphur dioxide was measured at 30-minute intervals and the results are reported in Table II.

Table II. Changes in concentration of sulphur dioxide in aerated and undisturbed raw juice at 65°C

	SO_2 *concentration (p.p.m.)*	
Time (min)	*Aerated juice*	*Undisturbed juice*
0	468	468
30	420	445
60	402	442
90	380	442
120	325	438
150	268	433

From the table it is clear that loss of SO_2 occurred in the aerated sample. The rate at which oxidation would occur in the factory cannot be predicted from this experiment but a similar experiment with formaldehyde resulted in no loss of bacteriostat, so that sulphur dioxide was again at a disadvantage.

Effect of nitrite concentration

In the previous experiment the nitrite concentration of the raw juice was zero, but bisulphite and nitrite ions react to form imidodisulphonate[3] and it

was found that when nitrite was added to raw juice at pH 6·7, containing 380 p.p.m. of sulphur dioxide, the concentration of sulphur dioxide was reduced.

This is shown in Table III.

Table III. Effect of nitrite on the concentration of sulphur dioxide in raw juice

Nitrite-N (p.p.m.) added to raw juice	*SO_2 concentration (p.p.m.)*	
	Initial	*Incubated 30 min at 65°C*
0	380	362
23	317	272
46	265	255

Clearly, if sulphur dioxide were working efficiently as a bacteriostat, there should be no nitrite present, but in the factory using sulphur dioxide, nitrite was still produced in the diffuser, so that sulphur dioxide losses by chemical reaction with nitrite would occur.

At lower pH, the reaction with nitrite occurred more readily as will be seen in Table IV.

Table IV. Loss of sulphur dioxide in the presence of nitrite as a function of pH

Sample	*pH*	*SO_2 concentration (p.p.m.)*	
		Initial	*Incubated 30 min at 65°*
Raw juice at	6·7	265	240
46 p.p.m. NO_3-N	6·4	242	208
	6·18	245	—
	5·72	230	125

Effect of Invert

Invert levels in raw juice were varied between 1·4 and 5·4 mg/ml and this had no effect on the concentration of sulphur dioxide before or after incubation at 65°C for 30 minutes.

It is concluded that sulphur dioxide is too chemically reactive to be satisfactory for use as a bacteriostat. That it might have some beneficial effect on juice quality remained to be examined.

Fate of Sulphur Dioxide in Liming and Carbonatation

Laboratory experiments showed that sulphur dioxide present in raw juice was completely eliminated by liming and carbonatation.

The liming procedure employed was as follows:

250 ml of raw juice was treated at 80°–85°C with 5 g of lime slaked in about 50 ml of water. The suspension was stirred for 5 min and then gassed with carbon dioxide to between pH 10·9 and pH 11·2. The total gassing time was normally about 10 min and the temperature was maintained at 80°–85°C. The floc was allowed to settle and the supernatant was filtered through a Whatman No. 2 paper on a Buchner funnel. The filtrate was re-heated to 80–85°C and gassed with carbon dioxide to between pH 9·1 and pH 9·3 in 1 to 2 minutes. The suspension was filtered as above, yielding the second carbonatation filtrate.

Although sulphur dioxide was completely eliminated in these laboratory experiments there remained the possibility that the use of sulphur dioxide at the raw juice stage might be beneficial from the point of view of juice colour at the second carbonatation stage or later.

To test this the following experiments were carried out:—

1. Raw juice with no additive was limed and gassed yielding a second carbonatation filtrate, termed 2C(1), of pH 9·20.

2. The same raw juice, containing 200 p.p.m. sulphur dioxide added as sulphurous acid, was limed and gassed, yielding a second carbonatation filtrate, termed 2C(2), of pH 9·22 and containing <0·8 p.p.m. of sulphur dioxide.

The second carbonatation filtrates were then treated as follows:—

(i) Three 100-ml aliquots of 2C(1) were adjusted to pH 7·5, pH 8·0 and pH 8·5 with dilute sulphuric acid.

(ii) Three 100-ml aliquots of 2C(1) were each treated with 200 p.p.m. SO_2 and then adjusted to pH 7·5, pH 8·0 and pH 8·5 with dilute sulphuric acid.

(iii) Three 100-ml aliquots of 2C(2) were adjusted to pH 7·5, pH 8·0 and pH 8·5 with dilute sulphuric acid.

The nine solutions in conical flasks were loosely stoppered with cotton wool and heated for 15 minutes at 30 p.s.i. in an autoclave.

The solutions were allowed to cool naturally to room temperature, filtered and their pH determined before adjusting to pH 7·0 for measurement of colour.

The results are recorded in Table V and show that the initial colours of 2C(1) and 2C(2) were similar and that, whereas sulphur dioxide added after carbonatation inhibited colour formation in solutions (ii), sulphur dioxide added to raw juice before carbonatation did not prevent colour formation in the resulting second carbonatation filtrates (iii). In fact, the amount of colour formed by autoclaving solutions (i) and (iii) was almost the same.

Table V. Changes in pH and specific absorptive index at 427 nm in autoclaved second carbonatation filtrates

	Sample	*pH*		*S.A.I. 427nm (violet)*	
		Initial	*Final*	*Initial*	*Final*
(i)	2C(1)(No SO_2)	7·5	7·98	1035	1715
	" "	8·0	8·18	1035	1729
	" "	8·5	8·51	1035	1685
(ii)	2C(1)(+ SO_2)	7·5	8·00	1035	817
	" "	8·0	8·38	1035	836
	" "	8·5	8·70	1035	880
(iii)	2C(2)(SO_2 in R.J.)	7·5	8·00	1105	1774
	" "	8·0	8·21	1105	1766
	" "	8·5	8·48	1105	1766

Summary

In a factory trial of bacteriostats in RT diffusers, 30% formaldehyde at a rate of 62 lb/100 tons of beet was compared with sulphur dioxide at a rate of 40 lb/100 tons of beet. Under the conditions of the tests, neither bacteriostat was effective in preventing

acid production and samples from the diffuser during both treatments showed high thermophilic activity.

In laboratory tests, thermophilic activity was normally inhibited by 50 p.p.m. of formaldehyde but not by 200 p.p.m. of sulphur dioxide. The cost of sulphur dioxide is more than twice that of 30% formaldehyde and so the latter is a far more economical bacteriostat.

Formaldehyde is stable in raw juice, but sulphur dioxide is readily oxidized, so that its bacteriostatic efficiency decreases with contact time in the diffuser. When nitrite is present, owing to thermophilic activity in the diffuser, further loss of sulphur dioxide occurs by reaction as bisulphite, to form imidodisulphonate, which is largely removed in carbonatation.

The raw juice is much lighter in colour when sulphur dioxide is employed, but the colour of the second carbonatation filtrate produced therefrom is not improved. The sulphur dioxide is completely removed in liming and carbonatation and so has no suppressant action against colour formation in subsequent processing.

The pressed pulp is more lightly coloured after use of sulphur dioxide in diffusion, but this is not a significant feature if molassed pulp is to be produced.

Acknowledgements

The authors wish to thank their colleagues at Cantley, Ely, King's Lynn, Spalding and Wissington sugar factories who co-operated in this work and, in particular, Mr. R. W. COPLAND of the Chemical Control Service who provided the diffuser results in Table I and data on the rates of application of sulphur dioxide and formaldehyde referred to in the paper.

The determination of phosphates in clarified juice

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INTRODUCTION

The phosphate content of clarified juice is one of the criteria of lime defecation in raw sugar manufacture. Its determination becomes all the more important if, as some authors believe, phosphates influence the filtering properties of raw sugar. Inefficient clarification allows phosphates to remain in clarified juice, and hence raw sugar, as an undesirable impurity. In Mauritius, where the problem of filtrability has received great attention during recent years, in an endeavour to improve the refining quality of raws, it was decided in 1965 to study, in a number of factories, the relationship which might exist between phosphates in clarified juice and filtrability of the sugar boiled from it. Accordingly factory chemists were asked to determine soluble phosphate of daily composite samples of clarified juice and correlate the results with corresponding filtrability data.

In ordinary practice the analytical method employed is the blue colorimetric phosphomolybdate method, using stannous chloride as reducing agent. For the purpose of the analysis a sample of clarified juice is mixed with acid-washed kieselguhr and filtered until a clear filtrate is obtained. A certain amount of the filtrate is taken, diluted with distilled water, mixed with reagents and the blue colour developed is compared with a disc in a colorimeter between five and ten minutes after adding the reagents.

This method is very sensitive but is unfortunately subject to interference especially from organic acids and ferric iron. It was found that by taking different volumes of clear filtrate for colour development, different results for the same clarified juice were obtained. As a consequence all the results obtained during the campaign were erratic and unreliable. It therefore became clear that for the purpose of the study a more accurate method of analysis had to be used. The procedure recommended by FOGG and WILKINSON[1] for the determination of phosphates in boiler feed and residual waters was therefore selected and its application to clarified juice investigated. At the same time the scope of the research was extended to include total phosphate. The technique adopted is described hereunder.

EXPERIMENTAL

Reagents

(1) *Ammonium molybdate.* 10 g ammonium molybdate is dissolved in distilled water to produce 100 ml, and the solution added slowly to a cooled mixture of 150 ml sulphuric acid with 150 ml distilled water. This reagent will keep indefinitely if stored in a borosilicate glass bottle and protected from light.

(2) *Ascorbic acid.*

(3) *Sulphuric acid*—N/10 solution.

(4) *Sodium hydroxide*—N solution.

Preparation of standard curve

A solution is made of 0·1916 g of potassium dihydrogen phosphate (KH_2PO_4) in a litre of water; this solution contains 100 mg P_2O_5 per litre (100 p.p.m.)

[1] *Analyst*, 1958, **83**, 406.

On dilution with ten volumes of water, a dilute solution containing 0·01 mg P_2O_5 per ml is obtained.

Into five beakers are pipetted 5, 10, 15, 20 and 25 ml aliquots of the dilute solution, and enough water added to make up to 40 ml. To each beaker is added 4 ml of ammonium molybdate (Reagent 1) and 0·1 g of ascorbic acid, each beaker covered with a watch-glass, heated to boiling point and boiled gently for 1 minute only. After cooling the solution quickly, it is transferred to a 50 ml flask and diluted to the mark with distilled water. This will give the following concentrations: 0·05 mg, 0·10 mg, 0·15 mg, 0·20 mg and 0·25 mg P_2O_5 per 50 ml. The optical density of the blue colour is measured in a colorimeter at 650 nm against a blank of distilled water and reagents treated in the same manner as the standards.

A graph of optical density against P_2O_5 concentration is then plotted from the measurements*.

Soluble phosphate

2–4 g of acid-washed kieselguhr is mixed with approximately 100 ml of juice and the suspension filtered until a clear filtrate is obtained.

50 ml of this filtrate is pipetted into a 100 ml beaker and neutralized with N/10 H_2SO_4 using a potentiometer. The neutralized juice is transferred to a 100 ml volumetric flask and made up to the mark with distilled water. An aliquot of the diluted juice is pipetted into a 150 ml beaker, enough distilled water added to bring the volume to 40 ml, 4 ml of ammonium molybdate solution (Reagent 1) is added and the solution mixed. After adding 0·1 g ascorbic acid the procedure, as described for the preparation of standard curve, is followed.

Total phosphate

A 10-ml sample of clarified juice is ashed at 550°C, cooled, moistened with 2 ml conc. HCl, and evaporated to dryness on a steam bath. The residue is moistened with 2 ml conc. HCl, about 25 ml of water added and boiled for a few minutes. After transferring to a 100 ml flask, cooling and making up to the mark, it is filtered, and an aliquot pipetted into a beaker and neutralized with normal sodium hydroxide solution. Sufficient water is added to bring the volume to 40 ml, and 4 ml of ammonium molybdate and 0·1 g ascorbic acid added, thereafter continuing as for preparation of the standard curve.

Discussion

This method, although not as sensitive as the Deniges[2] method, has the double advantage of colour stability and of being relatively insensitive to other ions especially iron[1]. Apart from the use of ascorbic acid in the place of stannous chloride as reducing agent, the main difference with the stannous chloride method is the development of the blue colour at the boiling point of the solution. The main source of error which makes the P_2O_5 determined dependent on the amount of clarified juice taken for colour development is eliminated as shown in the following table obtained using laboratory defecated juice.

Table I. Soluble phosphate in sample of laboratory clarified juice

Volume of original clarified juice taken for colour development, ml	P_2O_5 (*p.p.m.*) *determined by*	
	stannous chloride method	*ascorbic acid method*
1	55	55
2	49	55
4	31	55

When the method was tried with industrial clarified juice, the amount of dilution again had no influence on the result obtained (Table II).

Table II. Application of method to determination of soluble phosphate in clarified juice

Volume of original clarified juice taken for colour development, ml	P_2O_5 *content of clarified juice, p.p.m.*
1	10
2	11
4	10
10	10

Recovery experiments both for soluble and total phosphate were carried out. In the latter case phosphate was added to clarified juice before ashing. The results obtained are shown in Tables III and IV below.

Table III. Recovery of soluble phosphate from clarified juice

P_2O_5 *determined, p.p.m.*	P_2O_5 *added to juice, p.p.m.*	P_2O_5 *found, p.p.m.*
36	—	—
45	10	9
61·5	25	25·5
85	50	49

Table IV. Recovery of total phosphate from clarified juice

P_2O_5 *determined, p.p.m.*	P_2O_5 *added to juice, p.p.m.*	P_2O_5 *found, p.p.m.*
71	—	—
91	20	20
120	50	49
170	100	99

The method was tried under routine industrial conditions during the 1966 crop and found to be entirely satisfactory. It was therefore considered that the new procedure provided a reliable and accurate means of determining phosphates in clarified juice. Consequently it has been officially adopted for chemical control in Mauritius sugar factories.

Summary

A method is described for the colorimetric determination of phosphate in clarified juice. Stannous chloride has been replaced by ascorbic acid as a reducing agent. The blue colour, which is developed at the boiling point of the solution, is more stable and less subject to interference than in the stannous chloride method. Reliable results are obtained under industrial conditions.

* A standard curve must be prepared when changing to a new batch of reagents.

[2] *Compt. Rend.*, 1920, **171**, 802.

Sugar cane agriculture

Control of blue heliotrope in the Bundaberg area. ANON. *Cane Growers' Quarterly Bull.*, 1968, **31**, 80. Reference is made to the fact that "Tordon 50 D" has proved efficient in destroying this cane weed (*Heliotropium amplexicaule*) in more than one trial.

* * *

Principles of rodent control and some California programme applications. M. W. CUMMINGS. *Rpts.* 1966 *Meeting Hawaiian Sugar Tech.*, 50–55.—Rat control in cane is included in the discussion. The main difficulty, according to the writer, is the tremendous and relentless reproductive capacity of the rat. Recent advances with antifertility agents or reproduction inhibitors are discussed. Sufficient amounts in adults or directly in the young shortly after birth cause the young to be completely and permanently sterile.

* * *

Harvesting equipment and methods on the island of Hawaii. J. R. CARRAS. *Rpts.* 1966 *Meeting Hawaiian Sugar Tech.*, 131–134.—The purpose of this paper is to relate the various harvesting methods and types of equipment used on the 10 sugar cane plantations of the island. Progress made in these areas in the last 15 years is discussed as are the major harvesting improvement projects that are now under way or will be in the near future.

* * *

Varietal testing against sugar cane diseases. C. WISMER. *Rpts.* 1966 *Meeting Hawaiian Sugar Tech.*, 135–136.—A brief account or outline is given of the work being carried out in Hawaii in breeding for disease resistance. Diseases concerned are brown spot, eye spot, red spot, chlorotic streak and ratoon stunting disease. With regard to the last mentioned, the variety 49-3533 appears to be tolerant to the disease. The variety 39-7028 was shown to be resistant, while 60-6909 is either immune or highly resistant. Seedling selections from crosses with 60-6909 are being tested. Reference is made to the programme in Fiji for testing Hawaiian varieties against downy mildew and Fiji disease.

* * *

Disease resistance in relation to breeding. D. J. HEINZ. *Rpts.* 1966 *Meeting Hawaiian Sugar Tech.*, 146–148. This is a general discussion on the subject. The Dutch development of varieties resistant to Sereh disease of sugar cane in Java was one of the first examples of the usefulness of disease resistance breeding. Development of varieties resistant to mosaic, eye spot, leaf scald and red rot can be pointed out in Hawaii. Most types of resistance in sugar cane appear to be complex, for example the identification and transfer of resistance to ratoon stunting disease.

* * *

The variety collection and breeding at Kailua. R. URATA. *Rpts.* 1966 *Meeting Hawaiian Sugar Tech.*, 149–151.—At present 618 imported varieties are cultivated in the Kailua collection, having all been through strict quarantine. Among these are approximately 100 varieties of *Saccharum officinarum* (includes noble canes), 40 of *S. spontaneum*, 200 of *S. robustum* and 20 of *S. sinense*. The imported canes constitute only a small part of the total collection but are important in the breeding work which is described. The exchange or importation of fuzz from cane breeders in India is another function of the Station.

* * *

The development of automatic irrigation structure and devices. A. S. HUMPHREYS and J. A. BONDURAN. *Rpts.* 1966 *Meeting Hawaiian Sugar Tech.*, 152–168. It is considered that automation of surface irrigation has great possibilities for the future and could banish the picture of "the man with the shovel". It could give new life to projects suffering from labour shortage and high costs and make possible the irrigation of marginal lands. Many of the newer kinds of automatic equipment are described in detail and accompanied by photographs or drawings.

* * *

Urea as a fertilizer for sugar cane. D. H. PARISH. *S. African Sugar J.*, 1967, **51**, 1023–1027.—The writer, in a letter, criticizes a previous article on the use of different forms of nitrogen on sugar cane[1]. He contends that there is no well-substantiated evidence that urea produces cane with a higher sucrose content than does sulphate of ammonia. A reply to the criticism, by the writer of the original article, is included.

* * *

New rail wagon for transporting cane. R. PÉREZ V. *CubaAzúcar*, 1967, (Jan.-Feb.), 7–13.—A new type of rail wagon for cane termed "the hinged stake wagon" is described. It has been in trial use for two seasons and has proved very satisfactory. It is illustrated by means of photographs.

[1] DU TOIT: *I.S.J.*, 1968, **70**, 46.

Freezing and mill cane. J. E. IRVINE. *Sugar J.*, 1968, **30,** (8), 23–27.—Observations on frost damage of cane in Louisiana are recorded. As a general rule freezes of 32–29°F will produce only banded chlorosis of the leaves. Freezes of 29–25°F will produce leaf burn and terminal bud death in varying amounts. Freezes of 24–23°F will produce completely brown leaves and partially frozen stalks. Freezes of 22°F and below produce split stalks and frozen internal tissue to ground level.

* * *

Experiments with the new variety U.S.59-16-1 in Florida. L. P. HEBERT and E. R. RICE. *Sugar J.*, 1968, **30,**(8), 29–30.—Characteristics of this new variety, the first to be released to Florida growers under the expanding breeding programme, are given. Indications are that growers will plant this new variety in place of Cl 41-223, the most popular variety at present.

* * *

Smut disease. ANON. *S. African Sugar J.*, 1968, **52,** 34–37.—Cane smut (*Ustilago scitaminea*) was first recorded in Natal in 1877 and not again until 1945. It has now appeared in eastern Transvaal cane fields and this article is to warn cane farmers there about it. Symptoms, control measures (notably the importance of clean seed cane) and varietal susceptibility are described. The main varieties in the area are N:Co 310 and N:Co 376. A very susceptible variety, Co 301, has now been removed from the list of approved sugar cane varieties.

* * *

Trashworms in cane fields. J. DICK. *S. African Sugar J.*, 1968, **52,** 53–55.—Two similar species are known in South African cane fields, namely *Cirphis leucosticha* and *C. loreyi* (now placed in the genus *Pseudaletia*). The moths frequent cane trash and the larvae feed on cane leaves, especially young ratoon cane in trashed cane fields. Natural enemies, i.e. Tachinid flies and parasitic wasps, assist considerably in keeping the pest in check. The advantages of using insecticides as well, notably DDT, are discussed.

* * *

Downy mildew observed in Phil. 54-60. ANON. *Victorias Milling Co. Exp. Sta. Bull.*, 1967, **14,** (9 & 10), 2–3.—The prevalence of this disease (*Sclerospora sacchari*) in 4 areas in the Philippines is reported. Symptoms and characteristics of the disease are described as well as control measures.

* * *

Poor cutting methods reduce yield. ANON. *Victorias Milling Co. Exp. Sta. Bull.*, 1967, **14,** (9 & 10), 7. Attention is drawn to the constant loss that may be caused in hand cutting of cane when operators cut the cane too high. In the Philippines this applies particularly when operators bring their own cane knives. They are afraid of harming the knife by cutting at ground level, but if cane knives are supplied they do not object to low cutting. Another cause of loss to be guarded against is the leaving of odd pieces of cane among the trash when loading takes place.

Supply of oxygen during hatching of the nematode *Meloidogyne javanica* under non-competitive conditions. N. COLLIS-GEORGE and H. R. WALLACE. *Australian J. Biolog. Sci.*, 1968, **21,** 21–35.—Variability in hatching of the root-knot nematode was reduced by selection of egg sacs of uniform colour, size and age. This nematode may attack sugar cane. As a result of laboratory experiments it was concluded that there is apparently a linear relationship between cumulative exposure to oxygen concentration and cumulative hatch.

* * *

A contribution to the study of effectiveness of EPTC on *Cyperus rotundus* (Nut grass). F. SOUSA DE ALMEIDA and A. M. FONSECA. *Agronomia Moçambicana*, 1967, **1,** 215–221.—A description is given of this weed, often so troublesome in sugar cane, and the manner whereby it increases and becomes distributed. Difficulty of control by cultivation only is explained. Results obtained in herbicidal trials indicated that EPTC is effective against the weed provided doses higher than 2·7 kg/ha are applied.

* * *

Sources of phosphorus for sugar cane. R. ALVARES, J. C. OMETTO, A. C. P. WUTKE, H. V. ARRUDA and E. S. FREIRE. *Bragantia*, 1965, **24,** 97–107; through *Biol. Abs.*, 1968, **49,** 1359.—The efficiency of different sources of phosphorus on cane growth was compared, on three different soils and in the presence of adequate N and K. Three local rock phosphates were used and compared with traditional phosphatic fertilizers. The rock phosphates all registered improved growth but were not so efficient as the soluble P fertilizers.

* * *

Sugar cane variety experiments. First results. F. W. HESSE *et al. Awamia*, 1966, (18), 69–76; through *Hort. Abs.*, 1968, **38,** (1), 278.—The first results are given of a variety trial in Morocco. The highest yield of cane was from POJ 2725 followed by CP 44-101 and N:Co 310, giving a crude sugar yield of over 13 tons/ha. Sugar content and juice purity were highest in these varieties. Other varieties tested were Co 290 and Tuc 1376.

* * *

The I.I.S.R. weeder-mulcher is ideal for sugar cane. R. R. PANJE and R. G. MENON. *Indian Farming*, 1967, **17,** (2), 7–8, 47; through *Hort. Abs.*, 1968, **38,** (1), 279.—A simply constructed animal-drawn 4-bladed harrow, which pulls out the weeds and leaves a mulch, is described.

* * *

Sugar cane yields as related to soil acidity. F. ABRUÑA RODRÍGUEZ and J. VICENTE CHANDLER. *Agron. J.*, 1967, **59,** 330–352; through *Hort. Abs.*, 1968, **38,** (1), 279.—Sugar cane was grown in 40 plots with widely varying pH, base saturation and exchangeable aluminium contents from limestone dressings. Yields rose sharply with increasing soil pH. Foliar composition and sucrose content of the cane were not affected by the soil factors studied.

The accumulation of N, P, K, Ca and dry matter in the primary stems and tillers of sugar cane. G. A. ORIOLI *et al. Turrialba*, 1967, **17**, 131–142; through *Hort. Abs.*, 1968, **38**, (1), 280.—Numerical and geographical data are presented from monthly analyses of stems, green and dry leaves from cane fertilized monthly. In general, nutrient accumulation was greater in the tillers than in the primary shoots. This was particularly marked in the N content of fertilized and the K content of unfertilized plants. In the latter, dry matter and Ca contents were higher in primary shoots than in tillers. The effect of the fertilizer on dry matter production was less marked than on the accumulation of mineral elements.

* * *

Cultural variants of *Helminthosporium stenospilum* from sugar cane. L. J. LIU. *J. Agric* (Univ. Puerto Rico), 1967, **51**, 334–336; through *Rev. App. Mycology*, 1968, **47**, 234.—Five isolates of the fungus with different cultural characteristics were obtained from brown stripe lesions on sugar cane.

* * *

Salinity effects on sugar cane germination, growth and root development. L. J. LIU. *J. Agric.* (Univ. Puerto Rico), 1967, **51**, 201–209; through *Soils and Fertilizers*, 1968, 31, (1), 94–95.—Ten varieties of sugar cane were grown in initially non-saline soil and irrigated with 0, 4000, and 8000 p.p.m. NaCl solutions at 2–3 day intervals. The rate of stem growth was the best indicator of salinity tolerance. The variety PR 1028 was the most resistant, growing undamaged in a soil with a salt conductivity of 20 millimhos/cm, while PR 1000 was the most susceptible, being damaged when grown in a soil with a salt conductivity exceeding 5·4 millimhos/cm.

* * *

Photosynthesis in sugar cane varieties under field conditions. J. E. IRVINE. *Crop. Sci.*, 1967, **7**, 297–300; through *Plant Breeding Abs.*, 1968, **38**, 367.—The rate of photosynthesis per unit of leaf area (*P*) was tested for 10 varieties. F36-819 showed the highest rate, and those of interspecific hybrids were higher than those of *Saccharum officinarum* hybrids. A correlation between *P* and leaf thickness and leaf porosity was found. These two characters are more readily determined than *P*, and could be used in selecting varieties with higher photosynthetic potentials.

* * *

Studies on a strain of sugar cane mosaic virus causing severe mosaic disease on Co 527 cane at Nellikuppam. M. L. SETH. *Indian Phytopath.*, 1967, **20**, 54–56; through *Plant Breeding Abs.*, 1968, **38**, 368.—Inoculation with a virus isolate from Co 527 did not produce severe mottling in maize and sorghum. This virus from Co 527 was designated a substrain of sugar cane mosaic.

Sugar cane varieties tested in Tucumán, Argentina. R. F. ULLIVARRI and W. KENNING. *Idia*, 1967, (229), 26–46; through *Hort. Abs.*, 1968, **38**, (1), 278.—From preliminary trials at the Famailla agricultural experiment station, lasting only one year, the most outstanding results were from the variety NA 56/79.

* * *

Daily measurements of potential evapotranspiration from fully canopied sugar cane. G. D. THOMPSON and J. P. BOYCE. *Agric. Met.* (*Amsterdam*), 1967, **4**, 267–279; through *Hort. Abs.*, 1968, **38**, (1), 278. Daily evapotranspiration was measured by 4 hydraulic lysimeters in a sugar cane field freely supplied with water. The construction and operation of the lysimeters are described.

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Achievements of sugar cane research in Madras State. C. EKAMBARAM and K. NARAYANAN. *Madras Agric. J.*, 1967, **54**, 256–258; through *Hort. Abs.*, 1968, **38**, (1), 277.—Brief notes are given on the results of varietal, nutritional and cultural trials since 1957 along with current pest and disease control recommendations.

* * *

Some important ecological characteristics of tillering in relation to sugar cane culture. W. C. CHI. *Taiwan Sugar*, 1967, **14**, (6), 13–18.—Various tillering characteristics of different kinds or varieties of sugar cane are discussed and explained by means of diagrams. Their possible influence on tillering ability is pointed out. They may also affect interplanting potential and frost endurance. Varieties with many tillers at a late stage show the best regrowth on ratooning.

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Studies at the Houma station on the virus-vector relationship of sugar cane mosaic virus. N. ZUMMO and L. J. CHARPENTIER. *Sugar Bull.*, 1968, **46**, (9), 5–6, 10–12.—The 7 species of aphid known to be possible vectors of sugar cane mosaic in Louisiana are discussed or referred to. Laboratory studies have shown that all can become infective within a few minutes after feeding on mosaic-infected sugar cane. Attempts to control virus spread by the use of insecticides on the aphids were not successful in practice, nor was elimination of alternative host plants, mainly weeds.

* * *

Sugar cane termites—a résumé. D. K. BUTANI. *Indian Sugar*, 1967, **17**, 543–549.—The termites that attack sugar cane in India are discussed, as are the nature of the damage they do and control measures. The value of some modern insecticides is discussed, "Aldrin" being regarded as the most effective and economical, a small dose of 0·5 lb actual incredient per acre affording a year-long protection for the cane.

Control of lygaeid bug, *Macropes excavatus.* H. SINGH and S. P. SHARMA. *Indian Sugar*, 1967, **17,** 551–553.—In parts of Uttar Pradesh early maturing cane and ratoon crops suffer severely from attack by this pest, also called black bug. Results of insecticidal trials are recorded. Spraying with "Endrin", "Diazinon" and gamma-BHC at 0·125 kg actual ingredient per hectare proved very effective against nymphs. A higher concentration (0·175 kg/ha) was effective against adults.

* * *

Record of attack of sugar cane scale insect in the Sehore area of Madhya Pradesh. A. N. KALRA and A. K. MEHROTRA. *Indian Sugar*, 1967, **17,** 555–556. Heavy infestation of the scale insect, *Melanaspis glomeratus*, in some areas is recorded. Information is given on the desirability of segregating heavily infected pockets and on spraying and seed cane treatment.

* * *

Sugar cane wilt. R. KATHIRVELU and A. MAHADEVAN. *Indian Sugar*, 1967, **17,** 611–613.—Severe wilting in varieties Co 449 and Co 658 in the South Arcot District of Madras State was found to be associated with two fungi or pathogens *Cephalosporium sacchari* and *Fusarium moniliforme*. Both the pathogens were present in canes of various ages. Control of the disease may involve planting of wilt-resistant varieties.

* * *

"Atrazine" as a herbicide in sugar cane fields. V. S. NEGI and R. K. YADAV. *Indian Sugar*, 1967, **17,** 615–622.—The paper discusses the results obtained with "Atrazine" alone, or in combination with 2,4-D and in various doses at different times on weeds of sugar cane in India.

* * *

Effect of different semi-solid media on the growth of monosporidial lines of *Ustilago scitaminea.* S. K. SAXENA. *Indian Sugar*, 1967, **17,** 623–624.—The rates of growth of three monosporidial lines of cane smut in 15 semi-solid media are given.

* * *

Biological control of sugar cane pests. R. H. G. HARRIS. *S. African Sugar J.*, 1968, **52,** 123–127.—A short general account is given of the subject with special reference to South African cane pests. Biological control is discussed in regard to cane borers, trashworm, froghopper, leafhopper and *Numicia.*

* * *

A further study of the effect of trace elements on the sugar cane crop. G. TONAPY, S. J. JADHAV and P. S. KELAVKAR. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc.* (India), 1967, (1), (ii), 257–260.—In field trials the following trace elements were applied to 5–7 month-old cane at the rate of 2 kg/acre—zinc sulphate, manganese sulphate, copper sulphate, borax, ferrous sulphate. Out of 19 treated plots only one plot yielded less than the control plot. It was concluded that two years of trials indicated that these elements were beneficial to cane under prevailing soil conditions.

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Manuring of sugar cane in Bombay State. IV. Preliminary studies in the relationship between the mineral nutrient content of primary juice and C.C.S. per acre. K. V. JOSHI. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (iii), 1–10.—This is a continuation of some earlier work. Data over a wide area were collected, much of it being arranged in tabular form.

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A brief note on sugar cane soils of Buldhana district. K. V. JOSHI, G. M. BHARADI and S. T. RANADIVE. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (iii), 11–38.—The results are given of a survey of the cane soils of the Buldhana district, covering some 5000 acres, the cane being mostly grown under well irrigation. Some recommendations are made for cane cultivation depending on soil characteristics.

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Increasing cane and sugar yields per unit area. K. H. PAREKH and S. R. KHANDEKAR. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (iii), 39–42.—Attention is drawn to the low average yields of sugar cane in India (17·1 tons/acre) compared with other cane-growing countries. In some parts of India soil and climatic conditions are such that it should be possible to obtain yields comparing favourably with those of other countries. Limiting factors are discussed.

* * *

Comparative efficacy of different insecticides against scale insects. V. V. TEMBHEKAR. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (iii), 49–54.—Scale insects are usually minor pests with cane in India but may be serious in some areas. Results of trials with several insecticides are given. The best control was obtained with "Folidol", followed by "Dimecron", "Sevin", fish oil rosin soap and "Malathion".

* * *

Cane development through farm technology. V. P. VAIDYA. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (iii), 55–64.—The writer contends that many aspects of cane cultivation and production in India are outmoded and irrational, particularly where tillage, irrigation and manurial practices are concerned.

* * *

Effect of soil chemical characteristics on raw sugar ash content in Peru. G. HUSZ. *Sugar J.*, 1968, **30,** (9), 22–23.—Peruvian raw sugars are notable for their high ash content. This is thought to be due to high sulphate concentrations in soil water and in cane juice and raw sugar. The high concentration in the soil water is due to deposits made by irrigation water.

Sugar beet agriculture

Experiments on the time of application of insecticide to decrease the spread of yellowing viruses of sugar beet, 1954-66. R. HULL and G. D. HEATHCOTE. *Ann. Appl. Biol.*, 1967, **60**, 469–478.—The value of "Demeton"-methyl sprays applied at the proper time in destroying aphids responsible for spreading virus diseases is clearly illustrated. Between 1957 and 1960 when yellows was prevalent the incidence, assessed as "infected-plant-weeks", was decreased by 36–41% by one spray, depending on the time of application, and by 55% with two sprays. This gave yield increases of 1½ and 2 tons respectively. In other years when growers sprayed at the time advised by the British Sugar Corporation the incidence of beet yellows was reduced on average by 37%.

* * *

The practical application of "Pyramin" in different countries. H. LANGBEIN. *J. Int. d'Etudes sur le Désherb. Sélect. en Cultures de Betteraves*, 1967, 12 pp.; through *Weed Abs.*, 1967, **16**, 335–336.—Statistics are given to show the increasing acceptance of herbicides, especially "Pyramin" ("Pyrazon") for controlling weeds in European sugar beet crops since 1960. Where soil conditions are sufficiently moist, pre-emergence application on the day of sowing or shortly afterwards is the preferred method of treatment in most countries. Pre-sowing incorporated application, necessary under very dry conditions, is gaining favour, expecially in France.

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The use of "Pyrazon" in Great Britain. G. B. LUSH, A. J. MAYS and B. L. REA. *J. Int. d'Etudes sur le Désherb. Sélect. en Cultures de Betteraves*, 1967, 14 pp.; through *Weed Abs.*, 1967, **16**, 336.—Research on the use of "Pyrazon" in sugar beet in Great Britain since 1962 is surveyed chronologically. The importance of soil moisture and temperature in Britain is mentioned.

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The commercial use of herbicides in Great Britain. N. V. TURNER. *J. Int. d'Etudes sur le Désherb. Sélect. en Cultures de Betteraves*, 1967, 8 pp.; through *Weed Abs.*, 1967, **16**, 336.—Since some soil-acting herbicides have become commercially available for sugar beet the total acreage treated has risen from 11% in 1962 to 54% in 1966. The fact that 21% of the country's total beet acreage consists of soils with a high organic matter or clay content, on which soil-acting chemicals are often ineffective at economical rates, has militated against a more extensive use of herbicides.

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Precision drilling 5 cm, 7 cm or further apart. E. N. C. MEIJER. *Landbouwmechanisatie*, 1967, **18**, 221–226; through *Field Crop Abs.*, 1967, **20**, 322.—Stand data from 10 farms are recorded, sugar beet seed having been precision drilled 4, 5, 7 and 10 cm apart. Satisfactory stands were obtained from the three closest spacings in all instances except one, whereas at the widest spacing 60% of the stands were too thin. Emergence varied from year to year and district to district. Technical monogerm seed with 75% germination capacity sometimes gave less than 50% field emergence. About 90% of the area under sugar beet in Holland is now precision drilled.

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Rôle of the root in the translocation of products of photosynthesis in sugar beet, soybean and pumpkin. H. WINTER and D. C. MORTIMER. *Canadian J. Bot.*, 1967, **45**, 1811–1822.—The influence of root function on the export of ^{14}C-labelled products from leaves of sugar beet, soybean and pumpkin plants was examined with reference to the concept of a circulatory mechanism for translocation. When roots were placed in demineralized water for periods of up to 10 days, oxygen uptake rates were reduced. In sugar beet this was accompanied by an apparent stimulation of about 21% in the quantity of labelled sugar exported from the leaf. Other results obtained are discussed. This led to the conclusion that the root does not exert a controlling influence in translocation, but that it can contribute to the efficiency of the process.

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Nitrogen nutrition of some nematode-trapping fungi. V. SATCHUTHANANTHAVALE and R. C. COOKE. *Trans. British Mycolog. Soc.*, 1967, **50**, 423–428.—Certain fungi (species of *Arthrobotrys* and *Dactyaria*) which form adhesive networks, have been shown to be able to utilize nitrite, nitrate, ammonium and organic nitrogen during growth. Other fungi (species of *Monacrosporium* and *Arthrobotrys*), which form constricting rings, cannot utilize nitrite and have a reduced ability to grow on nitrate as sole nitrogen source. The significance of the different nutritional pattern found in each of the two groups is discussed. Fundamental information of this kind may eventually lead to better natural control of nematodes attacking both sugar beet and sugar cane.

Field irrigation trials, 1955-1965 at Gross-Enzersdorf. A. SUPERBSBERG. *Bodenkultur*, 1967, **18,** (1), 67–95; through *Field Crop Abs.*, 1967, **20,** 323.—Irrigation trials are reported; 40 mm water every 10–14 days increased root yield by 39·6%, yield of tops by 69·4% and sugar yield by 27·1%. Irrigation, whenever 50% of the available soil moisture had been used, increased root yield by 44·8%, yield of tops by 68·4% and sugar yield by 32·8%, though percentage sugar suffered greater reduction.

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Damage to sugar beet through mixing different beet herbicides. H. U. AMMON. *Mitt. Schweiz. Landw.*, 1967, **15,** (4), 79–82; through *Field Crop Abs.*, 1967, **20,** 323.—Results are given of the treatment of sugar beet (grown in a temperature-controlled environment) with "Pyrazon" (4 kg/ha) and "Lenacil" (2·5 kg/ha) and 5 different mixtures of the two herbicides. "Pyrazon" alone was not phytotoxic and "Lenacil" alone caused little damage, but the mixtures caused 5–30% crop mortality at 20°C and 40–80% mortality in most trials at lower temperatures. In field trials at fairly high temperatures there was no crop damage, but little weed control either.

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Carbon and nitrogen sources for protein synthesis and growth of sugar beet leaves. K. W. JOY. *J. Exp. Bot.*, 1967, **18,** 140–150; through *Field Crop Abs.*, 1967, **20,** 325.—Removal of mature leaves had no adverse effect on the growth of young sugar beet leaves although they normally import from older leaves. Steaming the petiole to block phloem transport showed that leaf growth could be independent of C from external cources, but N intake was considerably reduced. The C in young leaf protein was derived mainly from assimilated CO_2, while translocated sucrose contributed proportionally more of C to insoluble carbohydrate. It is thought that a small but significant proportion of the N requirement of the young leaf is translocated from roots as glutamine via the phloem.

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Sodium and rubidium as possible nutrients for sugar beet plants. A. M. EL-SHEIKH, A. ULRICH and T. C. BROYER. *Plant Physiology*, 1967, **42,** 1202–1208. This study, made in California, concerned the degree to which Na and Rb could substitute for K in the growth of sugar beet plants when K in the culture solution was low. Na and Rb were shown to enhance the growth of sugar beet plants under either high or low K conditions. High Rb concentrations were found to be toxic, especially to the growth of fibrous roots.

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Spraying sugar beet with urea. A. J. M. ROSENDAAL. *Landbouwvoorlichting*, 1967, **24,** (4), 72–73; through *Field Crop Abs.*, 1967, **20,** 323.—Sugar beet given 172 kg N/ha at sowing showed signs of N deficiency after the end of July and was given 10 or 40 kg N/ha on 26th August as a spray of aqueous urea, or 40 kg/N as solid calcium nitrate. The lower rate of N gave a non-significant yield increase; the higher rate increased the yield of tops and decreased those of roots and sugar. The two forms of fertilizer had similar effects.

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Some observations on the economic importance of sugar beet downy mildew in England. W. J. BYFORD and R. HULL. *Annals Appl. Biol.*, 1967, **60,** 281–296. Downy mildew (*Peronospora schachtii*) is a widespread disease of sugar beet in temperate regions of the northern hemisphere. In England it is most prevalent in the sugar beet and mangold seed-growing area of South Lincolnshire and West Norfolk. In 1965 some 6412 acres were reported with more than 10% infected plants. General information about the disease and its incidence in Britain is given.

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Effect of trace elements on yield and quality of sugar beets. B. BAGINSKAS. *Boron in Agriculture*, List No. 79, Abs. 27.—Simultaneous and single applications of low levels of B, Co, Cu, Mn, Mo, I and Zn administered as seed pre-treatment or as leaf sprays markedly increased green fodder and beet yields, ascorbic acid, carotene and chlorophyll contents of leaves, as well as leaf surface and the sugar contents of roots. B and Mo application effected the highest beet yield. Generally fertilizing with mixtures of trace elements in various ratios gave better results than applications of the individual trace elements.

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Investigations on damage to sugar beet caused by subterranean springtails. C. WINNER and W. R. SCHÄUFELE. *Zucker*, 1967, **20,** 641–644.—Heavy damage to sugar beet by subterranean springtails (*Onychiurus* spp., notably *Onychiurus campatus*) is reported from several fields in Germany, especially in a field trial concerning the effect of a "Heptachlor" seed dressing. Observations on the feeding habit of the pest led to the conclusion that the extent of damage by the pest in the field is very dependent upon the temperature and humidity of the soil as well as on the growth rate of the sugar beet seedling. Damage can be prevented or lessened by the use of a seed dressing with an appropriate insecticide.

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Beet sugar in Europe. P. B. SMITH. *Sugar J.*, 1967, **30,** (6), 23–26.—The Director of Agricultural Development of a large American sugar company gives his impressions of a visit to the major sugar beet producing countries of Europe. He states that with monogerm seed coming into the picture in some of the countries of northern Europe, the importance of proper precision drilling is very evident. In talks with farmers, sugar company people and research workers in the dozen countries visited, the use of monogerm seed was hailed with great acclaim.

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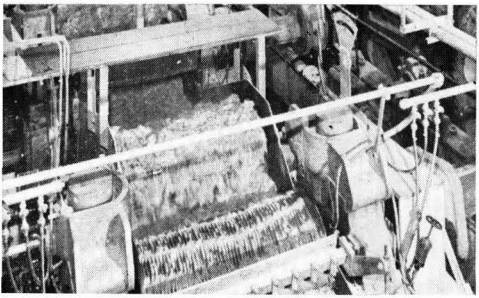
Practical guide of spring work with sugar beet. ANON. *Betterav. Franç., Suppl.* 1968, (184), 16 pp.—Various aspects of spring work in the cultivation of sugar beet are discussed in a popular manner, such as choice of seed, planting, manuring, weeding, use of herbicides, ect.



Cane sugar manufacture

Factory cane cleaners. J. H. PAYNE. *Ind.-Agric. Research Management Newsletter*, 1967, **7**, (4), 3. The four basic steps in cane cleaning as practised in Hawaii (carding, rock separation, washing and detrashing) are described as are the main pieces of equipment involved.

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The cane sugar industry of Peru. F. VON PROSKOWETZ. *Zeitsch. Zuckerind.*, 1967, **92**, 634–638.—A survey of the Peruvian sugar industry is presented. The eleven sugar factories (two of which crush less than 500 t.c.d.) produce a total of 800,000 tons of sugar annually, although annual home consumption stands at about 360,000 tons. The largest factory, Casa Grande, is to be expanded from 7500 t.c.d. to 11,000 t.c.d.

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Contribution to cane sugar technology. M. CARRANZA MARQUEZ and S. MELGAREJO. *Bol. Soc. Quím. Perú*, 1966, **32**, 20–22; through *S.I.A.*, 1967, **29**, Abs. 757. A new sugar extraction process is briefly described. Cane is shredded and mixed with 1 litre of ethanol/kg of cane. The extract is separated by pressing and the bagasse is re-extracted with fresh ethanol. The use of ethanol diminishes the extraction of non-sugars, especially ash and gums. The ethanol is recovered by distillation, wax is filtered off, and sugar is boiled from the residual aqueous solution. It is claimed that lignin can be separated from fibrous cellulose by screening the resulting bagasse.

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Division of Mill Technology. J. H. NICKLIN, P. G. ATHERTON and A. D. DOOLAN. *Ann. Rpt. Bur. Sugar Expt. Sta.*, 1967, (67), 68–75.—Work carried out by the Division of Mill Technology is reported, including tests on heat transfer in brass and stainless steel evaporator tubes, entrainment prevention, ATV subsider performance, flocculating agents, determination of fibre in new cane varieties, condensate monitoring, boiler flue gas analysis with the aim of improving combustion, cane preparation power requirements, pan boiling additives, and condenser tests. The individual investigations have been reported more fully elsewhere in the literature.

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The study of cane diffusion. U. C. UPADHIAYA. *Indian Sugar*, 1967, **17**, 143–151, 265–273, 331–338, 397–404. The theory, history and development of cane diffusion are surveyed and available cane diffusers described. Information is also given on various aspects of the process and basic requirements for high extraction efficiency.

Clarification of sugar cane juice and the production of dextran, beverages and khandsari from it. A. EHSAN, M. H. HASHMI and –. KARIMULLAH. *Sci. & Ind.* (Pakistan), 1966, **4**, 308–311; through *S.I.A.*, 1967, **49**, Abs. 771.—For the production of dextran and beverages, the juice was boiled with basic aluminium carbonate at a concentration of 0·05–0·12 g of Al_2O_3 per 100 g of juice, in order to remove gums and other colloids. The clarified juice was boiled with activated carbon (0·1–0·2 g of juice) until colourless. For the production of khandsari, the juice was filtered through rough cloth and brought to pH 5·8–6·0 with $NaHCO_3$ (5–8 g/40 lb). It was then heated to 80°C and the scum was removed by a sieve. The juice was then boiled, and $NaHCO_3$ solution and some plant extracts were added. The scum was again removed, and a centrifugal sugar produced from the juice.

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A new prototype boiler and the method of treatment of boiler water practised at Sakthi. K. K. MENON and M. K. RAMKUMAR. *Indian Sugar*, 1967, **17**, 467–469. Information is given on a Walchandnagar Industries prototype water-tube boiler of 6500 sq. ft. heating surface, two of which have been installed at Sakthi Sugars Ltd. The feed water is treated with sodium triphosphate and soda ash.

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India's cooperative sugar industry. A. L. N. MOORTHY. *Sugar y Azúcar*, 1968, **63**, (1), 24–25.—The development, structure and production levels of Indian cooperative sugar factories are discussed and their production figures compared with those for private sugar factories in India.

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Handling raw sugar in bulk, successfully. ANON. *Sugar y Azúcar*, 1968, **63**, (1), 26–27.—Details are given of the Honolulu bulk sugar terminal, which includes a warehouse of 30,000 tons capacity. About 180,000 tons of raw sugar per year is sent out in 16 shiploads. Up to 1000 tons of raw sugar can be loaded per hour into the ships.

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Sugar mill turbinization. F. C. SALONGA. *Sugar News*, 1967, **43**, 488–490.—Guidance is given on selection and installation of mill drive turbines, and principal troubles experienced with turbines are discussed.

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Sugar juice sanitation. J. A. CASEY. *Sugar News*, 1967, **43**, 492–504.—Information is given on the development of "Cane Mill Aid" by Fabcon Inc.

Taiwan sugar industry today. H. S. Wu. *Sugar J.*, 1967, **30,** (7), 9–13.—Various aspects of the Taiwan sugar industry are briefly discussed, including the history of the industry, cane agriculture, factory modernization, the function of the Taiwan Sugar Experiment Station, and management and ownership of the Taiwan Sugar Corporation. The crushing capacities of Taiwan sugar factory are listed, as are by-product plants operated by the Corporation.

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T.S.C. management. H. S. Wu. *Sugar J.*, 1967, **30,** (7), 30–31.—Brief descriptions are given of the Taiwan Sugar Corporation Data Processing Centre, which serves 26 sugar factories and 120,000 cane growers, and of automatic controls at Kaohsiung sugar central.

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Technical developments for bagasse saving in Taiwan factories. P. C. Kwan. *Sugar J.*, 1967, **30,** (7), 35–38.—See *I.S.J.*, 1967, **69,** 84.

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The Philippine sugar industry. E. R. de Luzuriaga. *Sugar J.*, 1967, **30,** (7), 41–43.—The Philippine sugar industry is surveyed and preliminary estimates for the 1967/68 crop are tabulated.

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Centrifuging of *B*-molasses. J. J. García N. *Cuba Azúcar*, 1967, (Jan./Feb.), 2–5.—Centrifuging *B*-molasses at 80–85°C in a De Laval QX 210-37B machine operating at 6000 r.p.m. gave a yield of 9,732 litres/hr from 10,197 litres of feed/hr, but reduced the viscosity from 91 to 77 cp and sulphated ash from 6·62% to 6·15%. Purity was raised from 57·83 to 58·66. The massecuites resulting required much less boiling and purging time and gave lower final molasses purity and yield.

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The influence of flash of juice and condensate on the evaporation rate of the last vessel of an evaporator and the effect on the tendency of entrainment of syrup by the vapour of this vessel. C. G. M. Perk. *S. African Sugar J.*, 1968, **52,** 63–67.—The evaporation rates of each effect in a quintuple-effect evaporator were calculated using the formula $E = ny + nB_n + (n-1)B_{n-1} + (n-2)B_{n-2} + (n-3)B_{n-3} \ldots$, where E is the total evaporation rate of an evaporator comprising n effects, B is the rate of bleeding (the subscript indicates the number of the effect bled) and y is the proportion of the total evaporation rate shared by each effect (this is the same for all effects). The calculated figures were then compared with values arrived at by taking account of juice and condensate flash, the latent heat of the steam (vapour) changes between effects, the specific heat of the juice changes between effects, and heat loss due to radiation and removal of incondensable gases. It was found that the actual evaporation rates were lower in the first three effects than the calculated values, while those for the last two effects were higher, that for the last vessel being nearly 30% higher. The significance of this is briefly discussed.

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Probable sugar and cane payment. E. R. de Oliveira. *Seminario Inst. Zimotécnico* (São Paulo), 1966, (4), 28 pp.—The harmful effects on factory sugar output and efficiency which result from cane payment on a weight basis only are discussed and the systems of payments in a number of cane-growing areas reviewed, including the legal basis applied in Brazil where weight only is the criterion. Alternative criteria proposed by various authors for Brazil are quoted and discussed. The payment for cane on a basis of recoverable sugar presents difficulties in regard to sampling and deterioration of cane in storage, and work needs to be done to solve the problems involved.

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The expansion of Okeelanta. F. R. Prieto. *Sugar J.* 1968, **30,** (8), 16–23.—Information is given on the stages by which the Okeelanta cane sugar factory of South Puerto Rico Sugar Co. was expanded from its initial capacity of 3000 t.c.d. to 8500 t.c.d. by installation of additional equipment.

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Pingtung sugar factory. Anon. *Taiwan Sugar*, 1967, **14,** (6), 27–28.—Details are given of equipment and processes at Pingtung carbonatation white sugar factory, which has a crushing rate of 3500 t.c.d. and produces not only coarse grain white sugar, but also a special fine grade known as Superior White Fine Granulated sugar.

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Sulphur in sugar manufacture. B. L. Mittal. *Indian Sugar*, 1967, **17,** 535–542.—Sulphur burning and the consumption of SO_2 in sulphitation factories are discussed. Two processing methods which would permit white sugar production with a very much reduced sulphur consumption are considered, i.e. (i) the defeco-melt crystallization process, and (ii) production of raw sugar and refining of it separately. The advantages and economics of the latter method are discussed. It is pointed out that the use of a carbonatation refining method would cut sulphur consumption by 90%.

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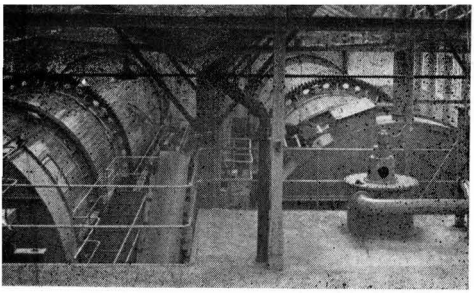
A new idea in milling. R. Ragbir. *Proc. 22nd Conv. Deccan Sugar Tech. Assoc. (India)*, 1967, (1), (i), 16. A number of advantages are listed which would accrue, it is suggested, from installation of a larger mill at the end of a milling tandem. Control of the number and sizes of mill rollers by the Indian Government is deprecated.



Beet sugar manufacture

Sugar factory control. Application to diffusion and (juice) purification stations. N. VANDORMAEL. *Sucr. Belge*, 1967, **87**, 213–221.—Requisites for automatic control of sugar factory processes are discussed, as are the choice of equipment and its installation and use. Details are given of a scheme for complete electro-pneumatic control of the diffusion and carbonatation stations which involves one central control panel supervised by one operator.

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Measurement and regulation of heat in sugar factories. P. MOTEJL. *Listy Cukr.*, 1967, **83**, 279–282.—The fundamentals of heat measurement and basic measuring elements are discussed and heat control schemes are described, including a proportional and a proportional-integration (PI) system. The components of these systems are listed.

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Simultaneous defeco-saturation with return of 6–8 times the quantity of normally gassed, unfiltered 1st carbonatation juice. S. L. SHOIKHET, A. K. KARTASHOV and V. A. ZAMBROVSKII. *Sakhar. Prom.*, 1967, **41**, (11), 25–29.—Tests at Artemovsk and Sambor sugar factories showed that, although the Dorr carbonatation scheme involving simultaneous defeco-saturation considerably improved filtration and sedimentation of 1st carbonatation juice compared with conventional carbonatation, it cannot be recommended for the Soviet sugar industry because of the smaller quantity of reducing matter decomposed compared with standard main liming. The residual reducing matter and nitrogenous matter is decomposed in later processes where it causes difficulties, particularly a fall in pH in evaporation and boiling, and higher colour of intermediate products and white sugar. The scheme is effective where the beet quality is very low.

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Determination of low-grade massecuite parameters. A. I. GROMKOVSKII. *Sakhar. Prom.*, 1967, **41**, (11), 30–35.—Tests were conducted on three types of crystallizers used for low-grade massecuite, having a disc element, a spiral element, and an element composed of straight and curved tubes (Fletcher & Stewart Ltd.), respectively. Under otherwise equal conditions, resistance of massecuite to shaft rotation was smallest with the disc element and greatest with the Fletcher & Stewart model. The maximum permissible viscosity for rotary speeds in the range 0·4–2·0 r.p.m. was greatest with the disc-type element, by far exceeding the value for the Fletcher & Stewart, while the spiral element crystallizer had the lowest value. The same order applied to the maximum permissible crystal content in massecuite (% by weight) for the same range of speeds. A nomogram is presented for calculation of the maximum permissible low-grade massecuite purity in terms of the rotary speed and standard molasses purity and viscosity for a crystallizer with disc element and for centrifugal curing at 550–650 and 1500–1800 r.p.m.

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Some causes of fall in juice pH during evaporation. K. D. ZHURA and L. V. ZAGAIKEVICH. *Sakhar. Prom.*, 1967, **41**, (11), 36–37.—Tests on model and factory juices showed that glutamine and asparagine, found in thin juice at concentrations of 0·15% and 0·04% on weight of sucrose, respectively, had little effect on pH change during evaporation. On the other hand, during defeco-saturation, glutamine has been found to form a pyrrolidone carboxylic acid-ammonia complex, of which only 25% is decomposed before evaporation. During evaporation, ammonia is released from the remaining 75% of the complex, which is broken down only after 30 min at 120°C, and the pH falls.

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FPAKM automatic compartmented filter-press. A. R. SAPRONOV. *Sakhar. Prom.*, 1967, **41**, (11), 38–39.—Details are given of a Soviet-designed filter-press which operates under a pressure of 15 kg/sq. cm. and is intended for treatment of finely dispersed suspensions containing up to 3 mm particles. The filtration surface ranges from 2·5 to 25 sq.m. according to model.

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The nature of undetermined sugar losses in diffusion—methods of determining them and ways of reducing them. N. V. KHEIZE, A. YA. ZAGORUL'KO, S. A. BOGDANOV and T. P. KHVALKOVSKII. *Sakhar. Prom.*, 1967, **41**, (11), 48–53.—Tests throughout the 1965/66 campaign with a battery diffuser showed that, while in the first half of the campaign the losses due to conversion of sugar to organic acids (mainly lactic acid) were initially greater than those due to inversion, the difference fell and in the second half of the campaign the position was reversed. Most of the sugar decomposition to organic acids, and invert extraction from the cossettes occurred in the tail and middle cells. Invert formation was greatest where the maximum diffusion temperature was below 75°C, i.e. the temperature at which invertase becomes inactivated. Remedial measures include maintenance of a temperature of 50–70°C in the head cells and measuring tank before the diffuser, a maximum temperature of 75°C, SO_2 addition to the condenser water used for diffusion, and treatment of beet with 0·5–1·0% chloride-of-lime.

Juice purification technology in the Polish sugar industry. S. GAWRYCH. *Gaz. Cukr.*, 1967, **75**, 285–290. The basic juice purification scheme developed for the Polish sugar industry (progressive pre-liming with 0·25% CaO on beet, main liming with 1·25–1·50% CaO on beet, 1st carbonatation, further liming with 0·1–0·2% CaO on beet, and 2nd carbonatation) is discussed. Variants include replacement of 1st and 2nd carbonatation with simultaneous defeco-saturation to pH 9·5 and 11, respectively. Juice deliming may be carried out by adding sodium carbonate (300 g/ton of beet) before 2nd carbonatation, or by cation exchange after 2nd carbonatation.

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The effect of raw juice and invert content on 1st carbonatation juice filtration and sedimentation. A. VIGH and K. VUKOV. *Gaz. Cukr.*, 1967, **75**, 290–292. Tests in which pectin and araban, isolated from beet, were added in varying amounts to raw juice which was then purified by hot or cold pre- and main liming followed by carbonatation, or pre-liming followed by simultaneous defeco-saturation, showed that the sedimentation rate fell and the filtration coefficient increased with rise in the concentration of colloids and invert decomposition products. The effect of araban was insignificant, while that of dextran was considerably greater. Invert decomposition products generally had a greater effect than did pectin, although the effects of both components depended on the juice purification method used.

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Process optimization. R. M. J. WITHERS*, R. J. BASS and M. F. BRANCH. *Paper presented to the 19th Tech. Conf., British Sugar Corp. Ltd.*, 1968.—Full details are given of a sugar factory process simulation using a mathematical model covering (*i*) diffusion and pulp pressing, (*ii*) pulp drying, (*iii*) evaporation, (*iv*) the dissolver, (*v*) 1st pans and centrifugals, and (*vi*) 2nd and 3rd pans, centrifugals and crystallizer. The model has been so written that all the equations may be collected together in a chained calculating process covering the factory from end to end, and hence enables the obtainable operating profit rate to be predicted for particular settings of the plant independent variables. Collection and logging of the data are described with reference to application of the system at Bardney sugar factory. Results of experiments have shown that the processes have very long time constants, so that the optimization technique need only be attempted once in several days. Application of the model to plant design and for indicating the presence of physical constraints in the system under a wide range of processing conditions is discussed.

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Corrosion problems in sugar factories. G. MANTOVANI. *Paper presented to the 19th Tech. Conf., British Sugar Corporation Ltd.*, 1968.—Corrosion of metal components in a sugar factory is discussed and illustrated by a number of photographs. The type of metal involved, the nature of the corrosion and the application of corrosive-resistant coatings are considered for diffusion, defecation, evaporation and boiler plant, as well as the pan station, syrup tanks and ion exchange equipment. Thirty-six references are made to the literature.

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The conservation of water and final treatment of effluent. G. W. CRANE. *Paper presented to the 19th Tech. Conf., British Sugar Corp. Ltd.*, 1968.—After summarizing the legislation covering water abstraction and control of water pollution in the UK, the author considers problems associated with beet sugar factory effluent and waste water treatment and disposal as carried out in the British Sugar Corporation.

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Boiling schemes. P. W. VAN DER POEL, N. H. M. DE VISSER and W. A. FENSTRA. *Paper presented to the 19th Tech. Conf., British Sugar Corp.*, 1968.—The HATTINCK method[1] of representing boiling schemes by vectors is described and illustrated by a number of diagrams drawn from factory data. It is emphasized that the aim of the article is not to compare the various schemes but to illustrate the use of the method.

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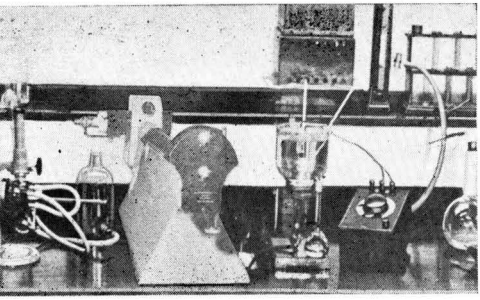
Effect of draft and of inversion on the quality of juice in beet diffusers. J. F. T. OLDFIELD, J. V. DUTTON, D. GRIERSON, R. K. HEANEY and H. J. TEAGUE. *Paper presented to the 19th Tech. Conf., British Sugar Corp., Ltd.*, 1968.—In experiments with a laboratory battery of nine diffusion cells, juice purity was found to decrease towards the water end, mainly because of increased potassium salts extraction. A more marked purity drop late in the campaign was due to inversion. At a draft in the range 107–122% and a sugar content in exhausted cossettes of 0·12–0·20% the purity did not fall below 70 at the water end when using fresh beet. Inversion was found to be caused by invertase activity and could be minimized by diffusion at a higher temperature or by steaming of cossettes before diffusion. When cossettes were macerated in water, the invert sugar concentration appeared to be higher than when lead acetate was used for maceration. Filtrates from beet macerates were examined for invertase activity at various temperatures and pH values. At least two enzymes were present: one had maximum activity at pH 8 and was inactivated at moderate temperatures, while the other had maximum activity at pH 5 and was more resistant to higher temperatures. The latter enzyme is considered the more important in sugar factory practice.

* The senior author of this paper, Mr. WITHERS, is well known to many of our readers as Chief Electrical Engineer of the British Sugar Corporation Ltd. However, as from 31st August 1968 he has taken up an appointment as a partner in Messrs. Urwick-Orr, Management Consultants, and is no longer with the B.S.C. Enquiries concerning this paper should therefore be directed to Mr. BASS at Peterborough.

[1] *Bijlage Archief voor de Suikerind. Ned. Ind., 10th Congr.*, 1928.



Laboratory methods & Chemical reports

Determination of chemical oxygen demand (COD). P. DEVILLERS, A. LEMAITRE and M. F. DEGRAND. *Sucr. Franç.*, 1967, **108**, 228–231.—A modification of a method established in the USA (ASTM D 1252-60) for determining the chemical oxygen demand of factory effluent is described. It involves oxidation of oxidizable organic and inorganic matter with potassium dichromate in sulphuric acid, using silver sulphate as catalyst and adding mercuric sulphate to prevent oxidation of the chlorides. After 2 hours' heating and cooling, the unreacted dichromate is titrated with ferrous ammonium sulphate using ferrous orthophenanthroline as indicator. The method is claimed to be accurate, although the purity of the reagents is highly important. In tests on samples containing water and sucrose 96–108% of the original sucrose was found (1 mg of sucrose is equivalent to 1·12 mg of O_2).

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Method recommended for determining sucrose (pol) in cane. J. LÓPEZ H. *La Ind. Azuc.*, 1967, **13**, 253–254. A laboratory technique for cane analysis is presented. A 50-kg cane sample is passed through a laboratory 3-roller mill having a top roller 350 mm wide by 300 mm dia., and the two lower rollers 350 mm × 200 mm dia. Brix and pol of the expressed juice are measured and the weight of bagasse measured. A 1-kg sample of the bagasse is dried in an air-oven at 125°C to constant weight and the fibre % bagasse (f_b) calculated from the following formula[1]:

$$f_b = \frac{100\,P_2 - P_1 Bx}{100 - Bx} \times 100,$$ where P_1, P_2 are the wet and dry weights of the bagasse sample, and Bx = juice Brix. The fibre % cane $f_c = f_b \times$ bagasse % cane, and pol % cane $(P_c) = P_j \times (100 - 1{\cdot}3\,f_c)$, where P_j = pol % juice, and the factor 1·3 is to correct for Brix-free or "colloidal" water in cane[2].

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Control of the degree of molasses exhaustion. I. N. AKINDINOV. *Sakhar. Prom.*, 1967, **41**, (9), 32–34. The method proposed by MIKHATOVA[3] for calculating sugar losses to molasses is shown to be inaccurate. While a method using a purity *vs.* Brix graph and non-sugars:water ratios found by analysis gave almost identical saturation coefficients calculated by a formula relating the coefficient to Brix and sugar content and by a formula of the type $a + b \times$ non-sugars, values calculated by the same formulae but based on MIKHATOVA's method were quite different.

Determination of invert sugar with 3,6-dinitrophthalic acid in the presence of excess sucrose. A. EMMERICH. *Zucker*, 1967, **20**, 603–611.—Two variants of a method are described which permit determination of 0·006% invert sugar with a reproducibility of ± 0·0003% in a solution containing 1 g of sugar per ml, and of 0–0·02% invert at a reproducibility of ± 0·001% or 0–0·15% at ± 5% reproducibility in a solution containing 0·1 g of sugar per ml. To 2 ml of the sugar solution are added (i) 1 ml of a solution prepared by dissolving 1 g of 3,6-dinitrophthalic acid and 0·5 g of anhydrous sodium carbonate in distilled water and making up to 500 ml after mixing, and (ii) 1 ml of a solution made up by dissolving 100 g of anhydrous sodium carbonate and 25 g of sodium thiosulphate in distilled water and making up to 500 ml after mixing. The reactants are thoroughly mixed in a nitrogen stream, and then heated over a water or glycerine bath for 10 min at 80°C. After cooling with water to room temperature, the solution is transferred to a flask and made up to 50 ml, after which the invert content is determined photometrically at 450 nm with distilled water as comparison liquid. Details are given of the technique used to obtain pure sucrose solution.

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The rate of saponification of L-glutamine under factory conditions. H. SCHIWEK. *Zucker*, 1967, **20**, 618–623. Tests with model juices, in which the rate of saponification of L-glutamine to pyrrolidone carboxylic acid during juice purification and evaporation was determined, showed that most of the glutamine forms pyrrolidone carboxylic acid after separation of ammonia, while at most 8% of the glutamine forms L-glutamic acid. The saponification rates agreed with values obtained by other authors. Tests with factory juices gave comparable results to those with model juices. The extent of saponification at the end of juice purification was found to depend on the purification scheme used. However, the differences are largely eliminated in pressure evaporation, so that only about 10% of the total glutamic acid content in thick juice will be in the form of L-glutamine. The results indicate one reason for the low thermal stability of thin juice where simultaneous defeco-saturation and/or thickener-filters are used, compared with the classic juice purification scheme.

[1] ROJAS: *Proc. 11th Congr. ISSCT*, 1962, 317.
[2] DOUWES DEKKER: *S. African Sugar J.*, 1958, **42**, 305–309, 573–577.
[3] *I.S.J.*, 1967, **69**, 85.

Study on the industrial and acquisitive value of sugar cane. G. ROUSSELOT and R. DE CAPOL. *Brasil Açuc.*, 1967, **70**, 217–218.—The difficulty involved in making separate analyses of cane deliveries to a sugar factory are discussed, and a simpler technique developed at Usina Sta. Cruz, Campos, Rio de Janeiro, is described. Measurements of Brix obtained using a pocket refractometer showed, over a 100 samples, a 0·7% higher value than those obtained densimetrically from juice from the same cane. Again, 10,000 analyses over a period of 15 years showed a factor of 0·740966, which when applied to the normal juice Brix gave the sucrose % cane. From these factors a table has been drawn up, whereby a refractometric Brix measurement made on the cane sample can be rapidly converted to the sucrose content and to the equivalent factor to be applied to the cane price.

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125 years of the Ventzke polarimeter. W. WÖHLERT. *Zeitsch. Zuckerind.*, 1967, **92**, 581–585.—Details are given of Ventzke's polarimeter and of his work on sucrose polarization. A bibliography of his works is presented.

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Laboratory carbonatation. V. H. DAWES. *Proc. 41st Congr. S. African Sugar Tech. Assoc.*, 1967, 33–36. Details are given of a laboratory carbonatation vessel. Comparison of the filtrabilities of laboratory carbonatated liquors with those of corresponding factory samples showed that the best correlation was obtained at a constant rate of gassing without stirring. Constant rate gassing with slow stirring using a mechanical agitator gave higher filtrabilities than the factory values. Two-stage gassing, with the second stage at (i) a slower rate, and (ii) a faster rate, gave slightly better correlation than constant gassing with stirring.

* * *

Further improvements in raw sugar quality. R. P. JENNINGS. *Proc. 41st Congr. S. African Sugar Tech. Assoc.*, 1967, 62–64.—Tabulated data are presented for six South African sugar factories supplying raw sugar to Hulett's refinery. The figures demonstrate the general improvement in quality of the raw sugar in 1966/67 compared with 1965/66 as regards grain size, filtrability, and ash, starch and total gum contents in the crystal.

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Sulphated ash and total non-sugars in Peruvian raw sugars. J. C. P. CHEN. *Sugar J.*, 1967, **30**, (6), 9–13. While washing of sugar in centrifugals reduces the total ash content and total non-sugars, the decrease in the former is smaller than the drop in the latter, so that the ash:total non-sugars ratio for Peruvian raw sugar, which is already high, is increased still further. Different materials used as footing in pan boiling will have various effects on reduction of the ratio. A reduction in ash:total non-sugars, total ash content and crystal colour is obtainable when refinery syrup is used for graining and where the refinery uses carbonatation. The absolute ash content of the sugar is considered a more suitable criterion than the ash: total non-sugars (or ash:total reducing sugar) ratios as laid down by the American Sugar Company.

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Modification of the Silin method for determination of the technological quality of sugar beet. J. RÁCIK. *Listy Cukr.*, 1967, **83**, 243–248.—Methods of determining beet quality are critically surveyed and details given of a modification of the Silin laboratory method involving processing of the press juice to crystal sugar. It is considered justifiable to process samples to molasses stage, using the melassigenic coefficients of the non-sugars in the press juice as criteria.

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Some diagrams for aqueous sugar solutions. T. BALOH. *Zucker*, 1967, **20**, 668–679.—Graphs are presented for a number of physical properties of aqueous sugar solutions at different concentrations and temperatures. The properties include density, specific heat, dynamic and kinematic viscosity, heat transfer, surface tension and the Prandtl number. A nomogram is given for determining the Reynolds number, and another diagram gives the ratio between heat transfer from wall to solution and from wall to water; this permits evaluation of the drop in heat transfer when evaporating sugar solutions compared with water.

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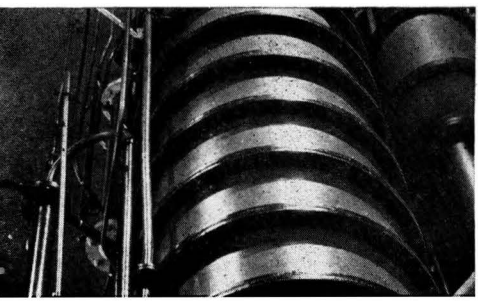
Formation and composition of beet molasses. VI. Other applications and properties of the saturation function. G. VAVRINECZ. *Zeitsch. Zuckerind.*, 1967, **92**, 630–634.—The law of mixtures is applied to mixtures of melassigenic substances composed of several compounds. The fall in the melassigenic capacity is calculated for two types of mixtures of non-sucrose fractions: (i) the salt and nitrogen fractions found by SCHNEIDER *et al.*[1], and (ii) the salt and non-salt fractions studied by FRIML[2]. Mathematical expressions derived by various authors for the saturation function are discussed and a mathematical method presented for calculating the three coefficients (*b*, *c*, *m*) in the exponential equation[3]. Guidance is given on the carrying out of saturation tests and the application of the results to forecasts of molasses yield and composition is briefly considered.

* * *

Enzymatic determination of glutamic acid in sugar factory products. M. FRIML and B. TICHÁ. *Listy Cukr.*, 1967, **83**, 275–279.—Tests are described in which glutamic acid in beet molasses was determined by enzymatic decarboxylation of the acid to γ-aminobutyric acid by means of a preparation cultured with *Clostridium welchii*. The presence of aspartic acid did not affect the determination. In parallel tests the coefficient of variation was 3·6%. The glutamic acid content in molasses from different sources in Czechoslovakia averaged 0·121% (maximum 0·213%), molasses from stored or deteriorated beet containing much less glutamic acid than molasses from healthy beet.

[1] *I.S.J.*, 1963, **65**, 87.
[2] *ibid.*, 1961, **63**, 317–318.
[3] *ibid.*, 1965, **67**, 250.



By-products

Feeding lactating dairy cows concentrates and sugar cane bagasse as compared with a conventional ration. P. F. RANDEL. *J. Agric.* (Univ. Puerto Rico), 1966, **50**, (4), 255–269.—The conventional ration in Puerto Rico consists largely of forage. No forage was given in this experiment. Overall feed costs per 100 lb milk were $3.67 with concentrates and bagasse as against $2.61 with the control or conventional feed. It was thought the bagasse-concentrates ration may have induced slightly greater incidence of mastitis, sporadic occurrence of diarrhoea, stiff joints and excessive drinking and urination.

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Feeding value of beet pulp in concentrate rations. R. J. BURT. *Brit. Sugar Beet Rev.*, 1967, **36**, 38, 41, 50.—Although there is great similarity between the digestible organic matter content in beet pulp and in barley, with higher fibre contents (both digestible and total) in the pulp, the starch equivalent value commonly given for beet pulp is only 58·3 compared with 71 for barley. However, investigations have shown that the feeding value of pulp is higher than the starch equivalent value indicates, and certain physical characteristics of pulp apparently responsible for the discrepancy are discussed.

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Possibilities of using sugar beet as fodder. A. DOBROWOLNY. *Gaz. Cukr.*, 1967, **75**, 200–203.—The use of beet, beet leaves, pulp, molasses and sugar as animal fodder is discussed.

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Citric acid production. J. MEYRATH. *Process Biochem.*, 1967, **2**, (10), 25–27, 56.—The historical development of citric acid fermentation is surveyed and certain aspects of the process are considered. A balance sheet for matter and energy based on the Embden-Meyerhof (EM) pathway is drawn up, providing a simplified, ideal scheme for citric acid synthesis from a hexose (glucose) using *Aspergillus niger*. The quantity of sugar transformed into mycelium is considered in deriving an equation for an overall balance, showing that the highest theoretical acid yield with hexose as carbon source is 85% compared with 89·8% yield from sucrose. Higher yields than those quoted in the literature are attributed to a lower velocity of sugar conversion to citric acid, and the establishment of optimum conditions based on yield *vs.* velocity is called for. The type of problem facing the citric acid manufacturer in his attempt to increase yield is briefly discussed.

Studies in the chemical activities of micro-organisms. VI. Gluconic acid from gur and molasses. M. I. D. CHUGHTAI and A. U. SHAH. *Pakistan J. Sci. Res.*, 1966, **18**, 75–82; through *S.I.A.*, 1967, **29**, Abs. 618. *Aspergillus niger* strains NRRL-3 and NRRL-372, *Penicillium chrysogenum* and *P. purpurogenum* var. *rubrisclerotium* were cultured on solutions of glucose and hydrolysed or unhydrolysed sucrose, gur or molasses, containing 10–20% of sugars as reducing sugars and added nutrients, at pH 6·9. Maximum yields of gluconic acid were obtained with *A. niger* strain NRRL-3; on the respective media they were 62%, 60%, 47% and 37% based on sucrose consumed. Hydrolysis of the sucrose and gur solutions increased the yield obtainable. Hydrolysis of molasses did not increase the yield.

* * *

Utilization of sugar in yeast manufacture. S. E. KHARIN and L. K. GROMKOVSKII. *Izv. Vuzov, Pishch. Tekhnol.*, 1966, (5), 65–68; through *S.I.A.*, 1967, **29**, Abs. 602. The culture of yeast on a 20°Bx clarified molasses medium with superphosphate is described, with a diagram of the apparatus. The yields of CO_2, ethanol, yeast and unchanged sugar from six experiments are tabulated as weights and as % of initial sugar content, assessed by the carbon balance method given in the text. Since the individual percentages add up to more than 100, it is concluded that the yeast assimilates carbon from substances other than sugar in the molasses. The low yield of yeast is explained by absence of growth factors.

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Investigations of food yeast culture in media containing increasing concentrations of sugars and non-sugars (molasses and vinasse). S. LABENDZIŃSKI. *Prace Inst. Lab. Badaw. Przem. Spoz.*, 1966, **16**, (3), 117–127; through *S.I.A.*, 1967, **29**, Abs. 603.—*Torulopsis utilis* was cultured in media containing varying proportions of molasses and vinasse. Yeast, initially cultured in molasses, adapted to the varying media, and the best yields were obtained when the ratio of sugars to total organic substance was 0·2–0·3 g/g (i.e. at molasses: vinasse dry weight ratios of 5:25 to 12·5:17·5).

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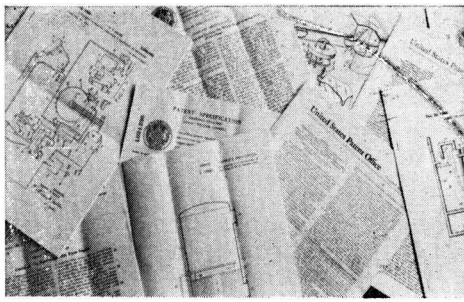
Technological observation of betaine as one of (the) by-product substances from (the) beet sugar industry. S. IWASHINA. *Proc. Research Soc. Japan Sugar Refineries Tech.*, 1967, **18**, 60–83.—The literature on betaine recovery from beet molasses is reviewed with 430 references.

Patents



UNITED KINGDOM

Removal of non-sugars from syrups. THE COLONIAL SUGAR REFINING CO. LTD., of Sydney, N.S.W., Australia. **1,093,917.** 18th August 1965; 6th December 1967.—See U.S. Patent 3,340,093[1].

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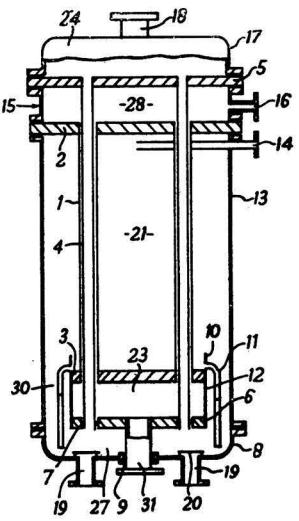
Juice heater. SOC. FIVES LILLE-CAIL, of Paris 8e, France. **1,097,599.** 24th December 1964; 3rd January 1968.

The heater enbodies a cylindrical casing 13 which is flanged to the bottom portion 8. Above the flanged upper end of the casing is a tube plate 2, a flanged ring 15, a second tube plate 5 and the flanged upper portion 17. Tubes 1 are fitted between the tube plate 2 and a lower tube plate 3 which is of smaller diameter than the casing. Inside tubes 1 are a second series of tubes 4 which extend between the upper tube plate 5 and a lower tube plate 6. To allow for expansion, the lower ends of tubes 4 are not firmly



fixed into the tube plate 6 but are held by means of toroidal seals 7. A cylindrical wall 12 surrounds and connects the two lower tube plates 3 and 6 and may be extended upwards as a lip 10 from which lead overflow tubes 11 for discharge of condensate. An entry port 16 is provided in ring 15 and an exit port 31 from the tube plate 6 to outside the casing, seals 9 being provided.

An entry port for steam 18 is provided in the upper part 17 of the heater as well as condensate discharge ports 19 provided with screens 20. The casing also has a vent 14 for incondensable gases. Steam is admitted through port 18 into chamber 24 and passes downwards through tubes 4 into chamber 27 from which it rises by way of annular chamber 30 to chamber 21 where it surrounds tubes 1. Condensate formed collects on the top of plate 3 and overflows through pipes 11 to join the remaining condensate at the bottom of the casing before it is discharged through ports 19. Juice is admitted through port 16 into chamber 28 from which it travels downwards through the annular passages between tubes 1 and 4 to reach chamber 23 from which it is withdrawn through port 31.

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Mounting for continuous centrifugal basket. THE WESTERN STATES MACHINE CO., of Hamilton, Ohio, U.S.A. **1,101,801.** 27th January 1965; 31st January 1968.—See U.S. Patent 3,333,707[2].

* * *

Continuous centrifugal. THE WESTERN STATES MACHINE CO., of Hamilton, Ohio, U.S.A. **1,101,802.** 20th October 1965; 31st January 1968.

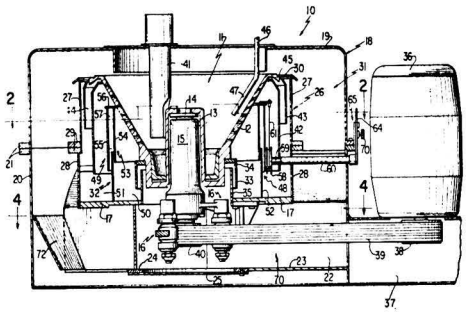
Massecuite delivered to the bottom of the conical basket 12 of the continuous centrifugal is separated into green syrup and crystals the latter passing upwards and over the rim into the chamber 31. During its transit across the upper parts of the screen the sugar is washed with liquid supplied through pipe 46 and manifold 47. In order to keep the green syrup and wash liquid separate, the fluid receiving chamber is divided into two concentric chambers defined by inner partition 33, outer partition 26 and intermediate partition 48.

The last comprises a lower fixed cylinder plate 52 above which are two cylindrical plates 54, 55 joined at the top by a ring 56 so that they form an annular chamber 57 into which plate 52 fits. Between the top and bottom of the outer plate 55 is fastened a cable which passes round a pulley 58 mounted on a shaft 59 which passes through suitable journals to

[1] *I.S.J.*, 1968, **70**, 285.
[2] *ibid.* 283.

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

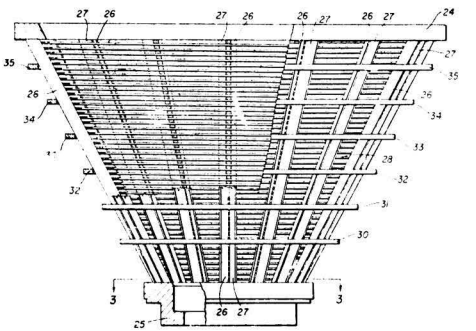
the outside of the machine where it is connected to a quadrant lever 64 held by a locking screw 70. By adjustment of the lever the position of the upper edge



56 of the intermediate partition 48 is brought to the level necessary for the required separation of green syrup and wash liquid.

* * *

Centrifugal basket. AMERICAN FACTORS ASSOCIATES LTD., of Honolulu, Hawaii, U.S.A. **1,102,311.** 11th January, 1966; 7th February 1968.—The basket includes a bottom ring 25 and a top ring 24 secured together by a number of double ribs 26, 27 which form V-shaped cross sections and are held together by rings 30–35. A flat wire spiral cone-shaped basket



28 is welded to each of the ribs at the internal apex of its cross-section. The bottom ring is drilled and tapped for attachment to the rotor, while the top ring may also be drilled and tapped for attachment of shield rings, etc.

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Production of L-glutamic acid by fermentation. ASAHI KASEI KOGYO K.K., of Osaka, Japan. **1,101,926.** 7th December 1965; 7th February 1968.—Bacteria of the family Corynebacteriacea (*Corynebacteria melassecola* ATCC 17965 or 17966, *C. lilium* NRRL B-2243, *C. callunae* NRRL B 2244, *C. acetoacidophilum* ATCC 13870, *Microbacterium ammoniaphilum* ATCC 15354 or *M. flavum* var. *glutamicum* ATCC 13693) are inoculated into a culture medium having beet molasses (and glucose) as the principal carbohydrate source and the medium cultured [at 28–37°C and at pH 6–9 (7–8·5)] under aerobic conditions and in the presence of (0·01–0·15 g/dl of) oleic acid or a salt or ester of oleic acid (polyoxyethylene mono-oleate or polyoxyethylene sorbitan mono-oleate), adding (0·01–0·06 g/dl of) an alkylamine (having 10–18 carbon atoms) or its acid addition salt to the medium at an appropriate time between the middle and final stages of the logarithmic growth of the bacteria, when the optical density of the medium is between 0·40 and 0·80 after deducting the figure obtained in a blank test from the measured value, continuing the fermentation until L-glutamic acid is accumulated in the medium, and then recovering it.

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Beet harvester. S. A. SOCIETER, of Orp-le-Grand, Belgium. **1,013,220.** 12th October 1965; 14th February 1968.

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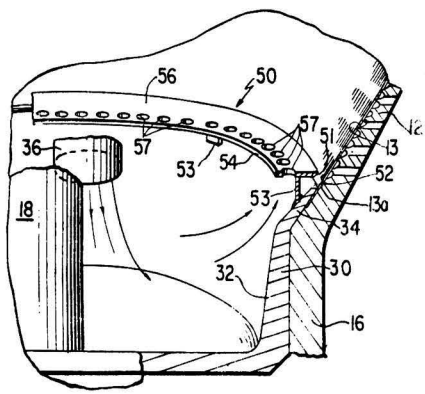
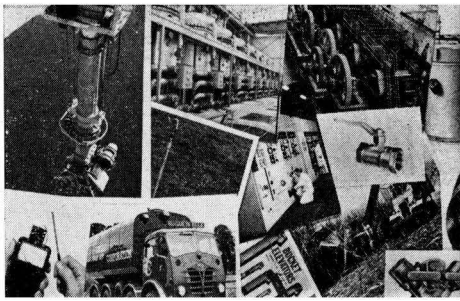
Continuous centrifugal basket. THE WESTERN STATES MACHINE CO., of Hamilton, Ohio, U.S.A. **1,103,794.** 20th October 1965; 21st February 1968.

In order to strain oversize solids from the feed material passing to the screen 13 of the centrifugal, a straining ring 50 is fixed within the basket by mounting it on supporting legs 53 so that its outer edge 51 is spaced from the basket wall 52 by a limited distance,



e.g. 5/32 inch, sufficient to allow a normal flow of feed, but small enough to prevent passage of oversize solids. Towards the inner edge of the ring is a series of circular holes 57 so that, when oversize particles have collected under the outer edge of the ring, the feed material can flow over them and on to the screen through the holes 57.

Trade notices



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DDS cane diffuser for Brazil. A/S De Danske Sukkerfabrikker, Langebrogade 5, Copenhagen K, Denmark.

In January the first cane diffuser in the Brazilian sugar industry was commissioned at Usina São Francisco in the state of Rio Grande do Norte. The plant was delivered during the 1967/68 milling season and erected and integrated with the existing Cail milling tandem, bagasse from No. 2 mill of the tandem being delivered to a conveyor which takes it outside the mill house to the adjacent diffuser. Bagasse from the diffuser is returned to the mill house by an elevator where it is dewatered by passage through the remaining two mills. Juice from these last mills is returned by chokeless pumps to the diffuser and needs no screening or other treatment. Bagacillo from the primary juice is added to the bagasse entering the second mill.

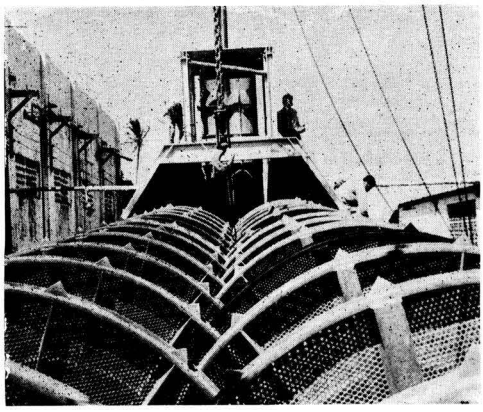

Fig. 1. The twin scrolls visible before fitting of the diffuser cover

During the period in which the diffuser was able to operate before the end of crop, throughput was limited by the roller condition of the 3rd mill to the 45 t.c.h. of the tandem alone. On regrooving of these rollers, it will be possible to attain 60 t.c.h. Even in this short time, however, it was possible to attain 1·1% pol and 45·3% water in bagasse compared with 4·3% pol and 47·6% water with milling alone. Diffuser operation was satisfactory from the start-up of the installation. The plant is fully automated with temperature and juice level controlled and recorded and the water flow controlled in proportion to the amount of 2nd mill bagasse entering the diffuser via a continuous belt weigher.

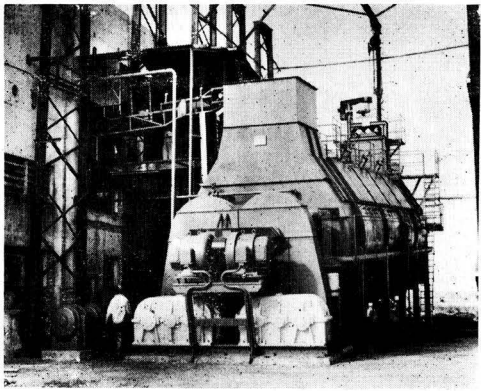

Fig. 2. The completed diffuser

Five DDS cane diffuser installations are now in operation in various parts of the world, and a large number have been ordered for delivery during the next two years.

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PUBLICATIONS RECEIVED

"FMB VARIATOR" VARIABLE-SPEED DRIVES. A. Friedr. Flender & Co., 4290 Bocholt, Postfach 139, Germany; Flender (U.K.) Ltd., Treefield Industrial Estate, Gildersome, Morley, Leeds, Yorks., England.

Catalogue W.32 gives details of the company's newly designed "FMB Variator" infinitely variable-speed positive drive units, which are supplied in a number of different designs. The basic unit can be supplied complete and ready for "plugging-in" to the appropriate machine. All structural elements, including speed control, speed indication, chain tension and oil level monitoring units, are combined in a compact "ES" slide-in unit which is a narrow side case acting as the core of every FMB unit.

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Beet sugar factory for Iran.—BMA have received an order for the design and supply of a complete white sugar factory to be built near Eghlid in Iran. The factory will have a daily slicing capacity of 1500 tons of beet extendible to 3000 tons/day.

European beet sugar production estimates[1]

	1968/69	1967/68	1966/67
	metric tons, raw value		
Western Europe			
Belgium/Luxembourg	610,000	578,744	413,781
France	2,560,000	1,766,250	1,825,082
Germany, West	2,125,000	2,104,559	1,955,078
Holland	710,000	772,221	586,222
Italy	1,340,000	1,673,887	1,395,776
Total EEC	*7,345,000*	*6,895,661*	*6,175,939*
Austria	308,000	307,691	363,180
Denmark	326,000	329,474	316,893
Finland	57,200	63,740	67,162
Greece	106,000	122,822	116,950
Ireland	154,560	145,487	111,492
Spain	630,000	599,657	585,493
Sweden	270,000	264,999	227,730
Switzerland	70,000	65,464	59,457
Turkey	630,000	727,908	644,843
UK	1,000,000	985,800	955,831
Yugoslavia	425,000	525,000	588,392
Total Western Europe	11,321,760	11,033,703	10,213,362
Increase	288,057 (2·61%)	820,341 (8·03%)	477,790 (4·91%)
Eastern Europe			
Albania	16,000	15,555	16,665
Bulgaria	260,000	285,000	295,000
Czechoslovakia	815,000	823,000	853,000
Germany, East	570,000	566,666	567,777
Hungary	439,000	451,110	473,332
Poland	1,650,000	1,913,100	1,683,700
Rumania	415,000	460,000	518,804
USSR	9,925,000	10,665,000	9,165,000
Total Eastern Europe	14,090,000	15,179,431	13,573,278
Increase or decrease	—1,089,431 (7·18%)	+1,606,153 (11·83%)	+178,795 (1·33%)
TOTAL EUROPE	25,411,760	26,213,134	23,786,640
Increase or decrease	—801,374 (3·06%)	+2,426,494 (10·2%)	+656,585 (2·84%)

Brevities

Brazil by-products utilization[2].—Through its technical branch the Instituto do Açúcar e do Alcool is developing a programme which envisages the complete use of sugar cane by the utilization of its by-products. The Institute contemplates establishing, in the cane-producing areas, industries for the manufacture of wallboards and furfural from bagasse. The budget for the entire programme is estimated at $200,000.

* * *

New Czechoslovakian sugar factory[3].—A new sugar factory is under construction in Dunejska Streda. It will cost 260 million crowns and is scheduled to be put into operation in 1969.

* * *

Brazil sales of invert molasses to Japan[4].—Brazil has sold 200,000 tons of high-test invert molasses for shipment to Japan during September 1968/June 1969. This quantity is equivalent to about 120,000 tons of raw sugar. The Export Director of the Brazilian Institute is reported to have stated that Brazil is now considering converting stocks of raws to crystal sugar for domestic consumption in some parts of the country where cane supplies are much reduced following drought.

* * *

Mechanical beet harvesting in the USSR[5].—Beet harvesting in the Ukraine is now in full swing, some 26,000 combines lifting the beets from 1,760,000 ha. It is planned to lift 97% of the crop with mechanical harvesters.

Sugar refinery in Costa Rica[6].—The first sugar refinery in Costa Rica, which is owned by the Cooperativa Agrícola Industrial Victoria de Grecia, began production at the end of June. The refinery, which cost 4 million colones (£220,000), has an annual capacity of 20,000 metric tons, enough to supply the domestic market and leave a surplus for export.

* * *

Egypt sugar factory expansion[7].—East German concerns are to supply boilers and water treatment plant for further extension of Kous sugar factory[8] which is designed finally to produce 150,000 tons of sugar and 67,000 tons of molasses annually. The plant to be supplied will cost one-third of the total costs of the sugar factory.

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Bagasse paper pulp study in Peru[9].—The UN Industrial Development Organization is to carry out a feasibility study in Chiclayo, at a cost of $72,000, for the building of a paper pulp factory which will use bagasse as raw material.

[1] F. O. Licht, *International Sugar Rpt.*, 1968, **100**, (27), 1–2.
[2] *Sugar y Azúcar*, 1968, **63**, (8), 35.
[3] F. O. Licht, *International Sugar Rpt.*, 1968, **100**, (25), 5.
[4] C. Czarnikow Ltd., *Sugar Review.*, 1968, (882), 165.
[5] *Izvestiya*, 5th September 1968.
[6] *Bank of London & S. America Review*, 1968, **2**, 460.
[7] *Die Lebensmittelind.*, 1968, **15**, 273.
[8] *I.S.J.*, 1968, **70**, 224.
[9] *Bank of London & S. America Review*, 1968, **2**, 475.

Brevities

ICUMSA Proceedings.—The Proceedings of the 14th Session of ICUMSA, held in Copenhagen in 1966, have been published and copies are available at a price of 50 French francs or the equivalent, which should be sent to the Treasurer of the Commission, Mr. N. J. LOFT, A/S De danske Sukkerfabrikker, Langebrogade 5, Copenhagen K, Denmark.

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Israel sugar situation[1].—During the 1967 campaign the sugar beet crop in Israel totalled 293,000 metric tons, from which the two factories at Kiryat Gat and Afula produced 33,609 tons, raw value, which compares with 39,527 tons produced in the 1966 campaign. A crop of 280,000 tons of beet is expected from the 1968 crop. Sugar imports, mostly from East European countries, were less in 1967 than in the previous year, while sugar consumption reached nearly 123,000 tons, compared with 115,218 tons in 1966. Consequently stocks were reduced by nearly 20,000 tons between the beginning and end of the year.

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The late Sir A. Cuke.—The death of Sir ARCHIBALD CUKE, C.B.E., a leading West Indies sugar economist, occurred recently. He was one of the inventors of the price formula in the Commonwealth Sugar Agreement and had been a member of numerous Commissions of Inquiry throughout the Caribbean. He was a member of the UK delegation to the 1956 International Sugar Conference and had served on the West Indies Federal Senate and in the Barbados legislative and executive councils.

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UK molasses import company.—In September two deep water terminals at Hull and Liverpool, costing £250,000 each, were officially opened by International Molasses Ltd. This company was formed two years ago and is 70% owned by National Molasses Company of Pennsylvania, a subsidiary of C. Brewer & Co., of Hawaii, and 30% by Louis Dreyfus & Co. Ltd. of London, a subsidiary of Louis Dreyfus S.A. of France, one of the world's leading grain shippers and traders[2]. The new company believes that the expanding and highly efficient and advanced British agriculture offers scope for further expansion of the molasses-compounded animal feedstuffs market, and that by use of up-to-date equipment and larger-sized loads, International Molasses Ltd. will be able to compete with United Molasses Co. Ltd., the Tate & Lyle Ltd. subsidiary which has hitherto held a virtual monopoly position. Further terminals are planned in Scotland and the south of England.

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Venezuela sugar production[3].—Sugar outturn in Venezuela declined from 350,000 tons in 1966 to 330,000 tons in 1967. The Corporación Venezolana de Fomento is to reopen the Cariaco sugar mill which has been closed for some years. The sum of 14,300,000 bolívares (£1,300,000) is to be spent on new equipment and the mill will begin production at full capacity (3250 t.c.d.) next year.

* * *

Philippines sugar factory proposal[4].—Batangas Sugar Central Inc. has been formed to build a new sugar factory at Balayan, Batangas, Philippines. The 85 million-peso central is to have a capacity of 4000 t.c.d. and will operate with a diffuser. Materials and equipment are to be supplied by Marubeni-Iida of Japan, with construction work by Honiron Philippines Inc. The new central is intended to operate from January 1969.

South India Sugarcane and Sugar Technologists' Association. A new technologists' association was formed in July 1967 to serve as a regional group for advancing cane and sugar technology in the States of Andhra, Kerala, Madras, Mysore, Orissa and Pondicherry. It is affiliated to the Sugar Technologists' Association of India. The President is Shri D. C. KOTHARI and the Secretary Shri G. RAMACHANDRAN, c/o New Horizon Sugar Mills (P) Ltd., P.O. Kandamangalam, Pondicherry, India.

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US domestic cane area[5].—Following representations from Congressmen for the areas affected, the 20% cut in the domestic sugar cane area announced in August[6] was reduced to 15% on the 18th September. A total of 417,070 acres will now be permitted next year as against the present limit of 490,670 acres.

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US sugar imports against 1969 quotas.—On the 27th September the US Department of Agriculture announced that 75,000 tons of 1969 quota raws would be permitted entry from then onwards for refining and storage in bond north of Hatteras[7]. Eligible suppliers must have fulfilled their 1968 US entitlements. This action resulted in little change so far as quotations on the US domestic market were concerned, and on the 9th October the quantity of imports permitted was raised to 150,000 tons[8].

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World sugar balance.—On the 20th September, F. O. Licht K.G. published their fourth estimate of the world sugar balance in 1967/68, with comparisons with previous years[9]. Details appear below, tabulated for campaign years of September to August 1967/68 and 1966/67.

	1967/68	1966/67
	—— (*metric tons, raw value*——	
Production	66,756,561	65,820,090
Imports	21,909,202	21,121,219
Initial stocks.....	18,517,522	18,650,042
Total	107,183,285	105,591,351
Final stocks	17,898,216	18,517,522
Deliveries	89,285,069	87,073,829
Exports	21,783,744	21,421,271
Consumption	67,501,325	65,652,558

The figures are more unfavourable than the previous estimates made at the end of July[10], largely owing to a reduction in the consumption increase, estimated earlier at 3·83% and now at 2·82%. This 1% difference—a full quarter of the average rate of consumption increase for many years—results from a drop in consumption in India where the sugar crop had been very much reduced. The world stock figure is increased accordingly, and the shortfall in production, compared with consumption, is reduced to only 600,000 tons, although this is, of course, still on the right side so far as reducing stocks is concerned.

[1] F. O. Licht, *International Sugar Rpt.*, 1968, **100**, (25), 8.
[2] *See I.S.J.*, 1967, **69**, 286.
[3] *Bank of London & S. America Review*, 1968, **2**, 479.
[4] *Sugar News*, 1968, **44**, 258.
[5] C. Czarnikow Ltd., *Sugar Review*, 1968, (884), 176.
[6] *I.S.J.*, 1968, **70**, 319.
[7] C. Czarnikow Ltd., *Sugar Review*, 1968, (886), 184.
[8] *ibid.*, (887), 188.
[9] *International Sugar Rpt.*, 1968, **100**, (26), 1.
[10] *I.S.J.*, 1968, **70**, 258.