# THE International Sugar Journal

MAY 1974

FOUNDED 1838

# Discerning people choose good company

When buyers within an industry return again and again to the same supplier for their requirements, it is logical to assume that this supplier is serving them extremely well.

Especially is this true of a company like Fletcher and Stewart which has served one single industry – Sugar – for nearly 140 years.

Time then becomes a measure of success, for no company could possibly survive such a span unless succeeding generations of buyers were convinced of its ability to serve them well.

Over the years, the name Fletcher and Stewart has become a byword in the Sugar Industry for its unique brand of personal service, integrity and technical skill in designing and manufacturing specialised plant.

No wonder its reputation is coveted throughout the World.

No wonder discerning people choose good company.

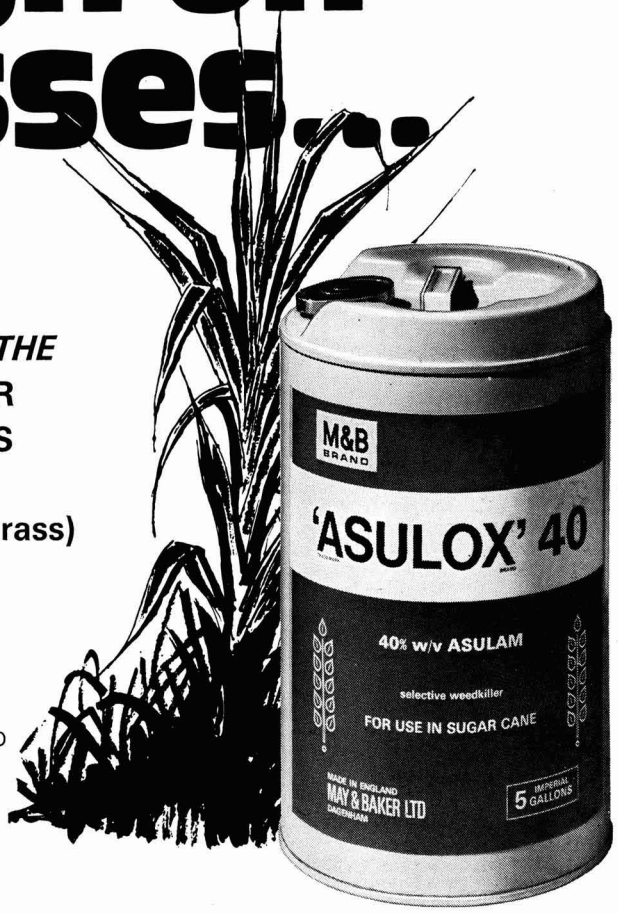
Fletcher and Stewart Limited

DERBY - ENGLAND

1966 1972

THE QUEEN'S AWARD TO INDUSTRY

# tough on grasses...

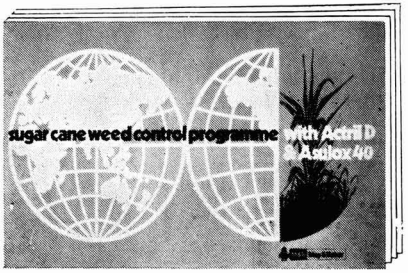



**SO USE 'ASULOX' 40 *THE* HARD-HITTING KILLER FOR TOUGH GRASSES SUCH AS *SORGHUM HALEPENSE* (johnsongrass) AND *PANICUM PURPURASCENS.***

. . . and the perfect partner for 'ACTRIL' D in a complete weed-control programme for rapid knockdown of the toughest broad-leaved weeds.

# ...gentle on cane

*SEND FOR FULL DETAILS OF THESE OUTSTANDING WEEDKILLERS NOW!*

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HA 4676

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PLEASE SEND INFORMATION ON 'ASULOX' 40 AND 'ACTRIL' D

Name .....

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# Only Fabcon offers complete process chemical service...

**for milling, clarification, evaporation, pan boiling, crystallization, centrifuging, and boiler water treatment. To assure increased sugar recovery and factory through-put, Fabcon's international engineers provide 1) proven application know-how, 2) follow-through evaluation of results, and 3) regular professional visits to maintain peak performance. Why don't you investigate Fabcon's complete process chemical service? Comments below are from a few of the mills already enjoying improved efficiency from this total service.**

"For the past few years we have employed Fabcon's chemicals, Zuclar, Fabcon 1-12 and Quite obtaining excellent clarification, extended evaporator operation between boil outs and superior sugar quality. Technical service and application suggestions from Fabcon were very helpful in obtaining optimum performance from these chemicals." — *Mr. Frank Barker, Jr., Valentine Sugars, Inc., Louisiana.*

"Quiero agradecerles la gentileza que han tenido en enviarme las Instrucciones Detalladas de Utilizacion de los quimicos Pan Aid Concentrado, Cane Milling Aid, Zuclar y el Tratamiento de aguas de alimentacion de las calderas, que usaremos en nuestra proxima Zafra." — *Ing. Jacinto Ponce T., Ingenio Monterosa, Nicaragua, C.A.*

"Conozco los quimicos Fabcon desde hace unos anos. El interes de que los mismos se apliquen correctamente, para obtener de ellos los mejores y mas positivos resultados, se demuestra por los consejos y recomendaciones que en forma detallada obtuvimos de los Ingenieros de Servicio de su Compania. Estamos compalcidos en esta cooperacion de ustedes." — *Ing. Juan J. Pena, Azucarera Nacional, S.A., Panama.*

"Estamos utilizando con exito desde hace varios anos los quimicos de Fabcon, entre ellos el Pan Aid Concentrado, el Fabcon 1-12, el Tratamiento de Aguas de Alimentacion de las Calderas de Vapor, y hemos observado el marcado interes por parte de ustedes que los productos rindan el maximo, lo qual se logra con las instrucciones detalladas de aplicacion que nos han dado y con el servicio que prestan." — *Ing. Gerardo Santacruz, Hacienda Juan Vinas S.A., San Jose, Costa Rica, C.A.*

"Continued usage of Fabcon's 1-12 for the third year confirmed its performance to practically double the time between evaporator boil outs. The technical service supplied by Fabcon throughout this period has been excellent and very helpful in maintaining best chemical performance." — *Mr. Wilton Roger, Glenwood Cooperative Inc., Napoleonville, Louisiana.*

"This is our second year using Fabcon 1-12. Now it is an excellent product reducing and greatly softening evaporator scaling, allowing greater evaporator throughput, and increasing operation capacity. The evaporators have not required any cleaning in the last 45 days. It also helps to increase the daily capacity of 1500 TCD to 1800 TCD with very satisfactory syrup Brix." — *Mr. Saovaraj Nitayavadhana, Supanburi Sugar Factory, Supanburi, Thailand.*

"En la aplicacion de Pan Aid Concentrado a los tachos he seguido sus indicaciones y recomendaciones de anadirlo en forma continua, en solucion, de un tambor de 55 galones, conectando la salida del mismo a las lineas de miel de entrada a los tachos. El metodo de aplicacion indicado es efectivo. Vamos a usar en la proxima Zafra otros productos de Fabcon, principalmente el Zuclar en los clarificadores de Jugo." — *Ing. Juan Chavez, La Laguna, S.A., San Salvador, El Salvador, C.A.*

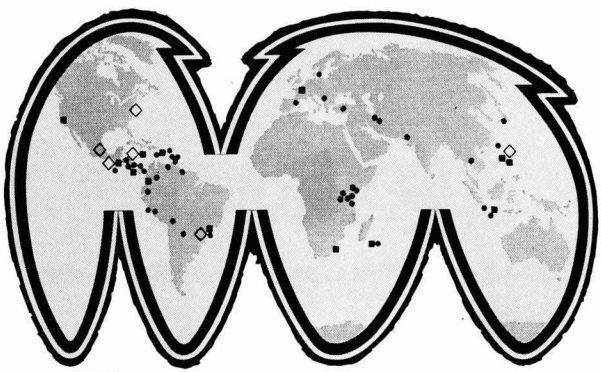
"Zuclar solved our serious clarification problem this year. We can obtain clearer juice and better filtering muds than before." — *Mr. Vitool Wongkusolkit, Mitrphol Sugar Factory Co. Ltd., Banpong/Rajburi, Thailand.*

"The Fabcon Water Treatment Program effectively keeps boilers clean with a minimum of water testing and control. In fact, the chemicals are that powerful that dosage had to be reduced more than 50% to avoid taking old scale off too rapidly." — *Mr. J. E. Stark, Caymanas Estates, Jamaica.*

"At your suggestion, following difficult crystallization of 'C' Massecuite and bad exhaustion of molasses, we experienced at the beginning of the campaign this year, we started using Pan Aid on the 1st of August at the recommended dosage in 'C' Pans and as lubricant in 'C' Crystallizers. I must say that the results obtained were very good.

"The average drop in purity from 'C' Massecuite to molasses which was 20.44, went up to 23.38 and the drop in Clerget Purity of molasses was about 3 degrees. Considering these results, the use of Pan Aid will be of current practice, in our 'C' Pans and Crystallizers, next year." — *Mr. Michel Leclezio, Societe Union, St. Aubin, Riviere Des Anguilles, Mauritius.*

■ Service Engineers ● Representatives ◇ Manufacturing Plants



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1275 COLUMBUS AVE., SAN FRANCISCO,
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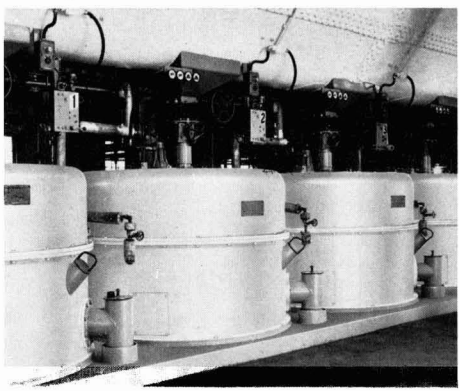
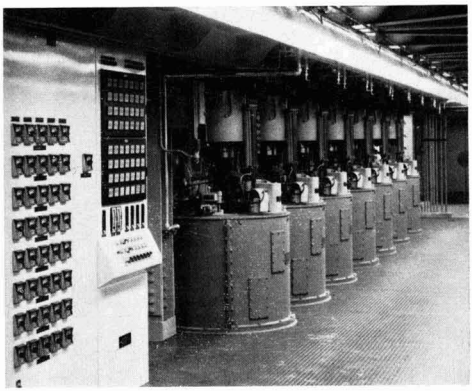
# think CENTRIFUGALS



Think continuous centrifugals . . . think Western States. Hundreds of sugar processors did and now, several years later, performance as forecast is a reality . . . minimum maintenance and maximum return on investment.

Think Western States . . . and we'll think with you. Our engineers will help you fit our centrifugals into your new or existing facilities.

# .think Western States



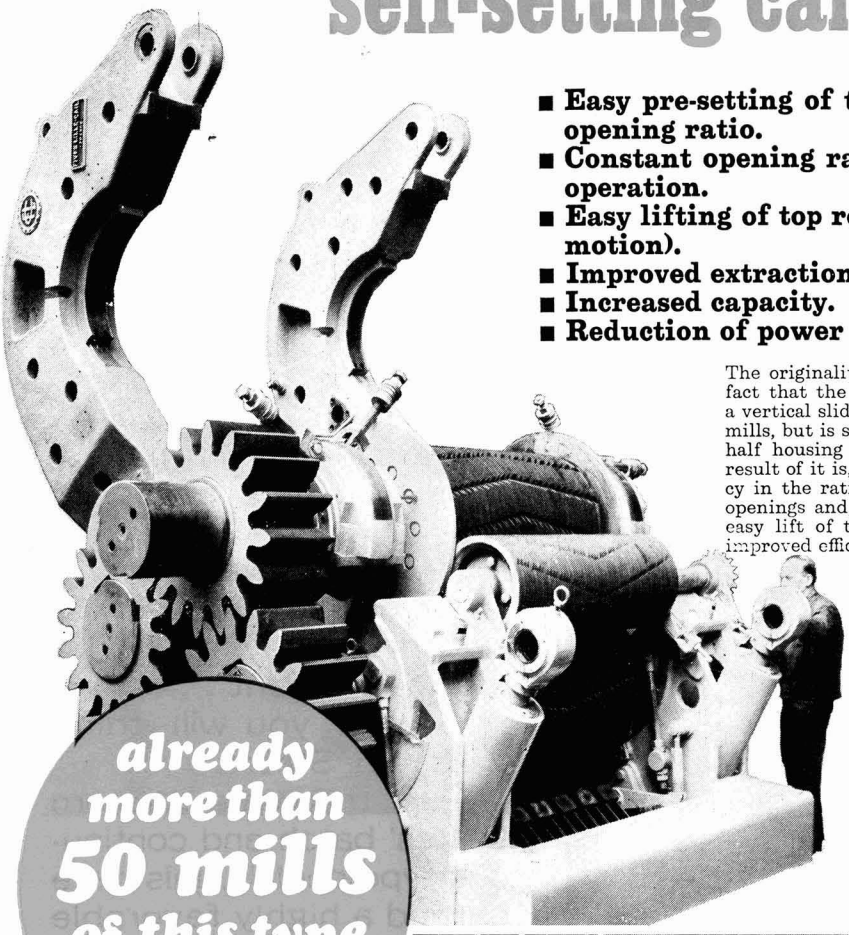
Think batch type centrifugals . . . think Western States. They are renowned for high production and minimum downtime over long periods (in some cases 30 years or more) . . . a real contribution to cost reduction.

Think productivity . . . durability . . . low maintenance . . . long life . . . engineering know-how . . . lower labor costs. . . ruggedness . . . profits . . . high return on investment . . . then, we think you will think Western States.

Over the years Western States' batch and continuous type centrifugals have earned a highly favorable reputation in all of these areas. It didn't just happen . . . our people made it happen. Our accumulated expertise is available to you. You can start the ball rolling by contacting Mr. James Coleman, General Sales Manager.

**THE WESTERN STATES MACHINE COMPANY**
**Roberts Centrifugals**
Hamilton, Ohio, 45012, U.S.A.

# with the Fives-Cail Babcock self-setting cane mill

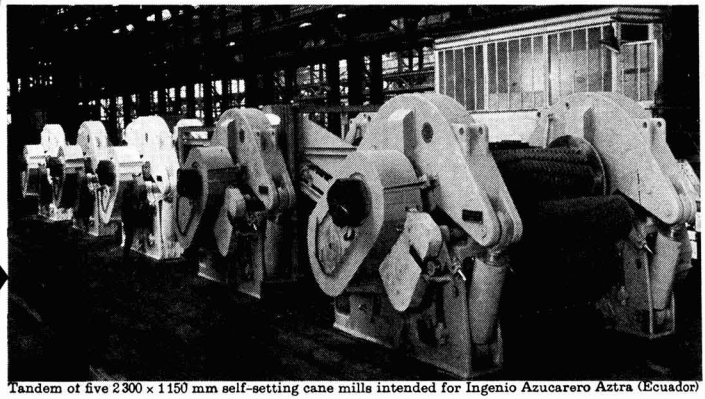


- **Easy pre-setting of the feed/discharge opening ratio.**
- **Constant opening ratio during operation.**
- **Easy lifting of top roller (rotating motion).**
- **Improved extraction.**
- **Increased capacity.**
- **Reduction of power peaks.**

The originality of this system lies in the fact that the top roller does not move in a vertical slide, as in all the conventional mills, but is supported by a hinged upper half housing forming a lever arm. The result of it is, on the one hand, a constancy in the ratio of the feed and discharge openings and, on the other hand, a very easy lift of the top roller, involving an improved efficiency.

***already more than 50 mills of this type in the world***

***THE BIGGEST IN THE WORLD***



Tandem of five 2 300 x 1 150 mm self-setting cane mills intended for Ingenio Azucarero Aztra (Ecuador)

**FIVES-CAIL BABCOCK**

**7, rue Montalivet - PARIS 8e** ☎ : 265-22.01 and 742-21.19

Cables : FIVCAIL-PARIS - Telex : FIVCAIL 65 328

# ·Quality
# ·Superior Design
# ·Service
# ·Reliability

**Four reasons why Gulf & Western specified Farrel drives at each step of its long-range expansion and modernization program.**

The Farrel-pioneered concept of individual, totally enclosed mill gearing was first introduced to South Puerto Rico Sugar Company, a predecessor of Gulf and Western Americas Corporation, in 1958 with the installation at its Central Romana factory in the Dominican Republic of a Farrel tandem comprised of six 38" x 84" 3-roll cane sugar grinding mills, each equipped with individual mill drive.

In this design, there are four reductions between turbine shaft and mill roll, two in a high-speed gear case and two in a low-speed gear case. The total ratio is divided between the two reducers to provide optimum use of materials and lubricants available to the industry. Connection between the two gear units is provided by an air-operated clutch, and the second unit is coupled to the mill by a conventional coupling. This design eliminates the need for a common foundation and makes possible a more accurate alignment to each mill. The major operational advantages are reduced power loss and infrequent lubricant replenishment maintenance.

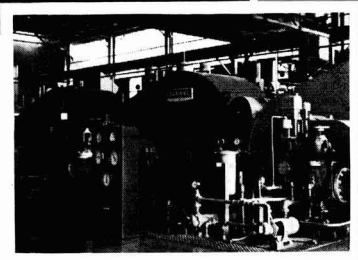
The satisfaction of Gulf & Western with the performance of the Farrel units is manifested by the fact that at each stage of its progressive modernization program, engineered since 1961 by its sugar technology consultants, Miguel Chinchilla Varona & Associates, Farrel individual mill drives have replaced previous arrangements.

In 1967, 1970 and 1971 existing mill drive arrangements at Gulf & Western's other sugar factory, Okeelanta in Florida, were progressively replaced with Farrel individual mill drives. That factory now has a total of seven.

In 1972 at Romana three Farrel individual mill drives were installed to replace a steam engine which had previously been driving three mills of the factory's second six-mill tandem, and the second steam engine is now being replaced with three additional Farrel units. At that point Gulf & Western will have a total of 19 individual Farrel drives in its two factories.

Whether you are planning a new installation, expansion or modernization, put Farrel's proven abilities to work for you. Find out for yourself why customers like Gulf & Western rely again and again on Farrel's long-standing experience and tradition of superior performance.

For additional information, write to Farrel Company Division, USM Corporation, Ansonia, Connecticut 06401, USA



Aerial view of Gulf & Western's Okeelanta sugar factory and installation picture of Farrel drives in operation at the Central Romana factory.

FARREL

Farrel Machinery Group

USM Corporation

*Plants:* Ansonia and Derby, Conn.; Rochester, N.Y.
*In Mexico:* Farrel Mexicana, S.A., Apartado Postal 48 Bis, Mexico, D.F., Mexico

A-1-36

# Ewart chains for the sugar industry

From their wide range, Ewart offers Sugar Mill chains specially developed for durability, including:

**STEEL CHAINS:** In heat treated alloy steels with hardened precision-ground pins and bushes. This series includes the EWART Carrier Outboard Roller Assembly: COBRA

**STAINLESS STEEL CHAINS:** Shell moulded links in stainless steel are offered for severe corrosive conditions.

**MALLEABLE CHAINS:** Heat-treated Pearlitic malleable with alternative metals of increased tensile strength and abrasion resistance to suit specific environments.

**All three types of chains are available with hardened stainless steel pins (and bushes).**

Write now for detailed literature to

## EWART CHAINBELT CO. LTD.

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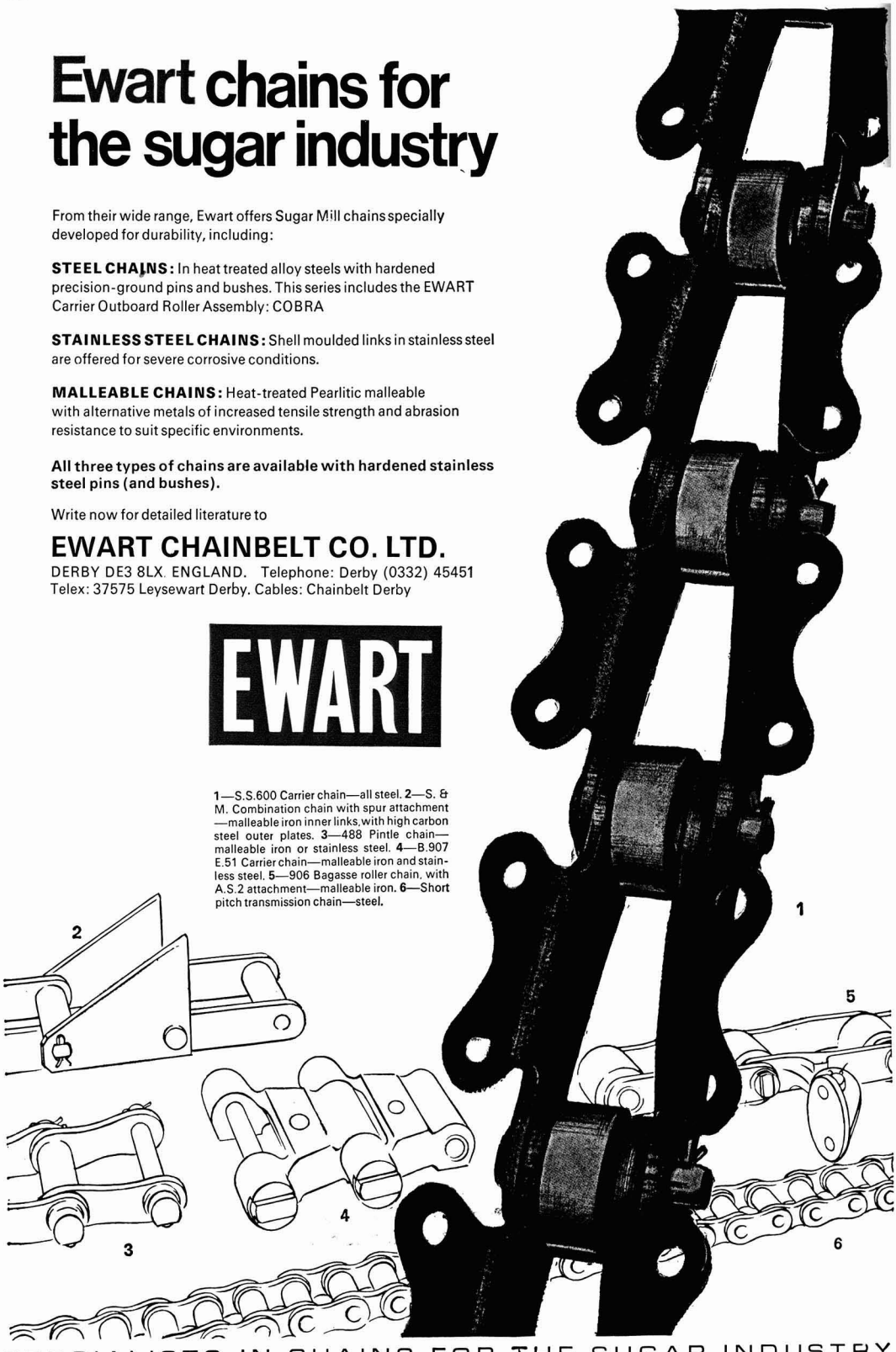
**EWART**

**1**—S.S.600 Carrier chain—all steel. **2**—S. & M. Combination chain with spur attachment—malleable iron inner links with high carbon steel outer plates. **3**—488 Pintle chain—malleable iron or stainless steel. **4**—B.907 E.51 Carrier chain—malleable iron and stainless steel. **5**—906 Bagasse roller chain, with A.S.2 attachment—malleable iron. **6**—Short pitch transmission chain—steel.



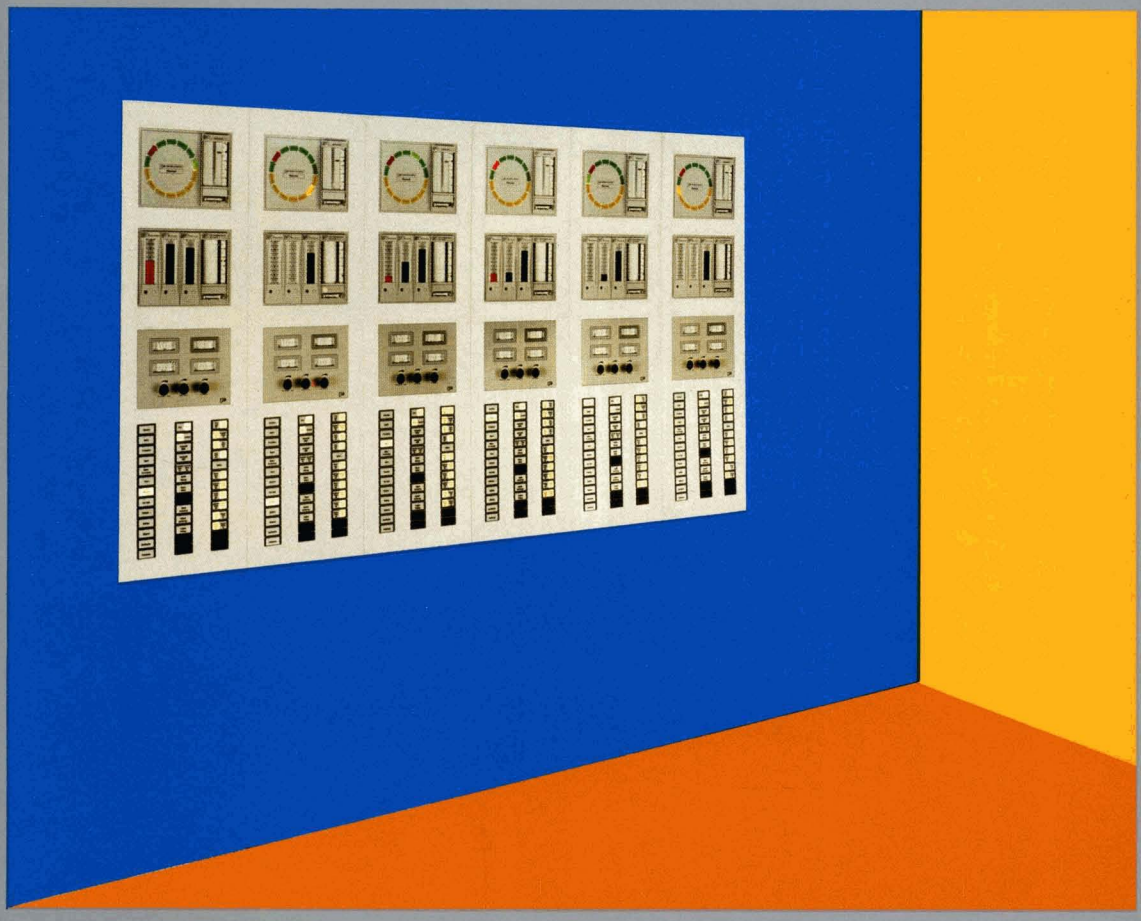

SPECIALISTS IN CHAINS FOR THE SUGAR INDUSTRY

FISCHER & PORTER

# RHEOMETER-RHEOSYST

## Automatic Vacuum Pan Control System

### Successful and approved



## Design features

Optimum coverage of the complex measurement value by the Rheometer process transmitter from seeding through strike end. Highest sensitivity at the beginning of measurement, thus assuring precise seeding point determination.

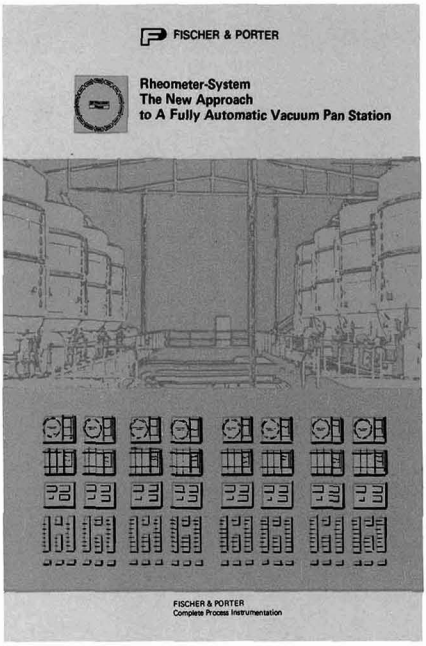
Control process adjustment by signal linkage via programmable computing circuits. Applicable to all products by coverage of all parameters.

Fully automatic cycle faciliates operations and assures uniform strikes.

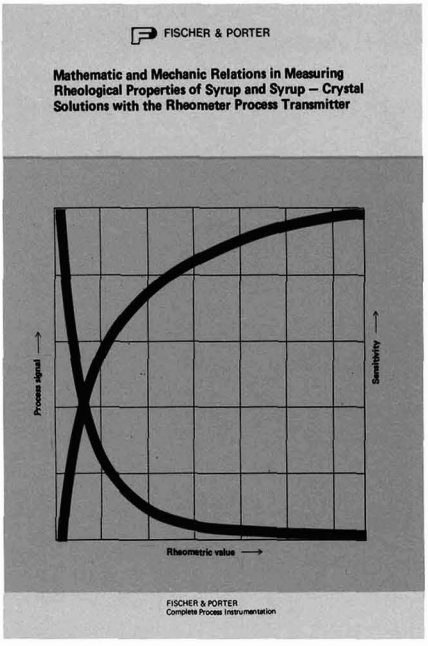
High operating reliabilty results in excellent crystal quality and improved crystal yield.

# Available literature

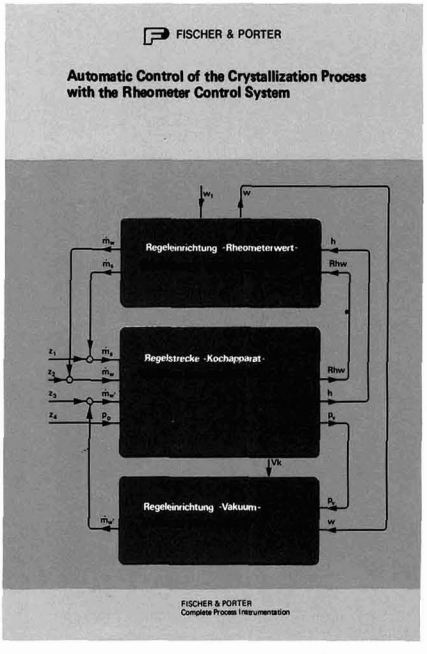
Will be mailed free upon request



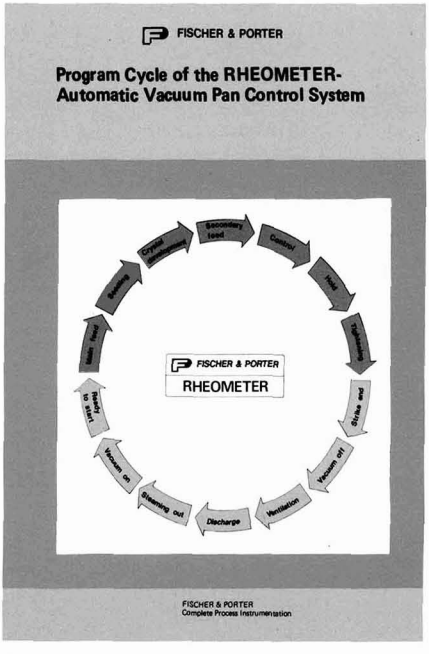

**Rheometer-System**
**The New Approach**
**to A Fully Automatic Vacuum Pan Station**




**Mathematic and Mechanic Relations**
**in Measuring Rheological Properties**
**of Syrup and Syrup-Chrystal Solutions**
**with the Rheometer Process Transmitter**




**Automatic Control of the Crystallization Process**
**with the Rheometer Control System**




**Program Cycle of the RHEOMETER-**
**Automatic Vacuum Pan Control System**

In printing – advance publication in
"Zeitschrift für die Zuckerinstustrie"

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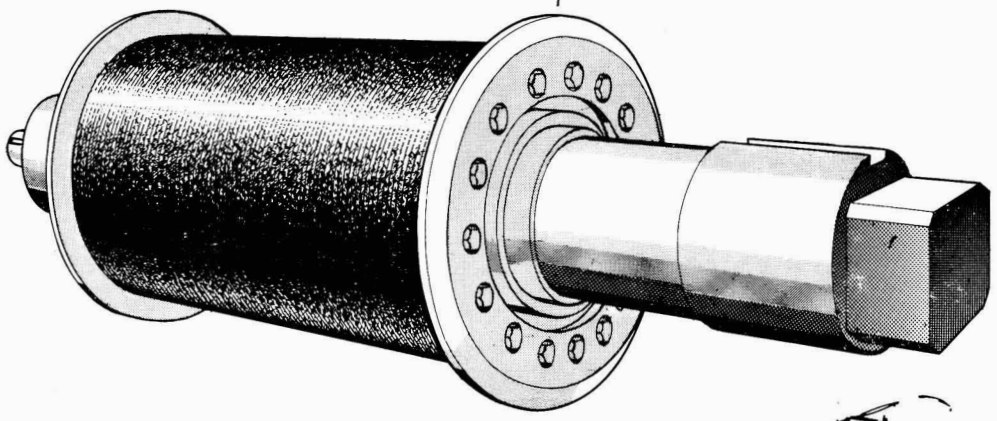
FISCHER & PORTER

FISCHER & PORTER GMBH

# What is 'GRANO'?

Enlarged view of the surface of a 'GRANO' casting



'Grano' is a hard open grained material with a rough surface to facilitate good cane feeding and ensure a high milling performance throughout the life of the shell.

'Grano' is a special metal from which our sugar mill roller shells are cast.

All A.F.Craig & Co. Ltd. roller shells are cast in our own foundry where the control of the chemical composition and method of casting is under the rigid and close supervision of our metallurgist which ensures a consistent grade of metal in every roller shell produced.

THE METALLURGICAL DEPARTMENT IS PART OF OUR COMPREHENSIVE SERVICE TO THE SUGAR INDUSTRY TO WHICH WE SUPPLY A WIDE VARIETY OF SUGAR FACTORY MACHINERY.

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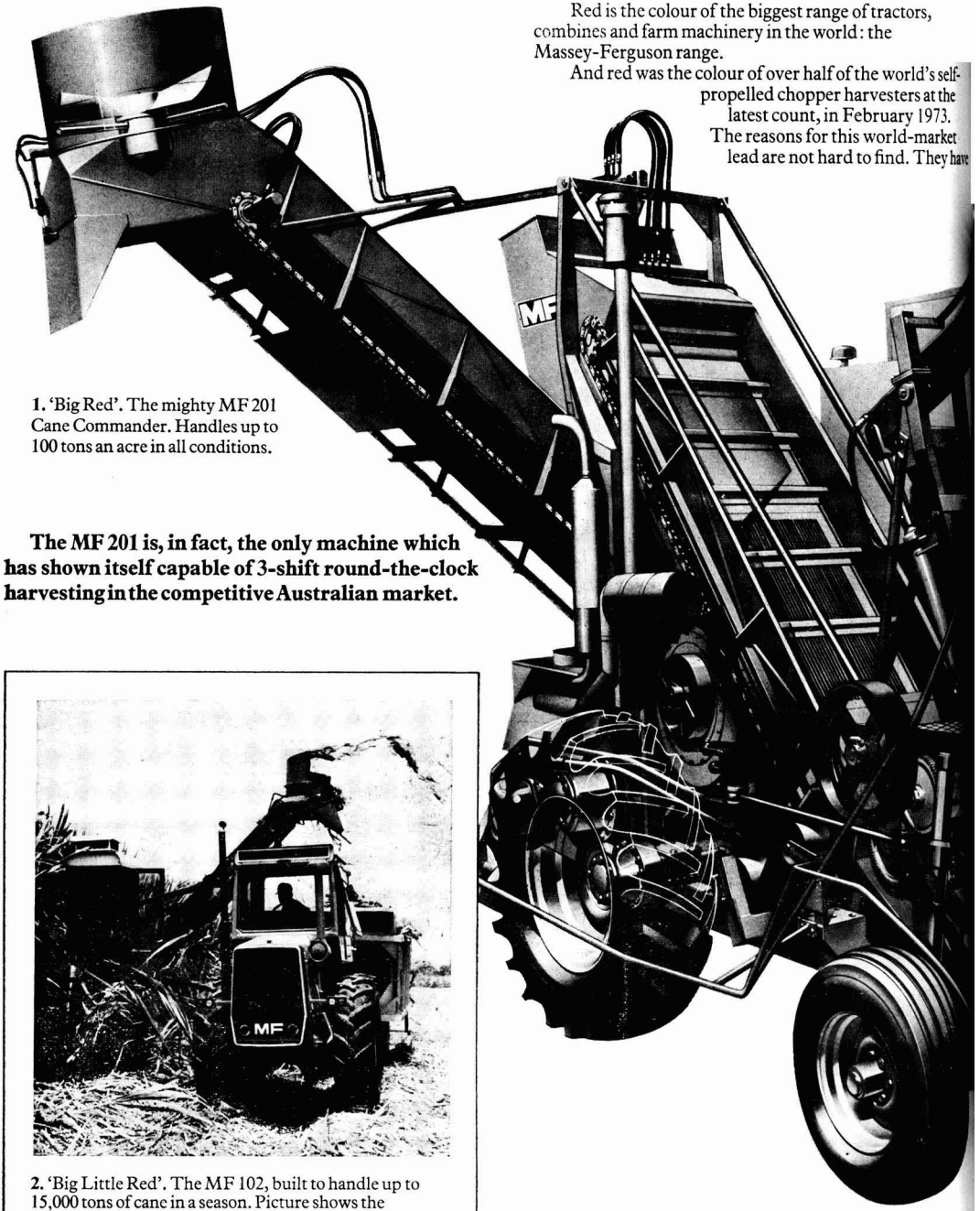
# Why over half of the world

Red is the colour of the biggest range of tractors, combines and farm machinery in the world: the Massey-Ferguson range.

And red was the colour of over half of the world's self-propelled chopper harvesters at the latest count, in February 1973.

The reasons for this world-market lead are not hard to find. They have




**1.** 'Big Red'. The mighty MF 201 Cane Commander. Handles up to 100 tons an acre in all conditions.

**The MF 201 is, in fact, the only machine which has shown itself capable of 3-shift round-the-clock harvesting in the competitive Australian market.**




**2.** 'Big Little Red'. The MF 102, built to handle up to 15,000 tons of cane in a season. Picture shows the MF 102 cutting green cane for seed at Cambalache, Puerto Rico, 1973. On this occasion it is accompanied by the 4 wd MF 1200 tractor pulling a 3-ton chopped cane planter.

# hopper harvesters are red

their origin in the simple fact that mechanical chopper harvesting as we know it today was first developed commercially by Massey-Ferguson.

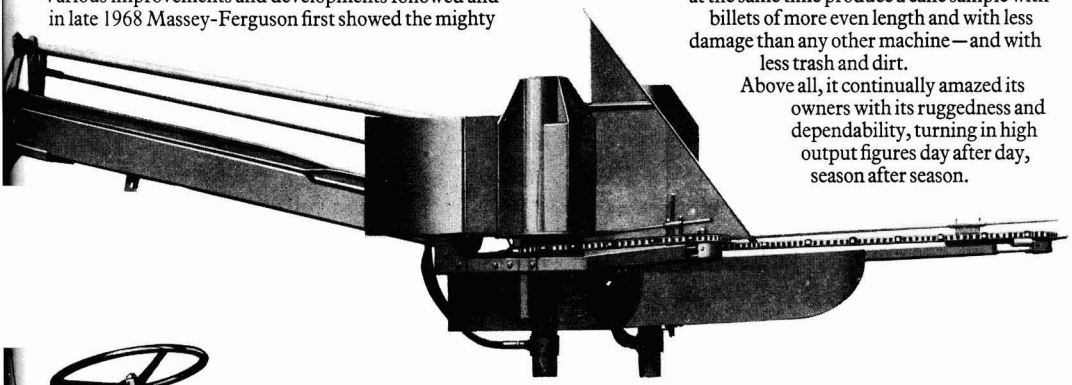
In 1959 Massey-Ferguson pioneered the system of cutting, chopping, cleaning and loading cane in one continuous operation and using only one machine.

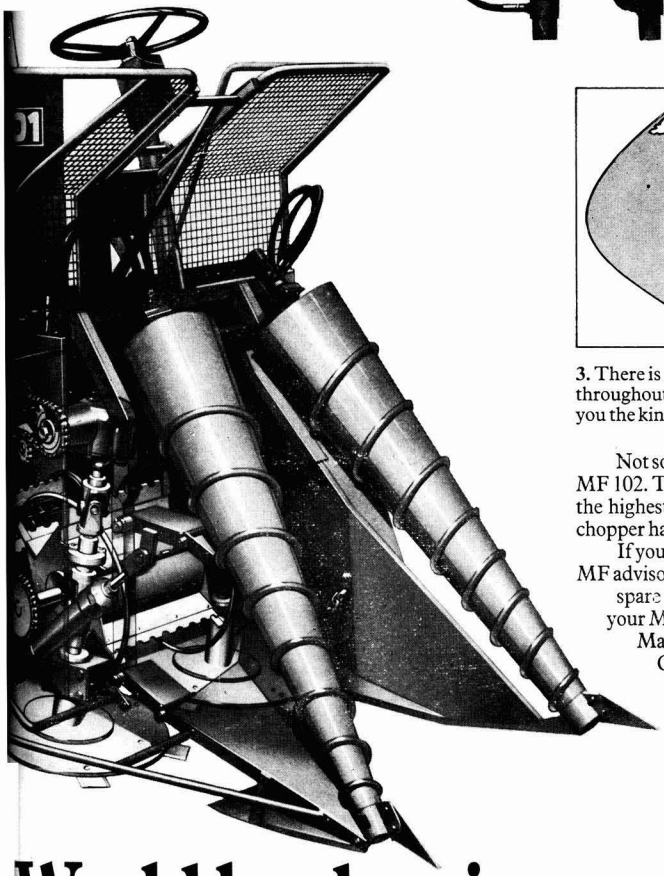
Various improvements and developments followed and in late 1968 Massey-Ferguson first showed the mighty MF 201 Cane Commander to the public.

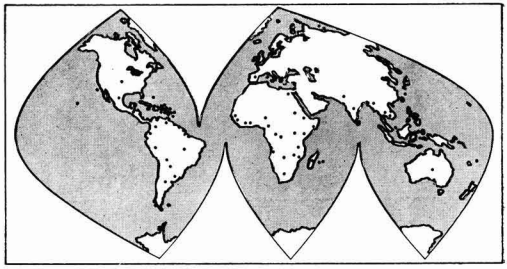
This machine quickly established new, high standards in cane harvesting. It demonstrated, firstly, an astonishing ability to handling crops of all kinds and in all conditions up to 100 tons an acre.

It also showed how it could leave the ground cleaner and at the same time produce a cane sample with billets of more even length and with less damage than any other machine—and with less trash and dirt.

Above all, it continually amazed its owners with its ruggedness and dependability, turning in high output figures day after day, season after season.







3. There is MF coverage in the cane countries throughout the world. Wherever you are, MF will give you the kind of service you want.

Not so long ago the MF 201 was joined by the 'big little' MF 102. Together, these two machines, manufactured to the highest production line standards in the world's biggest chopper harvester factory, have led the world markets.

If you'd like to know more about these products and the MF advisory services and the world-wide distribution and spare parts services that back them up, please contact your MF distributor, or write to Special Crop Systems Manager (7), Massey-Ferguson (Export), Coventry, England.

MF
Massey Ferguson

# World leaders in cane harvesting.

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# International Sugar Journal

## May, 1974

### *Contents*

# SOMMAIRES : ZUSAMMENFASSUNGEN : SUMARIOS

**La dissolution des cristaux de saccharose.** A. VANHOOK. *p.* 131–134

Les vitesses de dissolution et de croissance du saccharose sont déterminées en suspendant et en agitant des cristaux individuels (pesant en général 200–300 mg) dans du sirop sursaturé à 30°C, opération suivie par la dissolution dans du sirop sous saturé à 10% jusqu'à l'obtention d'environ la moitié du poids initial, et recroissance ultérieure sous des conditions identiques à celles des études de croissance initiales. Les résultats démontrent que le taux de croissance est comme usuel, tandis que la dissolution est beaucoup plus rapide et reste constante jusqu'à ce que environ un tiers du poids initial soit dissous. Par après la vitesse augmente, cet accroissement étant fonction de la température et du degré de sous-saturation. La recroissance des cristaux entaillés est rapide au début mais se ralentit rapidement. Le mécanisme de la croissance et de la dissolution est expliqué en termes d'énergie de diffusion et d'activation. On examine également l'effet de l'agitation sur les deux phénomènes et les vitesses de dissolution des différentes faces.

* * *

**Contrats globaux pour le développement sucrier.** ANON. *p.* 134–136

On décrit les approches pour la création d'une industrie du sucre dans une région tropicale ou une région où l'on rencontre des difficultés par suite des maladies de l'homme et des végétaux, de la texture du sol, des conditions de climat défavorables et des animaux et insectes nuisibles, ainsi que les activités de la Dashwood Finance Co. Ltd. en ce domaine.

* * *

**La viscosité et la sursaturation des solutions sucrées. Propriétés rhéologiques au cours d'une cuisson. 1ère partie.** H. THIELE et A. LANGEN *p.* 136–140

La viscosité de la masse cuite et les facteurs qui l'influencent sont discutés en relation avec la régulation de la cuisson par l'emploi d'un instrument et d'un procédé élaborés par Pfeifer & Langen. La viscosité est mesurée en termes de "valeur rhéométrique", qui tient compte de l'effet de la température. On décrit les difficultés rencontrées dans la mesure de la viscosité de la masse cuite quand il s'agit d'un mélange à trois phases de solution, de solides et de bulles de vapeur. On étudie les relations entre (i) la sursaturation, le Brix et la température, et (ii) entre le Brix, la température et la viscosité.

**Die Auflösung von Saccharosekristallen.** A. VANHOOK. *S.* 131–134

Die Auflösungs- und Wachstumsgeschwindigkeit von Saccharose wurde wie folgt bestimmt: Einzelkristalle mit einem Gewicht von üblicherweise 200 bis 300 mg wurden bei 30°C in eine durch Rühren bewegte, 10% übersättigte Zuckerlösung eingehängt, dann in einer 10% untersättigten Zuckerlösung angelöst, bis ungefähr das halbe Anfangsgewicht erreicht war, und erneut einer Wachstumsphase unterworfen, in der die Bedingungen gleich denen der ersten Wachstumsversuche waren. Die Ergebnisse lassen erkennen, dass das erste Wachstum mit der üblichen Geschwindigkeit erfolgte, während die Auflösung viel schneller verlief und die Auflösungsgeschwindigkeit dabei konstant blieb, bis ein Drittel des Anfangsgewichtes gelöst war. Dann stieg die Geschwindigkeit an, und dieser Anstieg hing von der Temperatur und dem Grad der Untersättigung ab. Das erneute Wachstum der angelösten Kristalle verlief zuerst schnell, aber verlangsamte sich dann. Der Mechanismus des Kristallwachstums und der Kristallauflösung wird mit Hilfe der Diffusion und der Aktivierungsenergie erklärt. Der Einfluss der Rührbewegung auf die beiden Prozesse sowie die Auflösungsgeschwindigkeiten für die einzelnen Flächen wurden ebenfalls untersucht.

* * *

**Kopplungsgeschäfte beim Aufbau einer Zuckerindustrie.** ANON. *S.* 134–136

Die Bemühungen über den Aufbau einer Zuckerindustrie in einem tropischen Land oder einem Land, in dem Schwierigkeiten durch menschliche oder pflanzliche Krankheiten, Bodenbeschaffenheit, ungünstige klimatische Bedingungen und Schädlinge gegeben sind, werden diskutiert, und die Aktivitäten der Dashwood Finance Co. Ltd. auf diesem Gebiet werden beschrieben.

* * *

**Viskosität und Uebersättigung von Zuckerlösungen. Rheologische Eigenschaften im Verlauf eines Sudes. Teil I.** H. THIELE und A. LANGEN. *S.* 136–140

Die Viskosität der Kochmasse und die Faktoren, welche sie beeinflussen, werden im Zusammenhang mit der Kontrolle des Kochprozesses mit Hilfe einer Vorrichtung und eines Verfahrens diskutiert, die von Pfeifer & Langen entwickelt wurden. Die Viskosität wird als "Rheometerwert" gemessen, bei dem der Temperatureinfluss berücksichtigt ist. Es wird auf die Schwierigkeiten hingewiesen, die dann bei der Messung der Viskosität einer Kochmasse auftreten, bei der ein Dreiphasensystem aus Lösung, Feststoff und Dampfblasen vorliegt. Die Beziehungen zwischen (i) Uebersättigung, Trockensubstanzgehalt und Temperatur sowie (ii) Trockensubstanzgehalt, Temperatur und Viskosität werden untersucht.

**La disolución de cristales de sacarosa.** A. VANHOOK. *Pág.* 131–134

Las velocidades de crecimiento y disolución de sacarosa se determinaron por suspensión y agitación de un sólo cristal (de un peso usual de 200 a 300 mg) en un sirope de 10% sobresaturación a 30°C y, después, su disolución en sirope de 10% sub-saturación hasta hubo perdido casi un mitad de su peso original. Después, el cristal se recreció en condiciones idénticas con éllas de los estudios de crecimiento inicial. Los resultados demuestran que la velocidad de crecimiento inicial fué como usual, mientras que disolución estuvo mucho más rápido y seguió siendo lo mismo hasta casi un tercio del peso inicial se había entrado en solución. Después, la velocidad se aumentó, dependiendo el incremento sobre la temperatura y el grado de sub-saturación. Recrecimiento de cristales rascados estuvo inicialmente rápido pero su marcha se moderaba temprano. El mecanismo de crecimiento y de disolución se explica en términos de difusión y energía de activación. El efecto de agitación sobre los dos procesos se examina tanto como las velocidades de disolución de distintas facetas.

* * *

**Desarrollos azucareros como negocios-en-bulto.** ANÓN. *Pág.* 134–136

Se discuten los caminos al desarrollo de un industria azucarera en un país tropical o un país donde hay dificultades originando de enfermidades de hombre y de planta, de la textura del suelo, de condiciones adversas climáticas, y de plagas. Se describen las actividades de Dashwood Finance Co. Ltd. en esta esfera.

* * *

**Viscosidad y sobresaturación de soluciones de azúcar. Propriedades reológicas durante una templa. Parte I.** H. THIELE y A. LANGEN. *Pág.* 136–140

Se discuten la viscosidad de una masa cocida y los factores que se influencian respecto del control de cocción en tacho usando un dispositivo y proceso desarrollado por Pfeifer & Langen. La viscosidad se mide en términos del "valor reométrico" que toma en consideración el efecto de temperatura. Se describen las dificultades en la medición de viscosidad de masa cocida donde hay una mezcla trifásica de solución, sólidos y burbujas de vapor. Se examinan las relaciones entre (i) sobresaturación, Brix y temperatura, y (ii) Brix, temperatura y viscosidad, y se presentan dados en forma tabular y gráfica.

THE

# INTERNATIONAL SUGAR JOURNAL

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## Notes & Comments

### World sugar production, 1973/74

In early March F. O. Licht K.G. produced their third estimate of world sugar production for the crop year September 1973–August 1974[1]. The total is now set at 81,357,750 metric tons, raw value, a decrease on the previous estimate of some 239,000 tons but an increase of 4,100,000 tons over output in 1972/73. The decrease is almost completely a result of smaller beet sugar crops and, although a 25,000-ton increase is shown for the EEC as a whole this is more than offset by falls in other countries of Western Europe, including 63,000 tons less for Spain and 48,000 tons less for Turkey.

The dry weather of 1973 also had a greater effect than realized on the crops of East Europe since, except for the USSR, smaller crops are shown for these countries. Total East European production is set 74,000 tons lower, as a consequence, in spite of an increase of 100,000 tons forecast for the USSR. The cane sugar sector is expected to yield 48,921,250 tons as against the earlier estimate of 48,939,807 tons and the 1972/73 figure of 45,920,257 tons. The very small alteration in the overall estimate conceals a number of greater changes for individual countries, of which the most-important are an increase of 350,000 tons in the Indian crop forecast, a decrease of 275,000 tons in that for Australia, an increase of 181,000 tons for Thailand, a decrease of 120,000 tons for the Dominican Republic and one of 60,000 tons for the Philippines, an increase of 57,000 tons for Argentina, and decreases of 40,000 tons each for Fiji and Trinidad.

* * *

### US sugar supply quota, 1974[2]

On the 15th March the US Department of Agriculture declared and reallocated shortfalls totalling 141,726 tons, consisting of Puerto Rico 55,000, Texas Cane 40,000 and Venezuela 46,726 tons. Venezuela's former quota of 63,540 tons included an extra 16,814 tons awarded from previous allocations which is also reallocated but does not have to be considered for the Philippines as this supplier participated on the first occasion. In addition to these adjustments the quota for Ireland was reduced by 4244 tons and that for the West Indies raised by 616 tons, both taking account of final deliveries against 1973 quota.

The table below sets out quotas and includes individual applications on the first-come first-served basis against the 500,000 tons quota increase announced in January, of which more than 70,000 tons remains to be applied for:

| | *Quotas as at 10th January* | *Quota increase* | *Shortfalls/ Reallocation of 15th March* | *Quotas in effect* |
|---|---|---|---|---|
| | | *(short tons, raw value)* | | |
| Domestic Beet | 3,300,000 | 0 | 0 | 3,300,000 |
| Mainland Cane | 1,677,667 | 86,666 | 0 | 1,764,333 |
| Texas Cane | 100,000 | 0 | —40,000 | 60,000 |
| Hawaii | 1,110,000 | 0 | 0 | 1,110,000 |
| Puerto Rico | 155,000 | 0 | —55,000 | 100,000 |
| Philippines | 1,555,358 | 0 | 43,723 | 1,599,081 |
| Argentina | 94,040 | 0 | 2,967 | 97,007 |
| Australia | 212,625 | 0 | 1,045 | 213,670 |
| Belize | 41,796 | 4,583 | 1,318 | 47,697 |
| Bolivia | 7,990 | 0 | 252 | 8,242 |
| Brazil | 678,564 | 173,973 | 21,405 | 873,942 |
| Colombia | 83,591 | 0 | 2,638 | 86,229 |
| Costa Rica | 84,821 | 16,640 | 2,676 | 104,137 |
| Dominican Rep. | 786,741 | 35,000 | 24,819 | 846,560 |
| Ecuador | 100,186 | 0 | 3,161 | 103,347 |
| Fiji | 46,592 | 0 | 229 | 46,821 |
| Guatemala | 72,528 | 0 | 2,287 | 74,815 |
| Haiti | 38,108 | 0 | 1,202 | 39,310 |
| Honduras | 14,751 | 0 | 465 | 15,216 |
| India | 85,134 | 0 | 419 | 85,553 |
| Ireland | 5,351 | 0 | —4,244 | 1,107 |
| Malagasy Rep. | 12,707 | 0 | 62 | 12,769 |
| Malawi | 15,671 | 0 | 77 | 15,748 |
| Mauritius | 31,344 | 12,813 | 154 | 44,311 |
| Mexico | 695,775 | 0 | 21,949 | 717,724 |
| Nicaragua | 79,287 | 0 | 2,502 | 81,789 |
| Panama | 79,287 | 0 | 2,502 | 81,789 |
| Paraguay | 7,990 | 0 | 252 | 8,242 |
| Peru | 449,446 | 0 | 15,389 | 464,835 |
| Salvador | 52,859 | 0 | 1,668 | 54,527 |
| South Africa | 60,144 | 0 | 296 | 60,440 |
| Swaziland | 31,344 | 0 | 154 | 31,498 |
| Taiwan | 88,524 | 0 | 435 | 88,959 |
| Thailand | 19,483 | 0 | 96 | 19,579 |
| Venezuela | 63,540 | 0 | —63,540 | 0 |
| West Indies | 61,756 | 99,786 | 8,624 | 170,184 |
| Not applied for | | 70,539 | | 70,539 |
| | 12,000,000 | 500,000 | 0 | 12,500,000 |

[1] *International Sugar Rpt.*, 1974, **106**, (7), 1–4.
[2] C. Czarnikow Ltd., *Sugar Review*, 1974, (1171), 50, 52.

**Brazil sugar export plans**[1]

The President of the Brazilian Sugar and Alcohol Institute (I.A.A.) has announced that Brazil will limit exports this year to 2·4 million tons, about 20% lower than in 1973. Brazil's current US Supply Quota stands at about 800,000 metric tons, leaving prospective shipments to the world market at no more than 1·6 million tons. Production in 1974/75 has been set at about 7·2 million tons, tel quel, compared with some 6·9 million tons, tel quel, in 1973/74. Domestic consumption in Brazil rose by around 300,000 tons in 1971 and again in 1972, and although this rate was not maintained during the first nine months of 1973, it is obvious that, given only an increase in production of some 300,000 tons, Brazil will need to curtail exports if she is to rebuild stocks.

* * *

**US sugar statistics, 1973**

Statistics for various aspects of the US sugar industry have recently been published[1] and reference is made below to some of these. Domestic consumption in the 49 states exclusive of Hawaii, is set at 9,172,842 long tons, refined value, a drop of 0·442% from the 9,213,615 tons of 1972 which itself had been 2·531% lower than the 1971 figure of 9,452,868 tons. Previously there had been a steadily rising domestic consumption since 1964.

The beet crop for the 1973/74 campaign is estimated at 2,600,000 tons, a 13% drop from the 3,014,893 tons of 1972/73 which had been a record figure. The 1973 total of raw and refined sugar imports was 5,670,803 tons, a considerable drop from the 5,842,375 tons imported in 1972, although refined sugar exports were also lower at 20,399 tons against 42,694. The reduced import requirement arose, however, from the considerable increase in domestic cane sugar production in Louisiana and Florida which rose from 1,078,576 tons in 1972 to 1,205,563 tons last year. Of the major suppliers treated separately, all except the Philippines reduced their tonnages: Hawaii 972,038 tons *vs.* 996,684, Peru 359,758 *vs.* 394,632, Dominican Republic 634,930 *vs.* 660,741 tons and, especially, Puerto Rico 60,979 *vs.* 117,954 tons. The Philippines raised their supplies from 1,245,490 to 1,282,629 tons while the aggregate of other supplies was reduced from 2,426,874 tons to 2,360,469 tons.

The average price for refined sugar during the year was 13·24 cents/lb while that for raw sugar at New York was 10·29 cents/lb.

* * *

**An FAO view of the sugar outlook**

"Sugar is an ideal commodity for the bold speculator" claimed Dr. ALBERT VITON, of the Food and Agriculture Organization of the United Nations, at a speech made on the 27th March to the New York Sugar Club. The speculator, he said, can rely that even a marginal shortage can push the market very high indeed, and a relatively small surplus to the opposite extreme.

"But it would be naive to blame the machinations of speculators either for wide fluctuations or the persistence of the relatively high level of prices. In the long run the market is made by the millions and millions of consumers who do not adjust their consumption to price changes and by governments which fear the political effects of inadequate supplies."

As to production it always has reacted strongly in the past to even comparatively short periods of high prices by over-expanding. Thus arose the traditional sugar cycles of short periods of high prices followed by long periods of low prices.

But the FAO, Dr. Viton said, concluded that this would not happen now, because a number of forces would probably make production less responsive.

There has been—to mention only the most important—the retreat of the plantation system in many developing countries. Both in cane and beet countries the competition of other crops and of other economic activities has become stronger than ever before. The threat and fear of nationalization have made private venture capital reluctant to invest in developing countries, and particularly in a commodity such as sugar, the profits from which have generally been such that the amortization of the capital investments has had to be protracted over a long period.

In most of the developing tropical countries productivity per acre and per man-hour has stagnated or even declined, because of inadequate and low quality research and extension services.

Finally, the investment required for establishing new enterprises has risen tremendously. Interest and amortization alone would cost around 3 cents per lb (about £28.00 a ton).

Therefore unless the world enters a serious depression—which would reduce demand—the next few years are likely to be characterized by periods of shortages, or marginal shortages, interspersed with periods of delicate balance.

However, Dr. Viton does not expect the average 1975–80 price of sugar on the world market to be anywhere near that of the last few months, in terms of 1974 dollars and cents. "I think, therefore, that it would be most unwise for the United States or any other country, whether exporter or importer, to base long-term policy on these prices.

"But it would be equally illusionary and unwise to treat the current price development as an aberration which is not likely to recur."

A solution to the possibility of shortages might be provided by twofold action by the United States. On the one hand it should protect its own domestic production, while on the other it should adopt a dynamic policy to stimulate output in other countries.

This, he suggested, could only come about if producers could be assured of a market at reasonable prices for their expanded production. The best way of achieving this end was through an International Sugar Agreement, with the United States playing a full part.

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[1] C. Czarnikow Ltd., *Sugar Review*, 1974, (1771), 49.
[1] *Willett & Gray*, 1974, **98**, 40–44.

# The dissolution of sucrose crystals

By ANDREW VANHOOK
(Department of Chemistry, College of the Holy Cross, Worcester, Massachusetts, USA)

*Introduction*

DISSOLUTION of crystals is generally regarded as a transport controlled reaction but this is not always so[1,2] and neither has it been positively demonstrated for sucrose[3] dissolving in water or under-saturated syrup. Compared with measurements of growth rates little has been done on the rates of dissolution of sugar[4] even though this is often the first operation in its processing and many uses. Upon dissolving a sugar crystal it is immediately perceived that the surfaces become progressively roughened with etch pits and crevices so that the exposed area increases considerably. However, to ascertain the kinetics of the process this disturbance may be minimized by measuring only slow and mild etching. With these restrictions in mind, the dissolution process is shown in this report to be first order and transfer controlled, as has often been intimated. The criteria principally applied were the linearity of the process and identification with diffusion rates, the similarity of activation energies of these processes and the influence of stirring.

*Methods*

Well formed single crystals usually weighing between 200 and 300 mg were used. These were freed of surface dust by gentle washing[5] in 95% ethanol and then grown in 5% supersaturated syrup until a constant growth rate was established. The shape factor* of these crystals was determined to be 92 $cm^6\ g^{-2}$, somewhat greater[6] than the KUKHARENKO value of 69·2. Upon etching the surfaces of these crystals became badly pitted[7] and edges rounded[8] so that the significance of the shape factor deteriorates since the crystal is no longer a well bounded polygon with smooth surfaces. In a moderate case when 5% of the initial weight had been dissolved it was estimated microscopically that the area had almost doubled so that the defined shape factor ($K = A^3/W^2$) would have changed almost 8-fold. This was reflected in a corresponding increase in the growth rate[9] but not, as will be seen, in the dissolution rate.

To determine the dissolution or growth rates the crystals were clamped in a crystal holder suspended in appropriate syrup and rotated, rocked or tumbled as required. It was noted that crystal orientation influenced especially the dissolution rates to some extent so that standard procedure was to clamp the crystal between *a* (100) faces with the truncated prism end down. Removal of adhering syrup at the end of a determination was effected by washing in a series of saturated syrups progressively richer in ethyl alcohol.

An attempt to determine rates continuously by a buoyancy method was fraught with many difficulties as well as an unfavourable factor for the weight change. This method was therefore not pursued in this work.

*Results and Discussion*

*(a) Progress of dissolution*

The course of the growth of a perfected crystal (a) in 10% supersaturated syrup at 30°C, followed by (b) dissolution in 10% undersaturated syrup until about half the initial weight had been removed and then (c) regrowth under the initial conditions, is revealed in Fig. 1. The crystal was maintained in free fall throughout by tumbling. $W^{1/3}$ coordinates are used in accordance with the rate expression $R = \frac{3}{K^{1/3}t}(W^{1/3} - W_0^{1/3})$ so that the slope is a measure of the rate, provided $K$ remains constant.

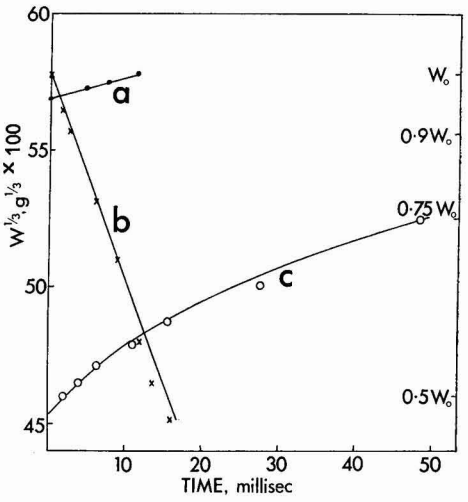


Fig. 1. Growth (*a*), dissolution (*b*) and regrowth (*c*) at 30°C, 10% displacement from saturation and free fall.

The initial rate of growth of $0{\cdot}6 \times 10^{-6}$ $g.cm^{-2}\ sec^{-1}$ is just about the usual value for these conditions[10].

* The area of a geometric body in terms of any particular dimension is proportional to the square thereof, namely $A = ar^2$; whereas the volume and thereby the weight varies as the cube, i.e. $V = br^3$ or $W = \rho br^3$. For this particular body, then, $A^3 = \frac{a^3 W^2}{\rho^2 b^2}$ where the constant $a^3/\rho^2 b^2$ is the shape factor of dimensions $cm^6.g^{-2}$.

[1] MULLIN: "Crystallization", 2nd ed. (Butterworth, London.) 1972.
[2] RUMFORD & BAIN: *Trans. Inst. Chem. Eng.* 1960, **38**, 10.
[3] SMYTHE: *Sugar Tech. Rev.*, 1971, **1**, 191.
[4] NICOL and PARKER: *I.S.J.*, 1971, **73**, 355.
[5] BENNETT and FENTIMAN: *ibid.*, 198.
[6] VANHOOK: *Ind. Sacc. Ital.*, 1962, **55**, 217.
[7] MANTOVANI: *Zucker*, 1967, **20**, 198; 1968, **21**, 70.
[8] POWERS: *Sugar Tech. Rev.*, 1969/70, **1**, 85.
[9] GRUT: *Proc. 7th Meeting C.I.T.S.*, 1953, 90.
[10] KUKHARENKO: *Planter & Sugar Man.*, 1928, **80**, 443, 463, 484, 504.

Subsequent dissolution, however, is much faster and, surprisingly, remained remarkably constant at $5{\cdot}4 \times 10^{-6}$ g.cm$^{-2}$ sec$^{-1}$ until about a third of the initial weight had been dissolved. Thereafter, the rate increased and more sharply so and earlier the higher the temperature and greater the degree of undersaturation.

This prolonged steady dissolution rate was unexpected since from the very start etching was obvious and the loss in weight should accordingly accelerate rather than remain constant. Apparently dissolution occurs principally from the measured, geometric area rather than the true surface so that pits, crevices, etc. first formed apparently seclude saturated syrup and block further dissolution from the newly formed areas. As these faults enlarge with advancing dissolution this interfering action diminishes and the calculated rate increases, rising, in this particular case, to $6{\cdot}7 \times 10^{-6}$ g.cm$^{-2}$ sec$^{-1}$ by the time 52% of the initial weight had dissolved—a 25% increase over the $5{\cdot}4 \times 10^{-6}$ value sustained for the early part. In another case similar to the one illustrated, it was estimated by microscopic examination that the area of such an engraved crystal was double that calculated from $A = 4{\cdot}51W^{2/3}$ so that obviously much of this new surface was inaccessible for continued attack.

Qualitatively it was observed that more rapid stirring diminished this behaviour drastically while it was even more pronounced under static conditions. Furthermore, two perfected crystals weighing about 200 mg each were lightly scored on their *a* and *p* faces with a fine jeweller's file. After washing in alcohol, the increase in area was estimated microscopically to be approximately 30 to 50%. One pair (scored and control) was then grown with tumbling in 10% supersaturated syrup at 30°C for about two hours while the other pair was etched at equivalent undersaturation until about 25% had dissolved. The rates of dissolution, calculated for the geometric rather than the true area, was just about the same for both crystals (9·8 and $10{\cdot}4 \times 10^{-6}$ for scored and unscored, respectively) while the scored crystal grew 50% faster than the control ($1{\cdot}5$ and $1{\cdot}0 \times 10^{-6}$, respectively). Deeper furrows caused greater differences in growth rates than in etching. Obviously, dissolution proceeds principally via the geometric area[11] if conditions are mild. The order of the dissolution process was then investigated under these circumstances and in accordance with accepted policy of restricting kinetic interpretation to the early part of reaction. But, before proceeding with this discussion, it is in order to consider first the regrowth of the crystal section (c) of Fig. 1.

This regrowth decelerates rapidly[9] and, in the case illustrated, repairs more quickly than it had deteriorated. Empirically, the early part of curve (c) is represented by $dW/dt = k^1A^2$ instead of the usual $dW/dt = k\,A$. The value of $k'$ is increased when etching before regrowth is more extensive and the deceleration primarily measures the repair of the porous surface.

The ratios of rates of dissolution to growth in Fig. 1 and others at lower and higher temperatures agree with the conclusion[12] that surface integration factors dictate growth at low temperatures while transport prevails at higher ones. In Table I the growth rate is that of the perfected crystal; that of an etched crystal would be considerably greater and the ratio correspondingly smaller.

**Table I. Ratio of dissolution to growth rates at various temperatures**

$\sigma = 0{\cdot}1$ at 30°C, but $\sigma = 0{\cdot}05$ at other temperatures; 30° tumbled others static

| *Temp.* 0°C | *Perfect surfaces* | *Etched* 15% | *Etched* 35% |
|---|---|---|---|
| —10 | (15–35) | 10 | — |
| 0 | 6 | 5 | 10 |
| 30 | 9 | 8 | 11 |
| 70 | $<1{\cdot}1$ | — | 2 |

*(b) Linearity of dissolution*

With the understanding of restricting considerations of dissolution of perfect crystals to less than 25% of the initial weight of approximately 200 mg, the dependence of the speed of this process on supersaturation was determined at several temperatures. This specified reduction is no more than 12½% decrease in size or, very roughly, the removal of less than $10^5$ molecular layers. Beyond this point damage of the surface becomes severe but, nonetheless, the porous surface so generated is relatively quickly repaired upon regrowth, i.e. Fig. 1 and Ref. 12.

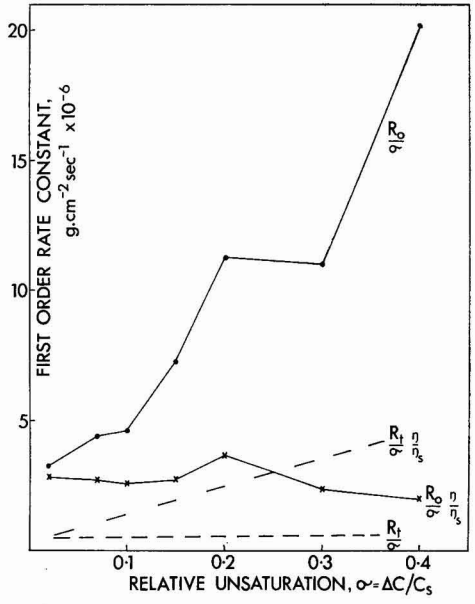


**Fig. 2.** Comparison of dissolution and growth at 0°C

Fig. 2 illustrates the results realized at 0°C while Fig. 3 are those obtained at 80°. These two extremes are those at which diffusion is unimportant and

[11] EWING and STERN: *J. Phys. Chem.*, 1973, **77**, 1492.

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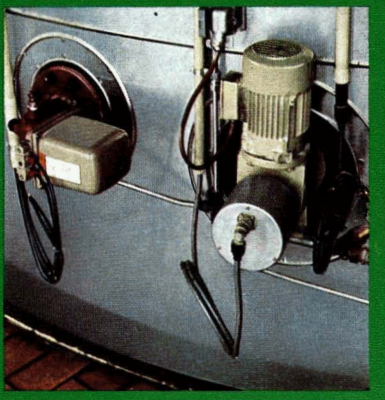

# Siemens automates crystallisation

significant, respectively, in the growth of sugar crystals[12]. The crystals were not moved about through the syrups in these experiments so that diffusion had full opportunity to operate. A few check determinations when the crystals were rotated indicated essentially the same sort of behaviour but, of course, at higher rates for both dissolution and growth.

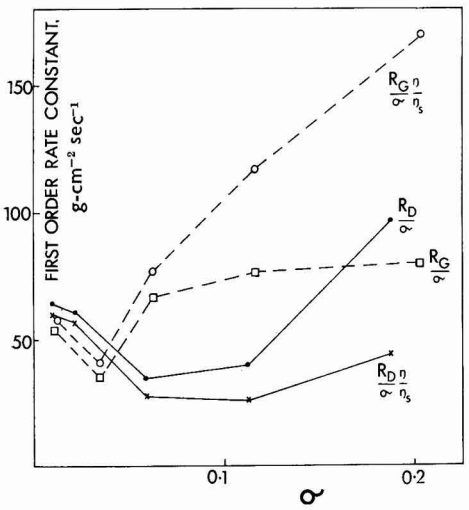


Fig. 3. Comparison of dissolution and growth at 80°C

In Fig. 2, at 0°, the growth rates are indicated only schematically from previous work. They are obviously viscosity-independent in contrast to the raw dissolution rates. The simple viscosity correction indicated does suggest that these dissolution rates are of first order over a considerable supersaturation range. Substitution of diffusion coefficients[13] (via the empirical relation $D\ \eta \sim \eta^{2/3}$ estimated from SCHLIEPHAKE's data) for viscosity, or the SHERWOOD correlation, neither improves nor alters this conclusion.

At 80° (Fig. 3) the non-linear nature of both dissolution and growth is evident. The closeness of the two opposing rates at equal displacements from saturation does, however, signify a common mechanism which by implication is diffusion[4]. To this end, various estimates[14] of the boundary layer about a sugar crystal in its saturated mother liquor at 80°C place the thickness at about $10^{-2}$ cm. This corresponds to a mass transfer coefficient of about $200 \times 10^{-6}$ g.cm$^{-2}$ sec$^{-1}$. The limiting value for both dissolution and growth in Fig. 3 is $60 \times 10^{-6}$ but this is for static conditions. With stirring, a value of 2 to 3 times this would be expected and this is just about the value calculated by hydrodynamic equations. At 0°C the result for dissolution would also agree, as will be seen in the following discussion of temperature coefficients, but the growth rate is much larger by a factor of 10 or more.

*(c) Activation energy*

Table II contains the activation energies calculated from temperature coefficients between –10 and 0°C, 30° and 40° and 70° and 80° for both dissolution and growth under strictly comparable conditions of excess saturation (±5%) and stirring (static or free fall). They are all in the same range previously determined by various workers[12] under a variety of conditions. The values listed as calculated are all about the same whether computed from viscosity, kinematic viscosity or diffusion constants and comparison intimates the identification of this transport coefficient with dissolution over the complete temperature range but with growth only at the upper level.

**Table II**

Activation energies, kcal. mole$^{-1}$

| | –10—0°C | 30–40°C | 70–80°C |
|---|---|---|---|
| Dissolution | 2–4 | 6 | 3 |
| Growth | 19 | 16 | 6 |
| Calculated | 5–6 | 5 | 1–3 |

*(d) Influence of stirring*

The effects of stirring on dissolution and growth were investigated principally by employing rotation at peripheral speeds up to 100 cm. sec$^{-1}$. Table III summarizes the most recent independent results in the form of the exponent in the empirical equation $R - R_o = \alpha\mu^{\beta}$. Similar results were realized in a previous investigation[12] in which a variety of stirring methods were used. Again, the relatively constant and high value for dissolution at the two temperatures suggests the operation of essentially hydrodynamic factors[15] which, however, apply to growth only at the higher temperature.

**Table III**

Influence of stirring: in $R-R_o = \alpha\mu^{\beta}$

| | 0°C | 70°C |
|---|---|---|
| Dissolution | 0·3–0·7 | 0·7 |
| Growth | < 0·1 | 0·7 |

*(e) Rates of dissolution of different faces*

ACCORSI and MANTOVANI[16] have determined the rates of growth of various faces of sugar crystals by covering all others with resistant varnish. The conditions were 10% supersaturation at 25°C and no stirring. The rates for the *a* (100), *r* (101) and *p* (110) faces were 0·25, 0·67 and 0·61–0·81 respectively, all in g.cm$^{-2}$ sec$^{-1}$ $\times 10^6$. These are in proportions of 1:2·8:2·5–3·4 which is similar to the results obtained by VERNON[17] and DEVILLERS[18] from lineal size measurements.

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[12] VANHOOK: *Zeitsch. Zuckerind.*, 1973, **98**, 499; *J. Cryst. Growth*, 1969, **5**, 305.
[13] SCHLIEPHAKE: *Zucker*, 1965, **18**, 138.
[14] LEVICH: "*Physicochemical Hydrodynamics*" (Prentice-Hall, Englewood Cliffs, N.J.) 1962.
[15] BRICE: *J. Cryst. Growth.*, 1967, **1**, 161.
[16] *Zeitsch. Zuckerind.*, 1971, **96**, 440.
[17] *Ph.D. Thesis* (*University of London*), 1938.
[18] *Proc. 13th Meeting C.I.T.S.*, 1967, 303.

The same method has been employed here for dissolution at 28°C and 9% undersaturation. Although exposure was short, some undercutting at edges was observed so that the results must be regarded as approximate only. They were 2·7, 4·9 and 4·1 $\times$ $10^{-6}$ $g.cm^{-2}sec^{-1}$ for the above faces, respectively; all much faster than the corresponding growth rates. However, even more significant is that the ratio of 1:1·7:1·5 indicates less difference in the radial distribution of dissolution than of growth.

# Package-deal sugar developments

THE history of Britain's interests in sugar development, linked as they were to the various phases of the then prevailing geo-political circumstances, has been recorded at length in recent years and need not be repeated. There are many current facets of sugar developments today, however, which, although known, are not always recognized.

In today's conditions, in spite of the existence of international or regional monetary, trade, economic, quota or tariff groupings and associations, those countries with the likely potential environmental conditions or circumstances conducive to further sugar development must still take individual decisions whether to go ahead on such projects and it is desirable that Britain's contribution to such developments should continue.

More and more is it the case that the individual governments, themselves, are having to decide, ultimately, if sugar developments are to go ahead. In certain areas, the distinctions between public and private sector sugar developments are already blurred; one finds—for cogent national reasons—the private sector unable to move without official support. Mixed enterprises, with public and private sector participation and, possibly, some minority foreign participation—sometimes for an agreed, limited period—are now an accepted part of the development pattern.

It is frequently difficult for the promoters of a project to envisage the effect of their activities within the various prevailing contexts of national debt, sociology, agriculture and liquidity. Indeed, it is a possible oversimplification to take the classical route, as it were, to sugar development, assuming the official go-ahead to be given.

This route may commence with a consultant survey (the cost of which has to be borne in some way) of the many facets of the project. Frequently time and consultants' fee limitations make it hard for the experts concerned to spend an adequate period in the field. They may have to rely, in varying degrees, upon information and statistics supplied to them by the client country—and have the task of trying to decide, for their own purposes, upon the merits of the information offered. They may, however, be fortunate enough to have access to supporting evidence from any of the international agencies to assist them.

In looking at some of these reports one recognises the constraints which may be placed upon the consultants by their terms of reference. Such constraints arise, frequently, for good reasons in that if every aspect—direct and indirect—and their related effects were to be intensively studied, this may be an impossible task in terms of time and money, and the resultant findings might cause the abandonment of the project.

Let us look at these "non-standard" matters a little closer, and presume that normal reference is in the consultant's report on the "standard" matters such as climate, soil conditions, beet or cane varieties, yields, irrigation, infrastructure, transportation, domestic and export market considerations and the like.

Taken at random, let us look at climate; if mathematical growth models are made, how does one provide therein for violent climatic variables, which arise when least expected? How does one cope with, for instance, cases such as almost 5 metres of rain in Luzon, Philippines, in July 1972, which destroyed 30% of the sugar crop (plus one million acres of rice fields) which means so much to Philippine's exports. Yet, who would argue that sugar should not be grown on the island?

Crop yield and disease are interrelated, not least on grounds of investment effort. What happens in tropical countries is that the ever-present heat means there is little to restrict plant growth, and thus weeds, as well as pests and human parasites, reproduce all the time and man, his crops and his animals suffer.

Anything new introduced into an area—be it animal or plant—can become an almost automatic target for every local pest or predator.

What of the human side? Does the creation, for instance of a sugar development, with expenditure on disease and pest control on a properly administered basis, mean that adjacent or peripheral areas to such developments are going to suffer or be afflicted in new ways?

If the manpower is drawn from such districts (because not everyone can afford, or desire to have, the most completely mechanized agricultural environment), how does one overcome the simple fact that

impaired health not only affects work output, learning ability and the like—but how does one look at this in terms of project viability—or should one overlook it—by design, default or ignorance—or in the national interest?

One would not like to quantify how many people will continue to suffer from bilharzia; nor, from an irrigation viewpoint, how much such a frequently vital part of a sugar project means a further spreading of this disease.

What of river blindness in potential sugar growing areas; and what of other human debilitating problems —filariasio, hookworm disease, intestinal worms and elephantiasis.

These things all occur in sugar growing areas, and one must pay tribute to the magnificent efforts of the World Health Organization in focusing attention on so many of these human afflictions. Unfortunately, a number of those deeply interested, for specific professional reasons, in sugar developments do not yet seem to have got to grips with these important facets of the scene; but this may not be the fault of the individual.

Again, let us take soil conditions; one can only hope that, for example, the external irrigation development assistance now being made available, in combination with the active support of the government concerned, will help to minimize, gradually, the terrible effects of the recent Sahelian drought. In parts of these areas, historically, the problems of difficult soil conditions has been partially obviated by moving human activity, in an almost nomadic way, from one area to another in order to survive. Yet sugar developments, even with water available, mean the creation of more permanent communities, otherwise where does one obtain and train adequate human resources? We all know how difficult it can be to get any group of humans to change their life pattern.

Tropical soils, generally, tend to be poor, with not much organic material; the soil benefits from dead vegetation and the natural equilibrium may be finely balanced. If one has to clear virgin forest for a sugar development, once the trees disappear, how long does it take the first heavy rains to wash away the thin layer of humus? Nature intended the soil to be protected by trees and other vegetation from extremes of heat and rain; bare soil temperature rises, the humus starts to disappear and, together with the range of day and night temperatures, this may cause the soil to disintegrate, while erosion by wind and rain may further complicate the problem.

These are only a few of the headaches associated with any sugar cane or similar development. It is difficult to transfer temperate agricultural practices to the tropics. The increase in productivity in temperate climates, to which biological engineering has made such a progressive contribution, is a fact; but it is not easy to apply this research to a tropical environment; the investment level required for an exhaustive financial and technological investigation—comprising proper fertilizer and pesticide inputs, provision of high yield varieties, disease control and the like—could upset the whole financial planning for a project and result in its demise. External, internationally-financed and well-planned agricultural research is a major step forward in this connexion; but such research and application of knowledge gained take time.

These few facets of sugar development are tough for anyone to evaluate; nevertheless they can cause—as do the myriad related sociological problems—a number of profound effects. One cannot, in many instances, find an acceptable solution, in terms of project viability, to the impact of infrastructure development expenditure essociated with any project. Indeed, we all know of examples where the absence of adequate roads, alone, militates against sugar developments.

Of course, to continue in this vein is impossible if one really believes that opportunities exist for further sugar developments, and particularly with estimates of 100 million metric tons of sugar by the end of the decade.

Possibly the most practical solution—one with known, recognizable characteristics—is that of a London-based company—Dashwood Finance Company Ltd.,i.e. a total package offer combining technological, equipment and credit considerations and which caters, in as near an optimum manner as is feasible, for the developer's total needs.

This Company has, during recent years, made a noteworthy contribution, as a member of the British private sector, towards sugar and other industrial developments—particularly to stimulating British suppliers to cater for the needs of the more non-traditional British export markets.

The company's philosophy is based on a critical, objective examination in depth of major project contract negotiations from which it was concluded—as has now been recognised by British industry—that there was a significant element missing in the approach of British firms to major export projects, particularly where large sums repayable over lengthy periods were involved.

For any sugar project, how does one create a total "package-deal" approach embracing every aspect, if need be, of the buyers' financial requirements whilst at the same time offering equipment and services whose technology, allied services and price parameters are equally acceptable to the buyer?

Dashwood decided that the "standard" method, with the supplier mounting a major marketing effort for such large projects to which, at an appropriate time, the services of, say, a merchant banker might be linked, was possibly no longer valid in today's conditions.

The company therefore pursued a vigorous approach of its own in certain countries to gradually obtain the confidence of prospective clients and be able to demonstrate that the United Kingdom has the

technical and financial ability to cater for the possible needs of a project provided a total package approach is made.

Obviously to effect this major transition to the now highly sophisticated form of package deal credit arrangements which Dashwood utilizes, with the realistic co-operation of the British Government's Export Credits Guarantee Department, took some time to evolve.

Yet the utilization of this package deal technique presupposed the existence of one important other element . . . how to obtain the go-ahead to negotiate a particular contract?

Dashwood's method is to be highly selective in its choice of sugar project; much technical and other research is undertaken; constant visits are paid to the area concerned to evaluate the situation until an indication of the client's willingness to go ahead and negotiate is given.

Once serious negotiations commence, Dashwood organizes both the potential suppliers of equipment and the financial syndicate. Dashwood then carries out the entire technical and credit negotiations on behalf of the suppliers and the financial syndicate culminating in the signing of both the project supply contract and the financial agreement. Similarly, the negotiations regarding the provision of an acceptable form of guarantee from the buyer's country, in respect of which the concurrence of the respective governments may be required, are also handled by Dashwood.

Thus, from the inception of project discussions through all stages of the negotiation until formal contract execution, Dashwood plays the key rôle, including retaining a close identity with the job until commissioning.

The Company is particularly concerned with sugar developments and believes there is much potential yet unrecognized by suppliers to the industry.

It is equally conscious of the growth pattern of natural sweeteners not derived from sugar cane or beet, and recognizes that the increase in the consumption of high-dextrose corn products may make parts of the refined sugar industry shudder.

However, Dashwood feels there are sufficient areas all over the world to be developed where sugar cane or beet is the only means of providing natural sweeteners and that their unique form of package deal approach can continue, despite the difficulties involved in starting up any sugar project, to make a significant contribution to the international scene.

# Viscosity and supersaturation of sugar solutions

## Rheological properties during the course of a strike

By H. THIELE and A. LANGEN
(Pfeifer & Langen, Cologne)

### PART I

*Introduction*

IN most of the literature dealing with the crystallization of sucrose solutions the viscosity is described as an unavoidable disturbance. However, the viscosity of sucrose solutions, which is part of the field of study in Subject No. 23 of ICUMSA, now entitled "Rheological Properties"[1], represents a considerably important and defined parameter in the course of the boiling process, as is explained amongst other things in the following text.

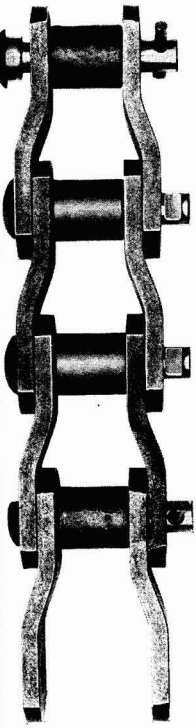
*Viscosity of sucrose solutions and suspensions*

In the various stages of the boiling process, such as the concentration of the syrup feed, seeding, formation of seed crystals, crystallization and final boiling, the viscosity of the syrup and subsequently the mixture of syrup and crystals according to THIELE and LANGEN[2] represents a decisive value.

At first there is a homogeneous solution in the boiling stage from feeding and concentration to seeding, and from the time of the feeding of the seeding crystals to this solution a mixture of syrup and crystals, i.e. a suspension, is formed. The rheological properties of a suspension are, according to MATZ[3], dependent on five factors:

the temperature of the suspension,
the rheological properties of the mother solution,
the solids content of the suspension,

[1] *Proc. 14th Session* ICUMSA, 1966, 137.
[2] *Zeitsch. Zuckerind.*, 1968, **93**, 469–474, 544–547, 656–661; 1969, **94**, 218–223.
[3] "Kristallisation, Grundlagen und Technik", 2nd Edn. (Springer-Verlag, Berlin.) 1969, p. 187 et seq.



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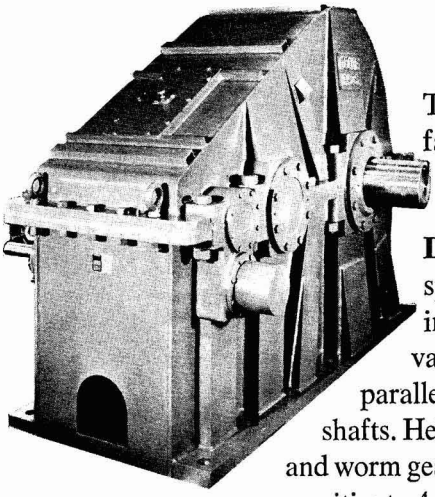

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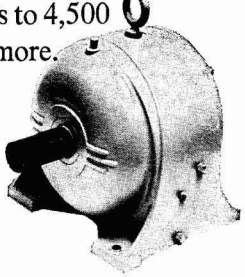

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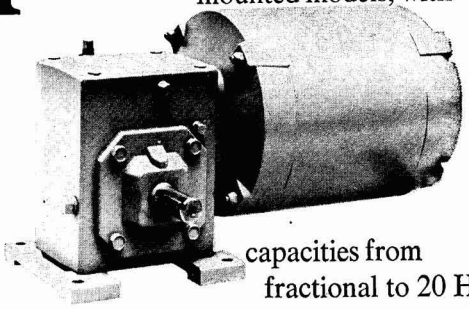

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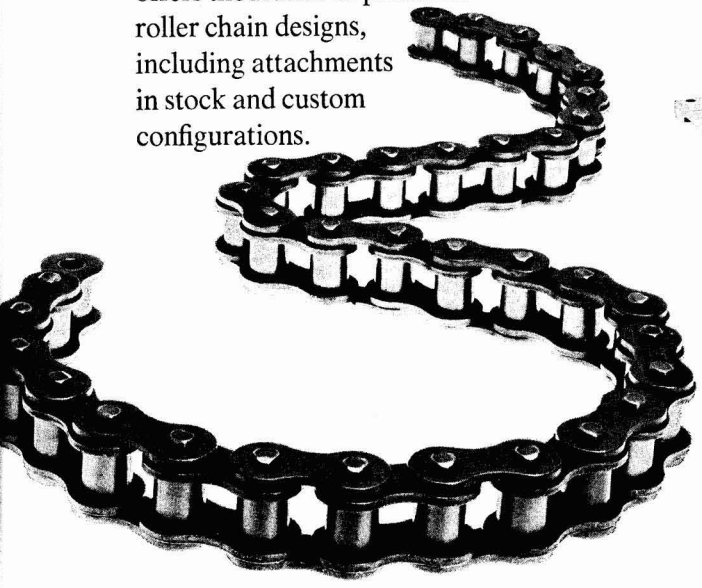

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the particle shape and
the size of the suspended solids.

If the mother solution is a Newtonian fluid, which can be assumed for aqueous solution such as sugar solution in general, then the ratio of the viscosities of the suspension $\eta_s$ and the corresponding mother solution $\eta_o$ in the case of spherical particles is independent of their size and is only dependent upon the solids content $\xi$ of the suspension. The influence of increasing solids contents in the form of crystalline sucrose upon the viscosities of mixtures of syrup and crystals, i.e. suspensions, has been determined by THIELE and LÜHRS[4] at constant temperature and with constant viscosity of the mother liquor. During these tests it was established that, at least up to a solids content of about 20% of crystals, the influence of the size and shape of the crystals in the suspension on the viscosity of the suspension is negligible.

The reason for this may be sought in the fact that the average spacing between the crystals[5], i.e. the spacing between the crystals distributed in the suspension during the seeding and seed crystal formation, is in any case so large that the small crystals in the suspension can move freely without making contact with each other. The crystals do not influence each other until the crystal content increases, the spacing reduces and the packing of crystals increases which, according to the measurements, begins at about 20%.

These test results on suspensions of sucrose crystals led at least to the establishment, in the initial critical phase of the crystallization process, of the fact that the shape and size of particles suspended in aqueous sucrose solutions do not play a significant part in respect of the viscosity of the suspension.

During the crystallization process, the ratio of the viscosity of the suspension $\eta_s$ to that of the mother liquor $\eta_o$ at the instant of seeding increases as a result of the increasing solids content of the crystals, up to about 6·5:1 at the end of the crystallization process. This ratio has been measured[4] and mathematically confirmed[6] by the torques which are necessary in order to penetrate the solution or suspension under equal mechanical conditions.

The solids content $\xi$, in this case the crystal content, in a precise crystallization process is always dependent upon the level in the vacuum pan, corresponding to a generalized expression $\xi = f(V)$, where $V$ is the volume of massecuite.

If the viscosity of the suspension $\eta_s$ is controlled in relation to the level, then there results only one further variable, viz. the viscosity of the solution $\eta_o$. This variable is, however, defined by temperature and dry substance content. But the temperature and dry substance content are also the parameters determining the supersaturation of the solutions. Thus, there exists a direct connexion between supersaturation and viscosity of sucrose solutions[7,8].

In methods hitherto developed for control of the boiling process, attempts have always been made, more or less indirectly, to determine the supersaturation values from auxiliary measurement criteria. This method of determining supersaturation values is, however, subject to numerous difficulties. The supersaturation of the solution represents without doubt an important factor in the crystallization process, and the maintenance of optimum supersaturation is necessary, not only in the initial stage of the process for the formation of a good crystal, but also in the subsequent stages, in which the crystal content increases continuously.

There are certain limits, however, to exact and reproducible determination of the supersaturation values, since an exact determination of the dry substance content of the sucrose solution inside the vacuum pan during boiling cannot always be carried out with the necessary precision.

Furthermore, possible errors occur in the determination of the supersaturation as a result of changes in purity during boiling and especially as a result of the unavoidable effect of temperature[6]. Each temperature measurement is thus influenced by a time delay, which can be up to several minutes. In view of the fact that the calculation of the supersaturation values is always effected from one value of the dry substance content and a corresponding temperature, the calculated supersaturation is clearly already subject to error. This can lead to considerable difficulties, particularly in the initial stage of the boiling process.

In order to overcome these difficulties, a measuring device and process have been developed by Pfeifer & Langen, with which the viscosities of the sugar solutions and the corresponding suspensions can be measured.

The viscosity is measured in terms of the "rheometer value" which implicitly allows for the influence of temperature, and this is used for controlling the boiling process for all products.

We do not propose in this paper to deal with the rheometer automatic boiling control, which is based on this system and with which the boiling process can be carried out automatically and, if required, by remote control. Reference may be made to the papers of THIELE[7,9], THIELE and LANGEN[2,10], MADSEN[11], REINEFELD[12], KEMTER[6,13], UECKER[14], THIELE and LÜHRS[4] and to the Pfeifer & Langen patents[15,16,17].

[4] *Zucker*, 1973, **26**, 80–88.
[5] GENIE: *Zeitsch. Zuckerind.*, 1962, **87**, 557–562.
[6] KEMTER: *ibid.*, 1973, **98**, 27–32.
[7] THIELE: *ibid.*, 1970, **95**, 316–317.
[8] AHARI *et al.*: *I.S.J.*, 1968, **70**, 71–75.
[9] *Zeitsch. Zuckerind.*, 1967, **92**, 416–419.
[10] "Der Weg zur vollautomatischen Kochstation mit dem Rheomat" (Fischer & Porter, Kat. Rheom.dl–11/72, Göttingen.) 1972.
[11] *Zucker*, 1967, **20**, 522–524.
[12] *ibid.*, 1972, **25**, 450–452.
[13] *Zeitsch. Zuckerind.*, 1973, **98**, 249–259.
[14] *Zucker*, 1973, **26**, 78–79.
[15] German Patent 1,598,911.
[16] UK Patent 1,221,124; *I.S.J.*, 1971, **73**, 381.
[17] US Patent 3,636,753; *I.S.J.*, 1973, **75**, 229.

The ten years of research and development work on the rheometer have proved that through the control of viscosity a precise crystallization may be achieved. The determination of viscosity in pure solutions without crystals presents no problem in the laboratory. It is different, however, in practice, i.e. when measuring in a vacuum pan where, after the formation of seed crystals, there is a two-phase mixture of solution and solids (in this case sucrose crystals). There is very often a third phase, viz. steam bubbles; the viscosity of this three-component mixture cannot be determined with conventional instruments, since the measurement is influenced by many disturbance factors, which we do not propose to list in detail here.

In spite of these difficulties, it is possible with the rheometer to maintain an optimum course for the viscosity of the particular product to be boiled. The rheometer value is additively composed of the viscosity of the solution and the rheological influence of the crystals, and, since the latter is known[4], it is clear that, for a given control programme, the viscosity of the solution must adjust itself to the required optimum course.

It has already been mentioned that the dry substance content and the temperature of the solution are the determining parameters for the supersaturation and the rheological behaviour of the solution. In the following text these relationships are dealt with in more detail.

*Relationship between supersaturation, dry substance content and temperature*

As early as the beginning of this century OSTWALD[18] and MIERS and ISAAK[19] found generally applicable relationships between temperature and solubility data, which were later extended by WEBRE[20] for sugar solutions, based on the solubility tables of HERZFELD[21].

In Fig. 1, in which lines of equal saturation are marked, the saturation area is divided into three zones: the under-saturated, the metastable and the labile zone[22]. There is, however, a clearly defined boundary, with respect to crystallization, only between the under-saturated and metastable zones, whereas the other two zones merge smoothly into each other[23,24,25]. WEBRE[20] described a region lying between these last two zones as the "intermediate zone" in the supersaturation range between 1·2 and 1·3.

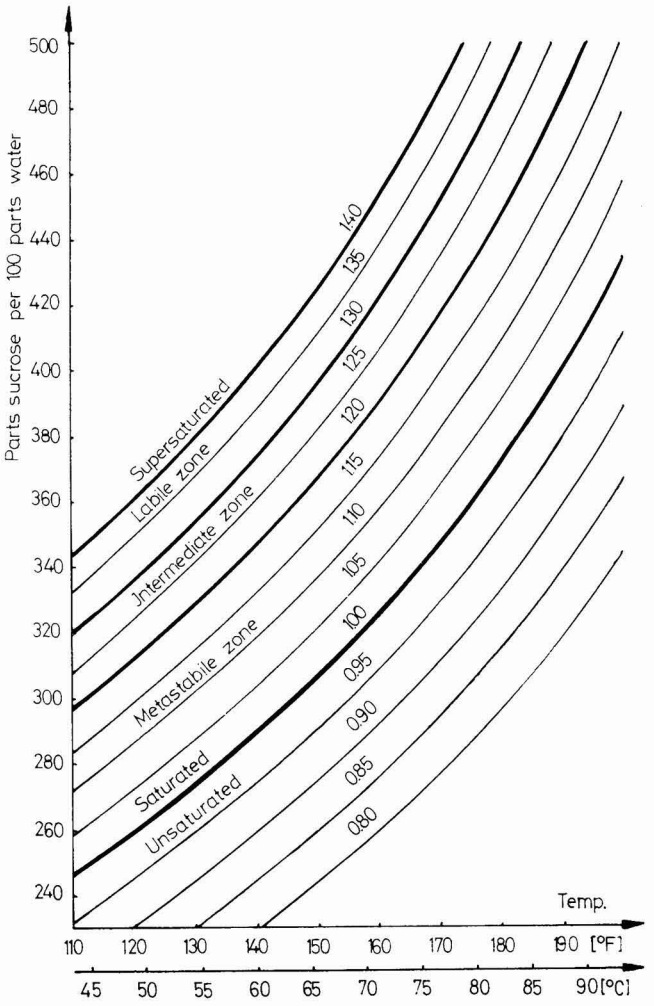


Fig. 1. Sucrose solution supersaturation according to Webre

As opposed to the conventional supersaturation graph, the dry substance content or the concentration (g sucrose/100 g solution = °Bx) is marked on the ordinate of Fig. 2 instead of the solubility (g sucrose/

[18] "Lehrbuch der allgemeinen Chemie" (Verlag Engelmann, Leipzig.) 1903.
[19] *J. Chem. Soc.*, 1906, **89**, 413.
[20] Cited in "Principles of sugar technology", Vol. II. Ed. P. HONIG. (Elsevier, Amsterdam.) 1959, p. 120.
[21] *Z. Ver. Rübenzuckerind.*, 1892, **42**, 147 et seq.
[22] PETRI: *Sugar Ind. Tech.*, 1969, **28**, 123.
[23] COSSAIRT: in MCGINNIS: "Beet sugar technology", 2nd Edn. (Beet Sugar Development Foundation, Fort Collins.) 1971, p. 384 et seq.
[24] WERNER: "Zuckertechniker-Taschenbuch", 7th Edn. (Bartens, Berlin.) 1966, p. 123.
[25] EMMERICH and FORTH: *Zucker*, 1962, **15**, 626–633.

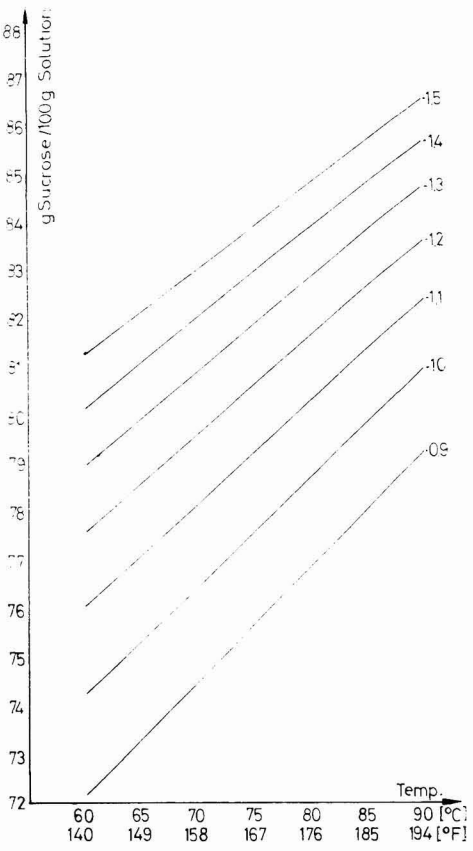


Fig. 2. Sucrose solution supersaturation

100 ml water), and lines of equal saturation or supersaturation are drawn in the region of 0·9–1·5.

In order to determine the individual values, the table of VAVRINECZ[26] was used with supplemented and revised data for the solubility of pure sucrose in water, as follows:

(*i*) *Saturated sugar solution*

| °C | *g sucrose/100 g water* | *g sucrose/100 g solution* |
|---|---|---|
| 60 | 288·2 | 74·24 |
| 65 | 305·7 | 75·35 |
| 70 | 325·0 | 76·47 |
| 75 | 346·2 | 77·59 |
| 80 | 369·5 | 78·70 |
| 85 | 394·6 | 79·78 |
| 90 | 421·7 | 80·83 |

According to definition, the concentration for a supersaturation of e.g. 1·1 may be calculated from the saturation value, i.e. if the saturation concentration at temperature $t$ is given by S = (g sucrose per 100 g water)$_t$, the concentration for 1·1 supersaturation is given by 1·1S. Thus, for a temperature of 60°, S = 288·2 g sucrose per 100 g water and $SS_{1\cdot1}$ = 1·1 × 288·2 = 317 g sucrose per 100 g water.

With the aid of the concentration data of sucrose solutions according to HIRSCHMÜLLER[27], the calculated concentrations in terms of (g sucrose per 100 g water) are converted into (g sucrose per 100 g solution). This gives the figures tabulated below:

(*ii*) *Supersaturation* 1·1

| °C | *g sucrose/100 g water* | *g sucrose/100 g solution* |
|---|---|---|
| 60 | 317 | 76·02 |
| 65 | 336 | 77·07 |
| 70 | 358 | 78·14 |
| 75 | 381 | 79·20 |
| 80 | 406 | 80·25 |
| 85 | 434 | 81·26 |
| 90 | 464 | 82·25 |

(*iii*) *Supersaturation* 1·2

| °C | *g sucrose/100 g water* | *g sucrose/100 g solution* |
|---|---|---|
| 60 | 346 | 77·56 |
| 65 | 367 | 78·57 |
| 70 | 390 | 79·58 |
| 75 | 415 | 80·59 |
| 80 | 443 | 81·58 |
| 85 | 473 | 82·55 |
| 90 | 506 | 83·48 |

(*iv*) *Supersaturation* 1·3

| °C | *g sucrose/100 g water* | *g sucrose/100 g solution* |
|---|---|---|
| 60 | 375 | 78·93 |
| 65 | 398 | 79·89 |
| 70 | 423 | 80·86 |
| 75 | 450 | 81·80 |
| 80 | 480 | 82·76 |
| 85 | 513 | 83·67 |
| 90 | 548 | 84·56 |

(*v*) *Supersaturation* 1·4

| °C | *g sucrose/100 g water* | *g sucrose/100 g solution* |
|---|---|---|
| 60 | 404 | 80·13 |
| 65 | 428 | 81·07 |
| 70 | 455 | 81·98 |
| 75 | 485 | 82·89 |
| 80 | 517 | 83·79 |
| 85 | 552 | 84·66 |
| 90 | 590 | 85·50 |

(*vi*) *Supersaturation* 1·5

| °C | *g sucrose/100 g water* | *g sucrose/100 g solution* |
|---|---|---|
| 60 | 433 | 81·21 |
| 65 | 459 | 82·09 |
| 70 | 488 | 82·98 |
| 75 | 520 | 83·85 |
| 80 | 554 | 84·70 |
| 85 | 592 | 85·53 |
| 90 | 633 | 86·33 |

Similarly for undersaturated solutions the concentrations may be calculated from the saturation data and the undersaturation factor, producing the figures tabulated below:

(*vii*) *Undersaturation* 0·9

| °C | *g sucrose/100 g water* | *g sucrose/100 g solution* |
|---|---|---|
| 60 | 260 | 72·17 |
| 65 | 275 | 73·33 |
| 70 | 293 | 74·51 |
| 75 | 312 | 75·69 |
| 80 | 333 | 76·88 |
| 85 | 355 | 78·03 |
| 90 | 380 | 79·14 |

[26] *Zeitsch. Zuckerind.*, 1973, **98**, 11.
[27] *ibid.*, 1954, **79**, 97.

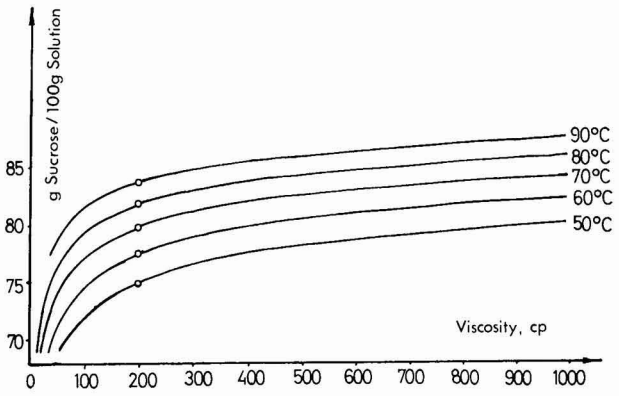


Fig. 3. Isotherms of sucrose solutions in relation to viscosity and concentration

The values calculated by this means for the various supersaturations in g sucrose per 100 g solution are transferred with their respective corresponding temperatures to the graph in Fig. 2. Expression of the concentration data as g sucrose per 100 g solution or °Bx on the ordinate results in lines having the same direction, but of opposite curvature to the supersaturation curves.

*Relationship between dry substance content, temperature and viscosity*

Using the same coordinates as in Fig. 2, curves of equal viscosity of sucrose solutions may be drawn. This is possible by using data from the tables of the National Bureau of Standards[28] and of SCHNEIDER, SCHLIEPHAKE and KLIMMEK[29] which have been adopted under Subject 23 of ICUMSA[1]. The isotherms of the range which is important for the boiling process are first drawn in accordance with Fig. 3. The values of viscosity on the abscissa range from 0 to 1100 cp, and on the ordinate the concentrations of the solutions lie in the range 69–87 g sucrose/100 g solution.

If vertical lines are drawn parallel to the ordinate for certain viscosity values, then these lines cut the group of isotherms. If these parallel lines of equal viscosity are transferred to a system of coordinates in which the temperatures from 60° to 90°C (140°–194°F) are marked on the abscissa and the concentrations from 71 to 88 g sucrose/100 g solution on the ordinate, this records (Fig. 4) the lines of equal viscosity for the important range in the boiling process of about 40–1100 cp. These lines of equal viscosity run in the same direction and are curved in a similar manner to the lines of equal under- or supersaturation.

The viscosity tables of the NBS[28] and of SCHNEIDER, SCHLIEPHAKE and KLIMMEK[29] which are used only cover a temperature range of up to 80°C (176°F). However, since the temperatures during the boiling process are increased to about 90°C, at times intentionally, the curves in Fig. 4 have been extrapolated. These curves are respectively defined by 4 points and the extrapolation is thus justified.

The connexion between supersaturation and viscosity of sucrose solutions, as shown in Figs. 2 and 4, indicates that it would also be admissible to split the range of viscosities into several zones, according to the ideas of OSTWALD and MIERS. However, since the transitions between the individual zones are effected smoothly, there seems at first to be little point in doing this.

*(To be continued)*

[28] *National Bureau of Standards Circ.*, 1958, (440).
[29] *Zucker*, 1963, **17**, 469.

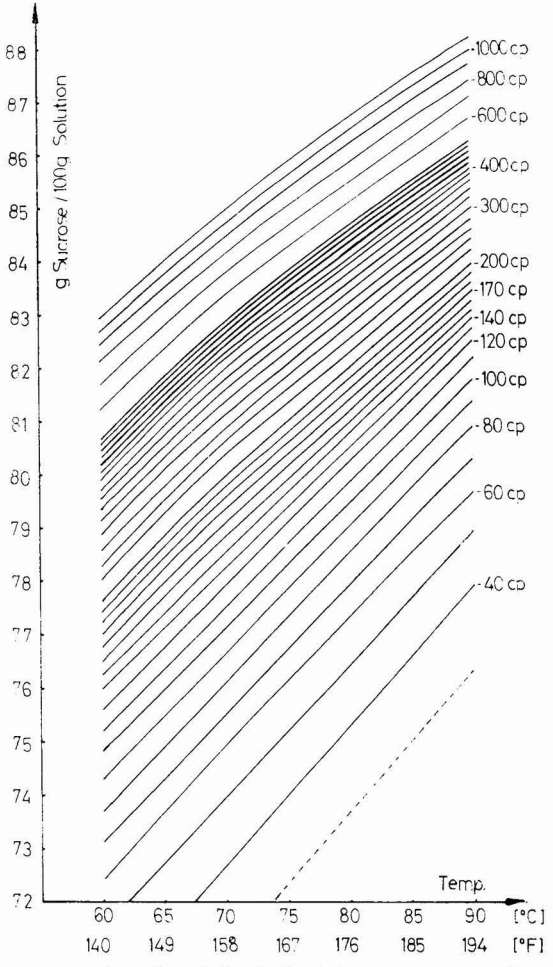


Fig. 4. Lines of equal viscosity in relation to temperature and concentration of sucrose solutions

# Sugar cane agriculture

**Drainage—where the most efficient solution is the cheapest.** ANON. *S. African Sugar J.*, 1973, **57**, 229–233.—Advice is given on the best approach to subsurface drainage using clay or plastic pipes as a cheaper and more efficient method of cane field drainage than permanent open drains.

* * *

**Higher sugar cane yields through higher populations.** R. J. MATHERNE. *Sugar J.*, 1973, **35**, (12), 9–12.—See *I.S.J.*, 1973, **75**, 15.

* * *

**The influence of variables and soil moisture on c.c.s. trends.** L. S. CHAPMAN. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 17–27.—Investigations to determine the cause of high cane sugar content in 1972 and measure the trends at eight sugar factories during the 1953–1972 period are reported. Increases in the 1953–1962 period in late-season cane sugar content and in the 1963–1972 period in early-season cane sugar content were attributed to changes in cane varieties grown, although correlation was found between c.c.s. and soil moisture, air temperature and sunshine, the effects of these climatic factors varying with season, so that what increased cane sugar in the early season had the reverse effect later, and *vice versa*. Hence, wet weather has a varying effect with season. Irrigation is thought to have contributed to c.c.s. increases in certain areas. Although nitrogen has been found to depress cane sugar levels, again the relationship is not simple and under some circumstances N will increase c.c.s.

* * *

**Acres to hectares.** S. T. CLARKE and O. F. LEWIS. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 29–30.—Of methods investigated for measuring, plotting and determining the areas of cane blocks in the vicinity of Babinda sugar factory, computer plotting (coupled with photographic conversion of master plans to metric measurements) proved to be the most suitable as regards costs.

* * *

**Further measurements of chopped cane deterioration.** P. C. IVIN and D. BEVAN. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 31–38.—Cane billets longer than 25 cm suffered deterioration, during 12–24 hours after harvesting, at a rate about half that of mutilated billets and billets shorter than 25 cm (3·4% loss in c.c.s. compared with 5·8% after 24 hours). Losses after 6 hours were 0·4% and 1·5% for long and short billets, respectively. Dextran was found after 12 hours in only one of the three varieties investigated, but after 18 hours had reached a very high level, the concentration in the short and mutilated billets being double that in the long billets.

* * *

**Epiphytology of leaf scald in the central district of Queensland.** G. J. PERSLEY. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 39–52.—The high incidence of leaf scald occurring in 1972 in the Mackay area of Queensland, particularly affecting Q 63 cane but also found in Q 87 cane, was investigated and geographic distribution and incidence of the disease in the central district during the 1960–72 period recorded. Climatic conditions for the same period are also reported. It was found that a year of high rainfall (especially in the summer) preceded a year of considerable leaf scald spread. The acute-stage symptoms of the disease are described and environmental factors favouring occurrence of the symptoms discussed. Actual losses caused are not reported, but are described as sufficiently heavy to warrant stringent control measures; recommended steps include removal of Q 63 cane from the recommended list of varieties, roguing and 24-hour soaking of setts in cold water followed by 3 hours in hot water at 50°C.

* * *

**Leaf scald in Mackay, 1970-1972.** P. J. AMIET. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 53–57.—Spread of the disease since 1970 is discussed. Observations indicate that Q 87 cane may mask the symptoms even more effectively than does Q 63, although so far no acute-stage symptoms have been found in the variety. It is thought that an undetected method of transmission must exist, since spread by mechanical harvesters and diseased planting material does not account for all the infection reported.

* * *

**An evaluation of aerial baiting for the control of rats in cane fields.** B. E. HITCHCOCK. *Proc. 40th Conf. Queensland. Soc. Sugar Cane Tech.*, 1973, 59–64. Experiments at Babinda and Ingham showed that aerial application of baits was as effective as ground baiting in reducing cane damage by rats (by about 3% absolute compared with nearly 7% in the control) when the rat incidence was low, but its effectiveness at times of high rat incidence has yet to be demonstrated. Baiting was equally effective against the ground rat, *Rattus conatus*, and the climbing rat, *Melomys littoralis*. Loss of cane sugar was significant only when the bitten stalks were actually broken, and it was found that the rats preferred thinner stalks. Size of sample, number of sampling points per field and number of replicates required to assess the effects of aerial baiting were also investigated.

**Fungicide spray trials demonstrate some losses caused by yellow spot disease.** B. T. EGAN. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 65–69. Application of "Benlate 50W" ("Benomyl") in amounts of 140 and 560 g a.i. per ha in tests against yellow spot increased cane sugar content compared with the untreated control but was not adequately effective. Losses caused by yellow spot were considerably underestimated since premature leaf death could not be taken into account. The incidence of yellow spot is governed by weather conditions, and in a very wet season will be high and cause severe losses in 4 out of 10 years in the Mossman and Tully areas of Queensland.

* * *

**Low c.c.s. at Gin Gin mill—a preliminary survey.** C. L. TOOHEY and L. K. KIRBY. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 97–103. Examination of possible causes of low c.c.s. in cane grown in certain seasons during 1963–72 in the Gin Gin mill district of Queensland showed that under certain conditions frost was a contributory factor as was the tendency to harvest immature cane under these same unfavourable conditions. Low rainfall around the time of frost incidence was a further cause, so that wider use of irrigation is called for as in the Bundaberg mill area, used as comparison, where early irrigation ensures heavier crop growth and improved frost protection. More judicious use of fertilizers is also recommended.

* * *

**Plant cane response to cultivation.** R. B. MOLLER. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 105–107.—Trials in which cane of four varieties planted just after the beginning of April was treated by one of three cultivation methods showed that as regards final stand percentages, shoot populations per ha, harvestable stalk populations per ha and stalk lengths, the conventional procedure (gradual filling of drill by tine or disc to leave a flat or slightly concave drill at the last cultivation) was slightly more suitable than complete filling of the drill at end-July before stool development, and half filling of the drill at end-July with complete filling at end-October. Although no conclusive evidence of variety × cultivation interaction was obtained, the possibility of such interaction in N:Co 310 and Q 93 was indicated.

* * *

**A progress report on calcium silicate investigations.** A. P. HURNEY. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 109–113.—Field tests, in which Ca silicate was added, dry, to cane of three varieties at the rate of 1·25, 2·5 and 5·0 metric tons/ha showed increases in yield and total sugar/ha but decreases in cane sugar content compared with untreated cane (both plant and ratoon cane was tested). Markedly differing response patterns were evident in the plant crops, as well as in the Si content of leaves and of the three types of soil involved. Since the major changes in soil Si occurred in the surface layers, the effect of Ca silicate may be greatest during early plant growth. The possibility that levels of Mn and Al in the soils treated may limit yields which would otherwise increase as a result of Ca silicate application was also suggested.

* * *

**Tully Sugar Experiment Station.** D. R. RIDGE and I. J. V. STEWART. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 115–120.—The work involved in developing the land at the new wet belt experiment station established at Tully and still in process of expansion is reported.

* * *

**The potential of "Class A" pan evaporation data, for scheduling irrigation of sugar cane at Bundaberg.** G. KINGSTON. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 151–157.—Hypothetical irrigation schedules based on evaporation data obtained with "Class A" pans (121·9 cm in diameter, constructed of galvanized iron with the water surface exposed some 30 cm above ground level) were compared with 4 years of actual irrigation schedules based on soil moisture potential data. Very good agreement was obtained between the types of schedule, the main discrepancies appearing to coincide with periods following heavy and sustained rainfall, when the hypothetical schedules over-predicted irrigation requirements. Generally, the predictions of crop water usage based on the "Class A" pan data were within the permissible limits of accuracy for commercial irrigation scheduling.

* * *

**Cane loader or mud loader?** L. L. LAUDEN. *Sugar Bull.*, 1973, **51**, (14), 4.—Reference is made to the high sugar factory losses in Louisiana caused by excessive quantities of mud accompanying mechanically loaded cane. Even in dry years the problem is one of excessive soil, and the author calls for an attachment to reduce the amount. A suggestion, made by C. HODSON, involves slight lifting of the cane when it is first touched by the piler. The cane is then moved to a storage area at the rear of the loader, the bottom of the storage area being only high enough to prevent the cane from touching the tops of the rows. The cane would not be pushed and rolled, as on current pilers used in Louisiana, and hence would not gather mud or soil.

* * *

**Full proportionality in determination of cane price premium.** M. PITTIE. *Indian Sugar*, 1973, **22**, 843–851. The system adopted in India involves a minimum price for cane linked to a basic sugar recovery of 8·5%. Division of the former by the latter gives an amount which is paid additionally for every 0·1% increase in recovery. Advantages and disadvantages of the scheme are discussed, the major drawback being reluctance on the part of the factories to increase recovery merely to pay more for the cane. Among suggested changes to the system is payment on cane sucrose content rather than on recovery.

* * *

**Factors affecting juice quality of sugar cane—a review.** S. K. OJHA, J. P. SINGH and N. AHMAD. *Indian Sugar*, 1973, **22**, 861–866.—A survey of the literature (the

vast majority of it Indian) concerning factors affecting cane juice quality is presented, covering climate, varieties, planting method and material, tiller number and formation, fertilization, irrigation and soil moisture, waterlogging and flooding, diseases and pests, lodging, arrowing, pre-harvest spraying, intercropping and post-harvest deterioration.

* * *

**Studies on loss in yield of sugar cane due to borer incidence, *Chilo infuscatellus* Snellen (Pyralidae: Lepidoptera).** S. C. RAO and M. M. K. MURTY. *Indian Sugar*, 1973, **22,** 867–868, 871.—In 3-year tests, cane was deliberately subjected to treatment simulating borer infestation, i.e. formation of dead-hearts to specified levels of 15% and 30% within 30 and 60 days of planting. It was found that up to 15% there was negligible loss in cane yield, while at 30% dead-heart incidence the cane yield loss was significant. Hence, chemical spraying is advised when the dead-heart incidence exceeds 15%. The time of dead-heart formation had no significant effect; juice sugar content was not significantly affected at either level of dead-heart incidence.

* * *

**Schedule for integrated control of sugar cane pests.** Z. A. SIDDIQI and R. A. AGARWAL. *Indian Sugar*, 1973, **22,** 869–871.—Although most cane insect pests can be controlled with chemicals, the authors consider the use of a specific chemical for each pest to be too costly as well as time-consuming. However, there are certain groups of insects against which combined treatment has proved effective. Among those discussed are (i) termite and shoot borers, (ii) Lugaeid (black) bug, *Pyrilla perpusilla*, grasshopper and curculionid beetle which attack young shoots and leaves, (iii) top and stem borers, *Pyrilla perpusilla* and white fly, and (iv) beetle grub (*Lachnosterna consanguinea*), a subterranean pest attacking roots and rootlets during monsoon months and therefore controlled only by separate measures.

* * *

**Influence of weather factors on the incidence of *Ustilago scitaminea* Syd. on sugar cane.** S. NATARAJAN, S. D. RAJAN, N. J. AHMED and D. PADMANABHAN. *Indian Sugar*, 1973, **22,** 873–874.—Of 142 cane varieties screened for smut incidence caused by *U. scitaminea*, about 74% were found to be affected during May–July, the same pattern occurring in all four groups (resistant, moderately resistant, susceptible and highly susceptible). The findings, covering the period 1963–70, showed that severity of the disease was enhanced by a combination of high day temperatures (above 35°C), low relative humidity (below 70%) and a moderate rainfall (30–70 mm per month).

* * *

**Comparative efficacy of some new insecticides against sugar cane Lygaeid bug (*Cavelarius excavatus*).** J. S. SANDHU, M. S. DUHRA and S. K. SHARMA. *Indian Sugar*, 1973, **22,** 879–882.—In trials on Co 1148 ratoon cane, 0·05% "Chlorfenvinphos", 0·05% "Dursban", 0·05% "Fenitrothion", 0·02% "Endrin" and 0·02% "Phosphamidon" in emulsions sprayed at the rate of 1000 litres/ha reduced black bug infestation by 96·0%, 95·7%, 90·5%, 86·8% and 85·6%, respectively, 72 hours after application. The first two chemicals mentioned were not available commercially so that comparison of the economics was not possible.

* * *

**Florida sugar cane industry hosts mechanical harvesting field day.** B. HUNTER. *Sugar y Azúcar*, 1973, **68,** (4), 19–21.—Information is given on the cane harvesting equipment demonstrated at the 7th annual Sugar Cane Harvesting Field Day (a 2-day event) held in Florida in 1973.

* * *

**Mosaic testing methods in Louisiana.** R. D. BREAUX and H. KOIKE. *Sugarcane Pathologists' Newsletter*, 1973, (10), 7–8.—The method used at Houma to test cane for mosaic resistance involves seedling inoculation in the greenhouse using a spray method[1] and eliminating all those (averaging 70–80%) exhibiting disease symptoms. (The same method is also applied to young shoots from clonal eye-pieces for early information on varietal resistance.) The greenhouse tests are followed by field tests, information also being collated on natural infection in areas of high mosaic spread. Careful selection of parents is also used. Results indicate that the methods are giving an increased number of resistant clones from CP trial varieties, with commercial varieties used as controls.

* * *

**Screening sugar cane seedlings for resistance to eye spot disease with a host-specific toxin.** R. S. BYTHER and G. W. STEINER. *Sugarcane Pathologists' Newsletter*, 1973, (10), 9–10.—Spraying 1-month cane plants with helminthosporoside obtained from the eye spot pathogen *Helminthosporium sacchari* produced eye spot symptoms in susceptible seedlings after 48 hr. Susceptible and resistant plants were separated and later transplanted, seedlings from the same seed lot but unsprayed also being transplanted as controls. At 6 months the cane plants were tested for eye spot susceptibility using stalk injections of the above toxin. Results showed that the spray method was effective in identifying susceptible seedlings.

* * *

**Mycoplasma-like organism in a leaf of sugar cane with grassy shoot.** N. RISHI, S. OKUDA, K. ARAI, Y. DOI, K. YORA and K. S. BHARGAVA. *Sugarcane Pathologists' Newsletter*, 1973, (10), 10.—Although grassy shoot, first recorded in India in 1955, has been considered to be a virus infection, studies indicated the absence of virus particles but the presence of a large number of spherical, ovoid and irregularly shaped mycoplasma-like organisms (MLO) in the sieve tubes of a severely diseased leaf. Diameter of the bodies was 300–400 nm and of the filaments protruding from them 30–50 nm. MLO concentration

[1] DEAN: *Plant Disease Reporter*, 1960, **44,** 874–876.

was very high in plants growing at about 30°C and exhibiting severe symptoms, while only a few MLO were found in mildly infected plants growing at about 25°C. MLO have also been found in Taiwan cane infected with white leaf disease, earlier reported to be similar to grassy shoot, and the possibility of a relationship between the two diseases is suggested.

* * *

**Fungicides in the control of sugar cane smut.** S. MUTHUSAMY and K. T. S. RAJA. *Sugarcane Pathologists' Newsletter*, 1973, (10), 11–13.—Of nine fungicides tested in field experiments on smut control in cane of two varieties which were dipped in solutions of the fungicides for 15 min before planting, the most effective with both varieties was 0·5% "Agallol" (84·9% and 79·3% decrease in smut compared with the control), followed by 0·3% "Dithane-Z-78" (zinc ethylene *bis*-dithiocarbamate), which reduced the disease by 81% in one case but only by 42·4% in the other.

* * *

**Diseases loss assessment and yellow spot.** B. T. EGAN. *Sugarcane Pathologists' Newsletter*, 1973, (10), 13. It has been shown that yellow spot can cause considerable decrease in total sugar production in cane, apparently as a result of the physical loss of green leaf area. Although it should be possible to obtain a reasonable correlation between the two losses, it is pointed out that opinions differ as to the relative importance of leaves of different ages as far as photosynthate production is concerned. If the one or two oldest green leaves on a stalk contribute little to total sugar production, their premature death from yellow spot would not cause much loss in sugar production; on the other hand, it appears that the oldest leaves may make a valuable contribution to sugar production and storage, and the author calls for further evidence on the question.

* * *

**Systemic fungicides in the control of pineapple disease of sugar cane.** S. MUTHUSAMY. *Sugarcane Pathologists' Newsletter*, 1973, (10), 14–15.—Tests in which two-budded setts were dipped in fungicide solutions 15 min before planting and their percentage germination determined after 20 and 35 days showed that maximum germination (33·9% and 37·9%) was obtained with 1000 ppm "Demosan" (1,4-dichloro-2,5-dimethoxy benzene) which also reduced the incidence of pineapple disease in the ungerminated setts to 40% compared with 80% in the controls. These results were better than obtained with "Agallol" which proved less effective as regards % germination and disease reduction than "Thiabendazole" and "Benlate", although it has been widely used to give protection against soil-borne diseases and to increase cane germination.

* * *

**Sugar cane mosaic strain K: a new strain of sugar cane mosaic virus in Meridian, Mississippi.** N. ZUMMO and I. E. STOKES. *Sugarcane Pathologists' Newsletter*, 1973, (10), 16–17.—Cane setts are screened at the Meridian Field Station, Mississippi, for resistance to the only strain (B) of mosaic virus hitherto found in cane in the state. In 1970, however, a high percentage of mosaic-infected setts of a particular cross showed symptoms of local lesions 4 to 7 mm wide and 20–80 mm long which were generally isolated, roughly lanceolate in shape, with discrete green centres. Subsequent investigations showed that the physical properties of the new strain (designated K) and of strain B were similar, but the incubation time for K was much shorter than for B. Since strain K was limited to the Field Station, all the mosaic-infected cane was destroyed in 1972 to prevent its spread to commercial fields, but this prevented complete determination of the host range of the new strain.

* * *

**Predators and parasites of vectors of sugar cane mosaic.** S. M. A. RIZVI and K. S. BHARGAVA. *Sugarcane Pathologists' Newsletter*, 1973, (10), 18–19. Investigations have shown that Coccinellid grubs and *Epilachna* beetles were predators on five aphid vectors of cane mosaic (*Aphis gossypii*, *Melanaphis sacchari*, *Lipaphis pseudobrassicae*, *Myzus persicae* and *Rhapalosiphum maidis*), while *Trioxys* sp. was a parasite of *Melanaphis sacchari*.

* * *

**Sugar cane diseases in Japan.** Y. OHTSU. *Sugarcane Pathologists' Newsletter*, 1973, (10), 19.—A brief report is presented on the work of the sugar cane seed station at Kagoshima, Japan, which is mainly concerned with producing healthy planting material of varieties N:Co 310, L60-14 and Ni-1. Mosaic is controlled by roguing and ratoon stunting disease by hot air treatment for 8 hr at 54°C. Apart from mosaic, found on all 3 varieties, 4 other diseases were found in 1972, all infecting N:Co 310. They were: banded sclerotial disease, black sooty mould, leaf scorch and RSD.

* * *

**Culmicolous smut.** G. L. JAMES. *Sugarcane Pathologists' Newsletter*, 1973, (10), 20.—The numbers of smut whips per ha in ratoon crops from 9 varieties (4th ratoon) and 15 varieties (3rd ratoon) as found in trials in Rhodesia are tabulated. The only varieties to prove completely resistant were N 52/219 (in both 3rd and 4th ratoons) and M 383-41 (only investigated as 4th ratoon), while Co 775 was only slightly affected as a 4th ratoon.

* * *

**Sugar cane diseases prevalent in Taiwan in 1972.** L. S. LEU. *Sugarcane Pathologists' Newsletter*, 1973, (10), 23–24.—Cane diseases found in Taiwan in 1972, the varieties involved and conditions under which they occurred as well as the extent of infection are discussed. Three diseases reported for the first time in Taiwan are yellow wilt, *Alternaria* leaf spot and black leaf spot, caused by *Phyllachora sacchari*.

* * *

**The taxonomic position of the pathogen of red stripe of sugar cane.** S. R. S. DANGE and M. M. PAYAK. *Sugarcane Pathologists' Newsletter*, 1973, (10), 25–28. In an attempt to clarify the situation regarding the

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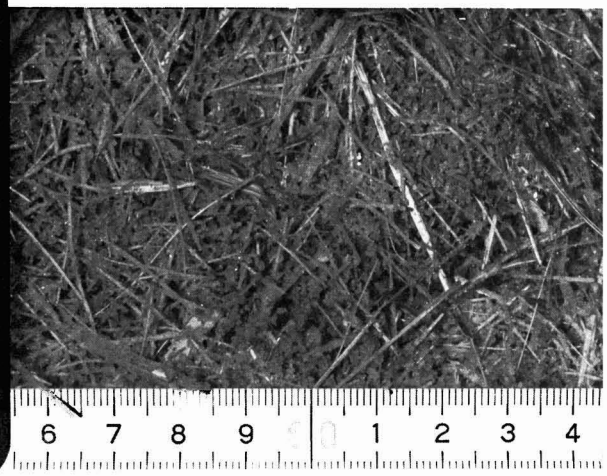


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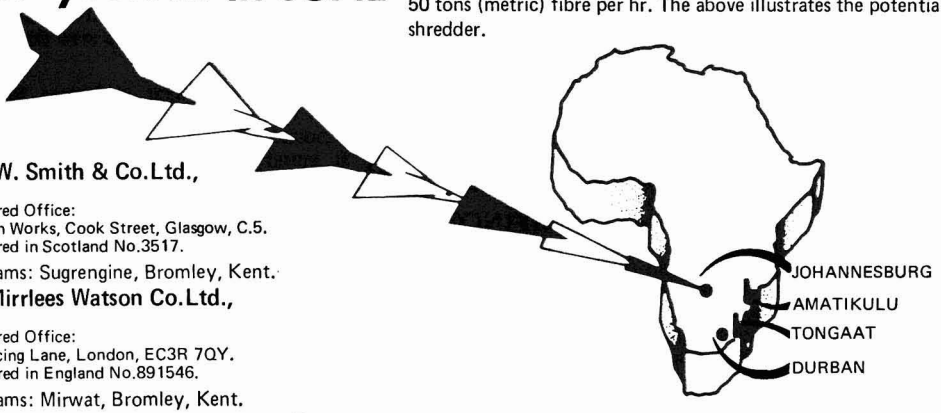


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causal agent of cane red stripe, cultural, morphological and biochemical studies were made of isolates from diseased maize, teosinte and cane. The characters indicated that the pathogen involved in cane red stripe and leaf stripe of maize and teosinte is *Pseudomonas rubrilineans* and not *Xanthomonas rubrilineans*, with which the former has no affinity.

* * *

**Notes from Mount Edgecombe.** G. M. THOMSON. *Sugarcane Pathologists' Newsletter*, 1973, (10), 28–29. Reference is made to outbreaks of red rot in Swaziland and Natal, the most susceptible cane variety being N:Co 376, the major variety grown in South Africa. "Benlate" as a pre-planting dip for pineapple disease control has been registered for use by cane growers, the recommended rate being 0·5 g/litre. Addition of a dye to help distinguish between treated and untreated setts has been suggested. Accurate diagnosis of ratoon stunting disease from nodal symptoms was tested in three varieties grown under different irrigation cycles. Results ranged from very clear symptoms in N 53/216 to inconsistent symptoms in N:Co 376. While evidence of stunting was very clear in plots irrigated less frequently, the harmful effect of RSD was less noticeable in cane irrigated more frequently.

* * *

**Epiphytology of leaf scald in the central district of Queensland.** G. PERSLEY. *Sugarcane Pathologists' Newsletter*, 1973, (10), 30–31.—See *I.S.J.*, 1974, **76**, 141.

* * *

**Heat therapy for sugar cane.** S. EDISON. *Sugarcane Pathologists' Newsletter*, 1973, (10), 31.—Treatment of setts with aerated steam for 1 hr at 50°C has proved superior to hot water treatment for 2 hr at 50°C or hot air treatment at 54°C for 8 hr as regards grassy shoot control and germination. Complete elimination of the disease was achieved even when the setts were clearly diseased before treatment.

* * *

**Weed control in sugar cane. Review and further research.** V. S. MANI. *Seminar on Weed Control in Sugar Cane, Deccan Sugar Tech. Assoc. (India)*, 1972, 19–24.—A review of the literature is presented, mainly covering work on herbicide application but also concerning associated themes such as the effects of herbicides on cane juice quality and the effects of weeds on crop yield. Suggestions for further research work are listed.

* * *

**Chemical weed control in sugar cane.** V. G. SATRALKAR. *Seminar on Weed Control in Sugar Cane, Deccan Sugar Tech. Assoc. (India)*, 1972, 25–26.—Trials with "Atratrop 50W" (50% "Atrazine") demonstrated its effectiveness against all common weeds except *Cynodon dactylon* and *Cyperus rotundus* in the area of Maharashtra in question.

* * *

**Studies on chemical control of weeds in sugar cane in the Punjab.** K. S. KANWAR. *Seminar on Weed Control in Sugar Cane, Deccan Sugar Tech. Assoc. (India)*, 1972, 27–28.—Brief mention is made of herbicide trials, and particularly of efforts made to combat *Cyperus rotundus*. "Eptam" (a carbamate) applied at 5 litres/ha before planting and "Diuron" at 2 kg/ha as a pre-emergence herbicide have both proved effective, while "Gramoxone" as a post-emergence herbicide has kept the weed in check for only about 1 week.

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**Water use efficiency as influenced by chemical weed control in sugar cane cultivation (variety Co 1104).** P. N. CHOUDHARY and V. S. MANI. *Seminar on Weed Control in Sugar Cane, Deccan Sugar Tech. Assoc. (India)*, 1972, 29–42.—Herbicide trials are reported in which the total amount of irrigation water used by the cane in treated plots and the loss of moisture from the soil were much lower than in untreated plots. Cultivation as a means of weed control was not as effective as herbicides in reducing water usage. "Atrazine" was the most effective of the chemicals used in reducing weed dry matter accumulation. Cane and sugar yields were also considerably increased by herbicide application compared with cultivation.

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**Further studies on weed control in sugar cane.** M. V. SANT and S. K. LAD. *Seminar on Weed Control in Sugar Cane, Deccan Sugar Tech. Assoc. (India)*, 1972, 43–49.—Attempts to control a wider range of weeds (mono- and dicotyledonous) by combining "Atrazine" with "Dalapon" and "Diuron" with 2,4-D were successful in trials which are reported.

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**Chemical weed control in sugar cane plantations.** M. V. SANT and G. K. ZENDE. *Seminar on Weed Control in Sugar Cane, Deccan Sugar Tech. Assoc. (India)*, 1972, 50–58.—A review of the literature is presented covering herbicide research in India and other countries as well as the subjects of weed effects on cane yield and quality, methods of herbicide spraying, choice of herbicides and factors influencing their effectiveness.

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**"Paraquat" for weed control in sugar cane in Western Maharashtra. A report.** P. N. PANDE, A. D. MANDKE and M. K. MITTRA. *Seminar on Weed Control in Sugar Cane, Deccan Sugar Tech. Assoc. (India)*, 1972, 59–64.—Results indicated that 0·5 kg "Paraquat" + 2·0 kg 2,4-D per ha as an overall post-emergence application 20 days after planting (coincident with about 15–20% cane shoot emergence) followed by direct inter-row application of "Paraquat" 50–60 days after planting gave excellent weed control without affecting cane growth.

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**Control of weeds in sugar cane by pre-emergence herbicide "Lasso".** N. S. NEGI and B. S. AGNIHOTRI. *Seminar on Weed Control in Sugar Cane, Deccan Sugar Tech. Assoc. (India)*, 1972, 66–70.—Reference is made to various experiments in which "Lasso" has proved effective against weeds, particularly grasses but also broadleaves.

# Sugar beet agriculture

**Quality tests reflect the grower practices used.** M. G. FRAKES. *Sugar Beet J.*, 1973, **36**, (3), 7–8.—Analyses have shown that in Michigan the average N application was reduced from 105 lb/acre in 1971 to 80 lb/acre in 1972, the overall average amino-N content being decreased by 22% (from 23 to 18 meq/100 sugar) with a corresponding increase in clear juice purity from 93·0 in 1971 to 93·6 in 1972. A simple procedure for determining N carry-over to the next crop and the recommended amount of N to apply is described. The smallness of weather effects on clear juice purity and amino-N is mentioned as is the fact that beet sugar content is half affected by weather and half by field practices.

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**Confirmations and developments in the mechanization of the beet cultivation sector.** E. MANFREDI and G. BARALDI. *Ind. Sacc. Ital.*, 1973, **66**, 35–46.—Various aspects of mechanization of sugar beet cultivation are examined, including soil preparation, seed sowing, etc., and the work of the Institute of Agrarian Mechanics of the University of Bologna is reviewed, with reference to 22 papers published.

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**The pygmy mangold beetle—*Atomaria linearis* Steph.—a harmful pest of sugar beet.** M. KUBACKA-SZMIDTGAL. *Gaz. Cukr.*, 1973, **81**, 81–85.—This pest has been particularly active in damaging beet in various regions of Poland during the last two years. Its biology is outlined and the type of damage caused described, while possible means of control are listed.

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**Field tests with beet seed treated with various insecticidal seed dressings.** W. R. SCHÄUFELE. *Zucker*, 1973, **26**, 308–314.—Three-year tests on a large number of beet fields in which various doses of "Lindane", "Mercaptodimethur" and "Heptachlor" were applied to pelleted and unpelleted beet seed showed that the first two were as good as or even slightly better than "Heptachlor" as regards emergence, depending on the degree of infestation and the emergence conditions. However, the warning is given that these results must be regarded as purely preliminary findings, and that the insecticides must be evaluated from all phytosanitary and toxicological as well as cultural aspects.

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**Effect of method of sowing and spacing on sugar beet under Hissar soil conditions.** S. S. NARWAL, S. SINGH, N. L. BHATIA and K. L. BEHL. *Indian Sugar*, 1973, **22**, 875–877.—Under the heavy soil conditions of Hissar (Haryana State), ridge sowing was better than flat sowing as regards yield and number of roots per ha, while a spacing of 50 cm was better than 60, 70 or 80 cm. Reasons given for the advantage of ridge sowing include better aeration, avoidance of the adverse effects of soil compaction on root growth, better water economy in irrigation, and the fact that in saline soils the salt climbs to the top of the ridge so that the roots do not come into contact with it.

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**Effect of nitrogen and irrigation on sugar beets production in southern Idaho.** J. B. CARTER, M. E. HENSEN, B. J. RUFFING, S. M. BOSMA and A. W. RICHARDS. *J. Amer. Soc. Sugar Beet Tech.*, 1972, **17**, 5–14.—N application before planting gave much higher beet and sugar yields per acre than did application in mid-July. In all cases the greatest increase in beet yield was obtained with the first 50 lb of N/acre (the smallest N dose) after which the rate of increase was much smaller. Sugar content fell with increased N rates, regardless of time of application. Split applications (some N applied before planting and the rest in mid-July) did not improve on the effects of preplanting application. Maximum sugar yields were obtained when the $NO_3$-N concentration in the petioles[1] exceeded 12,000 ppm in early July and was about 1000 ppm on 20th August. Under optimum irrigation conditions (to give maximum sugar yield) split N applications did not affect yields, but with irrigation practices commonly used in the area, split application gave somewhat lower yields than did preplanting application. Irrigation normally had little effect on the results given by N alone, but overirrigation early and in mid-season increased the effects of limited N rates.

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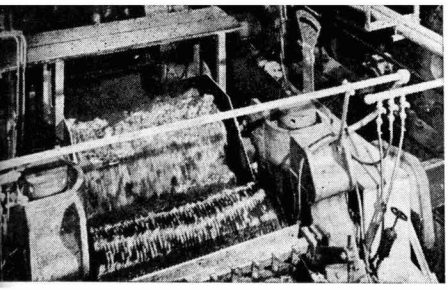
**Evaluation of cyst selection as a means of reducing variation in sugar beet nematode inocula.** A. E. STEELE. *J. Amer. Soc. Sugar Beet Tech.*, 1972, **17**, 22–29. Studies to determine hatching performance as a function of *Heterodera schachtii* cyst selection from infested soil showed that significantly greater numbers of eggs were hatched from whole cysts from which precystic females and partially evacuated cysts were excluded in selection. Greater hatching was obtained when beet root diffusate was used as hatching medium in contrast to tap water, and when the eggs in the cyst were clumped together rather than loose. Only about one-third of the cysts selected produced fewer than 201 larvae.

[1] *I.S.J.*, 1973, **75**, 215.



# Cane sugar manufacture

**Guidelines for effective pH control.** D. J. HALE and E. WHAYMAN. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 141–150.—pH control in juice liming is discussed and a basic control scheme described. Of various types of control valve for milk-of-lime addition which are examined, the only one which combines a wide operating range with an unrestricted flow path is an "iris" type, the Clarkson "C" valve, manufactured by the Clarkson Company of America. Tests on a system including this valve showed that pH control within $\pm$ 0·05 units is possible provided there is efficient control of juice flow, milk-of-lime make-up and lime dilution for injection.

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**High capacity (centri)fugalling—Racecourse, 1972.** C. S. HENDERSON and L. K. KIRBY. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 159–165. Difficulties in handling massecuite in 10 Broadbent batch centrifugals plus labour deficiencies led to the decision to modify 3 BMA K1000 continuous centrifugals and use them to treat all the low-grade massecuite at Racecourse in 1972. A fourth continuous unit was put into operation during the last two weeks of crushing. The modifications include feed inlet alterations, redesigning of the feed probe and provision for more rapid removal of molasses from the vertical basket section. It is also considered necessary to have a flowmeter of the "Rotameter" type for measuring total water usage. Recovery was maintained at the level of the previous season, while 17% more massecuite was handled. Magma purities were the same as before, but sugar grist was among the lowest in Queensland. Labour and maintenance costs were substantially reduced.

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**The control of electric heating of low-grade massecuite.** P. G. WRIGHT and J. D. MALAN. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 1967–170. Widely varying input massecuite temperatures can create problems for electric reheaters where use of a manually switched ring system cannot prevent current instability with considerable fluctuation in voltage requirement and the heaters are thus damaged. Silicon controlled rectifiers can control the input current with a substantial fluctuation in input voltage, but two SCR's are needed to control an A.C. circuit. Addition of an extra layer of material to an SCR and modification to the design of the gate gives a device known as a triac, which can block or conduct in either direction while only one is needed for control of an A.C. circuit. Use of triacs in a massecuite heater control system is described. Operation for most of the 1972 season showed that current control was better than with earlier SCR controllers while the system was considerably less complicated than some systems using later types of SCR. Costs are probably similar to those of current systems.

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**Preliminary studies on the breakage of sugar crystals on impact.** R. J. NORBURY and E. T. WHITE. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 171–179.—Initial experiments to assess the effect of crystal impact against the stationary casing of a continuous centrifugal are reported. It was found that breakage probably increases with velocity, and that below a certain velocity little breakage is likely while above it the likelihood of breakage increases rapidly with rising velocity. Reduction in the angle of impact also reduced the probility of breakage, as did the presence of a molasses film on the crystals. A relationship between crystal size and breakage was also suggested but has not been studied. The crystals used in most of the tests were of screened mill shipment sugar about 0·8 mm in size.

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**Some thoughts on recovery and low-grade stations.** L. K. KIRBY and P. G. ATHERTON. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 181–185. The subject is discussed against the background of poorer performances at sugar factories from the pan station on, most likely (it is suggested) caused by increased throughputs in Queensland. The need for rational planning of recovery and low-grade stations is emphasized, and factors requiring consideration are discussed. These include automatic process control by computer as well as simple, more localized means of control, continuous boiling and crystallization, use of continuous centrifugals and the associated problem of crystal breakage, massecuite reheating and transfer.

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**The use of boiling point rise for the control of pans.** R. J. BATTERHAM, J. A. FREW and P. G. WRIGHT. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 187–192.—The advantages and disadvantages of the use of boiling point rise (BPR) for the control of pan boiling, particularly by computers, is discussed and details given of tests involving a pan of 81 m³ capacity. It was decided to use the bulk liquid temperature as the main measure of BPR and eliminate the superheat by using a suitable correlation $SH = 9{\cdot}905 + 0{\cdot}029L + 3{\cdot}99H/(T_H - T_L) - 1{\cdot}7286CC + 0{\cdot}1203TP$, where $SH$ = superheat (°C), $L$ = massecuite quantity (metric tons), $H$ = steam flow

(metric tons.hr$^{-1}$), $T_H$ = temperature in calandria (°C), $T_L$ = bulk liquid temperature (°C), $CC$ = crystal content (kg/kg massecuite) and $TP$ = true purity. Standard error was 0·20°C, and the expression permitted supersaturation to be calculated at any time during the strike to within ± 0·03 units of the actual values. While this is considered an adequate accuracy for pan boiling, the need to evaluate superheat for all operating conditions weighs against use of BPR. Data collected for the superheat correlation enabled the overall heat transfer coefficient from steam to massecuite to be calculated, showing a drop in the coefficient with fall in level and rise in purity.

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**Continuous treatment of *C*-massecuite at Mossman mill.** S. C. GRIMLEY. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 193–200.—Because of poor low-grade crystallizer performance, the six batch crystallizers were converted to a continuous system with the six troughs arranged in parallel in a cascade scheme, each trough being divided into two compartments. Massecuite from the receivers enters the first crystallizer and is discharged from the opposite end and side to the next trough, and so on, following a zig-zag path until discharged from the sixth crystallizer to a header pipe over the continuous centrifugals. The massecuite is transferred to each successive crystallizer by a 600 mm long square-sectioned chute which slopes down to 152 mm below its upper point, and flow can be completely halted by means of a sliding door at each crystallizer discharge point. Crystallizers 1–5 and two-thirds of crystallizer 6 normally have cold water circulating through them, while the remaining third of No. 6 is provided with re-heat water at 70°C. Results for massecuite flow control, temperature control and residence time are discussed, showing generally satisfactory results, while optimum operation of the continuous centrifugals to secure minimum molasses purity and acceptable sugar purity remains to be established, although the two Buckau-Wolf machines gave highly promising results.

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**Performance of continuous crystallizers.** R. BROADFOOT. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 201–210.—Lithium chloride was used as tracer to evaluate the flow characteristics of three continuous crystallizer systems and compare them with each other and with a batch crystallizer as well as with ideal plug flow conditions. The Mossman system (see abstract above) proved the best as regards overall exhaustion for different mean residence times, followed by the Pleystowe 14-compartment Werkspoor crystallizer, although with residence times from 30 hr onwards this gave approximately the same results as did the batch system. The Marian system, consisting of two Werkspoor crystallizers followed by two Blanchard crystallizers was the least efficient of all four systems, including the batch system. Reasons for the performance characteristics of the different systems are discussed.

**Some practical aspects of milling.** M. D. SULLIVAN. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 217–221.—Reference is made to cane preparation and mill operation at Isis. Maceration recycling at mills No. 4 and 5 in the 5-mill train accompanied by improved drainage has resulted in a marked increase in extraction and a reduction in roller wear. The system is advocated where high maceration levels are not possible.

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**The use of hydraulic nuts for tensioning large diameter bolts.** S. G. CLARKE. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 223–225.—The advantages of hydraulic nuts (a combination of small hydraulic pressure cylinder and a screwed centre section or nut) used in place of large hexagonal nuts are discussed and details given of the component parts and of the hydraulic oil requirements.

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**Mill maintenance practices.** J. E. HOLT and M. F. BEHNE. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 227–231.—Aspects of sugar factory equipment maintenance as carried out in Queensland are discussed on the basis of a series of interviews conducted at 25 factories to gauge the attitudes of factory personnel towards maintenance costs and practices. The relationship between downtime and maintenance costs is examined and recommendations made on the best approach whereby costs can be minimized for a selected downtime target which is adequate for the purpose.

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**The development of balanced cast shredder hammers.** S. G. CLARKE. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 233–237.—The production of a shredder hammer which would answer all the requirements examined by other authors, viz. a cast iron of particular shape incorporating a special form of eye which provides for the high stresses developed and allows sufficient material for a reasonable amount of wear, is described with emphasis on the balancing method and equipment used.

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**Flocculants in raw sugar production.** O. L. CREES, D. J. HALE, E. WHAYMAN and A. L. WILLERSDORF. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 239–250.—Flocculant application in settling and filtration was studied in laboratories of sugar factories representing different areas of Queensland, viz. north, central, south and Burdekin. The flocculants (supplied by BTI Chemicals Ltd., Bradford, England) were partially hydrolysed polyacrylamides with hydrolysis ranges of 10–50% and molecular weights in the range 2–12 × $10^6$. The results showed that under favourable conditions of low particle electrophoretic mobility, molecular weight and degree of hydrolysis had little effect on juice clarity, which was generally excellent. However, under less favourable conditions, decreases in molecular weight caused reductions in juice clarity, which decreased more

rapidly at degrees of hydrolysis below the optimum. A relationship was established between settling efficiency and the anionicity of the flocculants, the optimum of which is related to electophoretic mobility or surface charge. An appropriate degree of hydrolysis and, to a much lesser extent, molecular weight were found to be prerequisite for high filtration efficiency, most flocculants improving retention and, in sufficiently high doses, cake porosity. However, health considerations limit the maximum usage to 5 ppm on cane. Hence, the optimum material for settling will be approximately the same as for filtration.

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**Computer-assisted schedules and rostered harvesting.** R. A. JAMES and J. B. HAYES. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 251–254. Implementation in 1972 of a cane railway schedule[1] at Racecourse sugar factory with the aim of reducing the time between harvesting and crushing is reported. Advantages of the scheme included lower levels of dextran than in 1971, significantly fresher cane supplies, greater factory throughput, one fewer locomotive shift and 120 fewer bins required for cane transport than in the previous year.

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**A queuing model for tipping road transported cane.** A. J. PINKNEY. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 255–258.—Use of a computer programme model showed, as expected, that the delay time and lengths of queues at the weighbridge of road trucks used to transport cane were affected by the proportion of cane transported by road but not by the size of truck. Changes in the tipping procedures may bring some benefits.

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**A proposed model to allocate cane railway costs.** C. R. MURRY. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 259–267.—A computer model and its use to proportion the total costs of cane transport (divided between costs proportional to the length of track, those proportional to the quantity of cane hauled and those proportional to the product of quantity and distance hauled—so-called "locomotive costs") are described with the aid of an example.

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**Automatic carrier feeding through a rotary tippler.** E. L. HORNIBLOW and J. A. BARBAT. *Proc. 40th Conf. Queensland Soc. Sugar Cane Tech.*, 1973, 269–273.—Details are given of the automatic system of cane discharge from trucks on a tippler and transfer to the main carrier at Cattle Creek. Advantages include smooth carrier operation with uniform knife loads as well as elimination of problems caused by damage to bins through faulty securing of doors (the bins now have no doors) as well as to the doors themselves, which necessitated a 2-man maintenance crew to repair an average of 15 doors each day. The tippler rotates bin trucks, carrying chopped cane, through 180°, while whole-stalk trucks are tipped at 80°, the type of truck being sensed by a limit switch feeler.

**Milling efficiency formulae.** K. SHANKAR, S. N. M. TRIPATHI and V. K. JAIN. *Indian Sugar*, 1973, **22,** 853–859, 866.—The formulae of DEERR and MITTAL for calculation of reduced milling extraction are compared, and a further formula of MITTAL for calculating whole reduced extraction examined. In DEERR's formula, lost absolute juice% fibre is taken as constant while in both of the MITTAL formulae pol lost in bagasse % fibre is assumed constant. While DEERR takes a fibre content of 12·5%, MITTAL, in his reduced extraction formula, has taken cane pol as the observed pol whereas in derivation the pol should be that corresponding to 12·5% cane fibre, while in his whole reduced extraction formula the cane pol has been taken as 12·5%. Hence, values obtained with MITTAL's formulae are subject to error, and DEERR's formula is preferred. It is shown that under constant milling conditions efficiency is not affected by cane pol but by cane fibre.

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**Production of high quality raws.** E. R. DE LUZURIAGA. *Sugarland* (Philippines), 1972, **9,** (10, 11, 12), 12, 23, 30–31; 1973, **10,** (1), 20–24, 54–55.—The standards laid down by US refiners for imported raw sugar are set out, and some reasons as to why it is not economical to produce low-quality raw sugar are listed. Details are given of the test procedures of the American Sugar Co. as modified for application to raw sugar in the Philippines, and means of improving raw sugar quality throughout the sugar factory are discussed.

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**The behaviour of high-grade massecuites during cooling.** D. R. PARASHAR. *Sugar News* (India), 1973, **4,** (11), 7–8.—Cooling of *A*- and *B*-massecuite to 50°C was tested to determine the effects on viscosity, curing, exhaustion and sugar colour. In all respects the treatment was regarded as a suitable means of replacing a 4 boiling system with a 3-massecuite scheme subject to certain conditions.

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**Studies on the use of flocculating agents as settling aid for muddy juices obtained on clarification by the sulphitation process. Laboratory assessment of indigenously produced "Flocal LT 26/25", "Flocal 26/50" and "Separan AP 273".** S. K. D. AGARWAL, K. K. MATHUR and B. K. GUPTA. *Sugar News* (India), 1973, **4,** (11), 15–22.—See *I.S.J.*, 1973, **75,** 115.

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**Bright outlook foreseen for Thai sugar industry.** H. KAMPF. *Sugar y Azúcar*, 1973, **68,** (4), 17–18.—A brief survey of the Thailand sugar industry, which produces about 7000,00 tons of sugar per annum, is presented.

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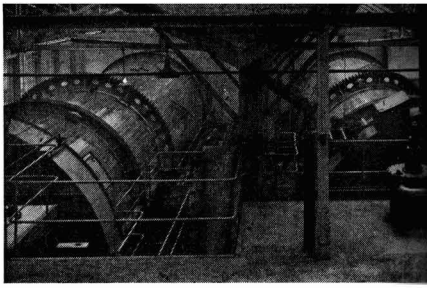
**Experiences with the milling-diffuser system in the Cuban sugar industry.** A. VALDES, S. ORTEGA and V. CRESPO. *Bol. Azuc. Mex.*, 1973, (270), 16–21.—See *I.S.J.*, 1971, **73,** 147.

[1] *I.S.J.*, 1973, **75,** 281.

# Beet sugar manufacture



**Biological treatment of sugar factory waste waters in two-stage mixer aeration tanks.** O. V. DEMIDOV and L. G. DEMIDOV. *Sakhar. Prom.*, 1973, (6), 32–34. Equations are presented for calculation of residence times in both stages and of other parameters involved in two-stage aeration tanks designed specifically for use in Soviet sugar factories.

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**Control of 2nd carbonatation juice pH by electrodialysis in a cathode chamber.** D. M. LEIBOVICH and V. A. KOLESNIKOV. *Sakhar. Prom.*, 1973, (6), 37–40. Experience has shown that in a number of cases the pH of juice in evaporation has fallen below optimum, with consequent adverse effects. On the other hand, the greater the amount of $SO_2$ applied in sulphitation and, hence, the lower the pH of the treated juice, the smaller is the increase in colour. To overcome the difficulty, tests were conducted on electrodialysis of sulphitation juice in cathode compartments, in which minimum colour increase in evaporation was obtained by sulphitation to pH 7·0 followed by electrodialysis to pH 8·0. Even better results were obtained by heating 2nd carbonatation juice (to an unspecified temperature) followed by sulphitation to pH 6·0 and electrodialysis to pH 8·0.

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**Alkalinity of 1st and 2nd carbonatation juices when dolomite limestone is used.** G. P. VOLOSHANENKO, N. I. NASTALENKO, S. N. KEISER and I. S. CHERKAS. *Sakhar. Prom.*, 1973, (6), 40–43.—In view of difficulties experienced in sugar factories using milk-of-lime prepared from dolomite limestone, tests were conducted with lime from limestone containing 89·4% $CaCO_3$, 3·69% MgO and 2·74% $SiO_2$. Determination of alkalinity, dry solids and Ca and Mg salts contents in 1st and 2nd carbonatation juices showed that the Mg salts content in both juices fell with increase in 1st carbonatation juice alkalinity, with consequent fall in Mg scale formation in the evaporators. Minimum Ca-Mg salt content occurred at a 1st carbonatation juice alkalinity of 0·11% CaO, which is regarded as optimum. In view of the Mg content, milk-of-lime from dolomite limestone should not be added at 2nd carbonatation and the alkalinity of this juice should be optimum as regards minimum Ca salts content.

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**Cossette scalding in the drum of rotary diffusers.** N. M. DATSENKO, N. N. PUSHANKO, B. D. KOVALENKO and O. I. SKOBELEV. *Sakhar. Prom.*, 1973, (6), 46–46. Difficulties with the twin-scroll pre-scalder of an UCMAS rotary diffuser are reported. Modifications to one of two such diffusers at the factory in question, after which cossettes were pre-scalded with recirculated raw juice in the first 3 of the total 31 sections of the diffuser drum, resulted in a 1·5–2° higher juice Brix than in the other diffuser using the normal pre-scalder, juice draft being the same for both. The second diffuser was subsequently modified, and the throughput of both diffusers has increased.

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**Seasonal variations in the non-sucrose content of several straight house process streams.** P. H. MILLER. *J. Amer. Soc. Sugar Beet Tech.*, 1972, **17**, 67–79. Analyses of cossettes, raw juice and thin juice taken every hour during the 1970/71 beet campaign (running from July to May) at Woodland, California, and composited on a weekly basis showed seasonal fluctuations in the total non-sugars concentrations and contents of specific non-sugars and particularly marked differences between the autumn and spring values. However, one relationship which has been found to be constant during and between campaigns is that between beet apparent purity and molasses sugar content as a percentage of sugar entering the factory; but since the procedure involved in determining beet apparent purity is time-consuming, an effort is being made to find a parameter consistently associated with it but which can be easily determined, so that a "quality index" could then be given to beet.

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**Utilization of anthracite in lime kilns.** A. KEBOURI. *Sucr. Maghrebine*, 1973, (6), 16–18.—Results obtained from mixing anthracite with coke in sugar factory lime kilns (made necessary by coke supply difficulties) are discussed. It was found that the mixture did not alter the quantity or quality of waste gas $CO_2$, but could cause a drop in the quality of lime with possible damage to the kiln lining. A noticeable drop in fuel costs resulted.

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**Comparison of steam consumption in different multiple-effect evaporator systems.** S. ZAGRODZKI. *Zeitsch. Zuckerind.*, 1973, **98**, 376–381.—The steam consumption in quadruple- and quintuple-effect evaporators where full use is made of condensate heat is examined and partial heating of vacuum pans with 3rd effect vapour and of raw juice with pan vapour considered. Steam jet ejectors are compared with turbocompressors for vapour compression and the minimum nominal steam consumption calculated for each evaporation system.

**The destruction of invert sugar during juice purification in the presence of atmospheric oxygen.** H. SCHIWECK. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—Since juice coloration is mainly attributable to the formation of Maillard products in the individual process stages, it would be possible to prevent colour formation by removing substances containing amino- or carbonyl groups. However, it is not practical to block amino-acids and peptides in juices, so that the only possibility is to prevent formation of carbonyl compounds when invert sugar undergoes alkaline decomposition. Laboratory and factory experiments were carried out to establish whether pre- and main liming could be carried out in the presence of atmospheric oxygen so that invert sugar decomposition took place without carbonyl compound formation. While a reduction in coloration of 30–50% was achieved in the laboratory trials, only about 15% reduction was obtained in the factory tests at an air feed of 0·75 $Nm^3/m^3$ juice because of unsatisfactory air distribution in the reaction vessels.

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**Progressive methods for intensifying technological processes in sugar production.** I. M. FEDOTKIN. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973. Various methods by which the boundary layer could be affected for process intensification were investigated, viz. pulsation, vibration, gas blowing into the liquid, atomization and use of magnetic, electric and supersonic fields. Means of increasing process profitability were examined, as were possible methods of applying: ultra-, hyper- and superfiltration; magnetic and electric fields; thermal, concentration and hydraulic instability to juice purification and evaporation processes. The theories of adsorption of mixtures, liquid atomization, heat and mass transfer by pulsation, filtration and hyperfiltration, lime slaking and reactors were considered and methods of preventing scale formation investigated.

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**Investigations of the heat exchange process in a cossette extraction vessel under laboratory conditions.** J. GRABKA and S. ZAGRODZKI. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—At the Sugar Industry Institute in Poland investigations were carried out on heat transfer in cossette extraction using an apparatus consisting of a heat exchanger with a rotating heating jacket. Variations were made in jacket speed, cossette charge, cossette length and mixture composition in the heat exchanger (cossettes-water, cossettes-raw juice and beet pulp-water). The heat transfer coefficient was determined as was its dependence on the variables.

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**Coagulation of the protein-pectin complex.** J. VAŠÁTKO, A. DANDÁR and E. MÓROVÁ. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—Coagulation of the protein-pectin complex in acid and alkaline media and under the effect of lime addition was studied. In acid medium the additive viscosity sank with change in the pectin-protein ratio, a minimum being reached at a given ratio in association with the degree of coagulation. $Ca^{++}$ ions or change in pH caused simultaneous coagulation of the protein and pectin, an optimum being attained by each at a given pH. Protein degradation products increased in proportion to protein N and caused a reduction in coagulation by increasing the solubility of the coagulate. Maximum coagulation was reached after a given time, after which it diminished to a greater or lesser extent as a function of the proportion of decomposition products. Variation in this proportion caused simultaneous change in coagulation of both complex components.

* * *

**Examination of the kinetics of 1st carbonatation and its optimization conditions.** L. P. REVA, I. M. FEDOTKIN, V. M. LOKHVIN and V. A. SHESTAKOVSKII. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973. The dependence of carbonatation rate on temperature, lime concentration in the juice and the gas $CO_2$ content was determined as a contribution to optimum carbonatation vessel design. Decisive for the carbonatation rate was the $CO_2$ absorption by the alkaline juice and subsequent 2nd order chemical reaction, for evaluation of which a differential equation system was used. Solutions based on the model of interface renewal were used for the investigations. Studies were also made of the hydrodynamic conditions in carbonatation vessels in order to obtain a mathematical model of the process, allowing for macrokinetics. This permitted the concentration distribution of the alkaline solution vertically and across the vessel to be determined and time distribution functions of the juice to be obtained.

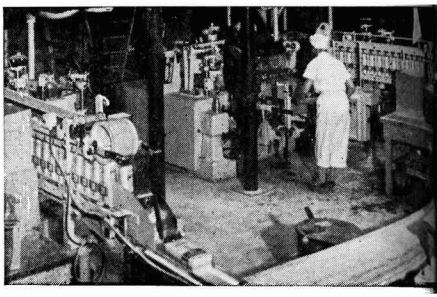
* * *

**Raw juice purification with multi-stage pre-carbonatation.** S. ZAGRODZKI, H. ZAORSKA, S. M. ZAGRODZKI and K. SZWAJCOWSKA. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—See *I.S.J.*, 1973, **75,** 139–140.

* * *

**Thick juice and remelt liquor filtration.** S. M. ZAGRODZKI. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—Equipment for filtration of sugar suspensions of high viscosity has been developed in which the filter elements take the form of a bundle of rods and a cloth of low filtration resistance is used. In experiments in which various types of kieselguhr and cellulose were used as precoat, absolutely clear filtrate was obtained at an average flow rate of 20 litres.$m^{-2}$.$min^{-1}$ at a pressure of 0·5–4·0 atm. A filter surface of 8 $m^2$ was sufficient for juice of 65°Bx from 1000 tons of beet/day. Cake is removed from the cloth by vibration of the elements with back-flow of the clear juice through the cloth. Optimum vibration conditions were established by tests at varying amplitudes and frequencies. Cloth consumption is approximately 0·3–0·5 $m^2$ per 1000 tons of beet. No washing of the cloths is anticipated, while the filter will be cleaned out periodically with acid.

# Sugar refining



**Plant scale thermal regeneration of powdered activated carbon used in sugar purification. I. Process development and product properties. II. The commercial scale system and economics.** ANON. *Proc. 31st Meeting Sugar Ind. Tech.*, 1972, 124–138.—Details are given of a patented system for regeneration of carbon which is separated from filter cake by rinsing with water and draining under suction after which it is fed into a high-velocity air stream for further drying and transferred to a reactor above a gas furnace. The suspended carbon is dried by the upward stream of hot gases and devolatization takes place; both moisture and adsorbed organic matter are vaporized by the sharp temperature rise, the volatile matter is pyrolysed and the gaseous products burnt in the excess air admitted with the feed. Gases and carbon are quenched by water sprays. Recovery of 84·2% of the original is indicated in data for cake from corn sugar refineries. Modifications incorporated in a full-scale plant and operating costs are discussed.

* * *

**Char—natural and synthetic.** G. W. MULLER. *Proc. 31st Meeting Sugar Ind. Tech.*, 1972, 140–141.—The use of bone char and of "Synthad" synthetic bone char for decolorizing are discussed. The possibility of a shortage of bone char in the USA and the consequent need to use "Synthad" are considered.

* * *

**Carbon in cane sugar refining.** H. M. WALLENSTEIN. *Proc. 31st Meeting Sugar Ind. Tech.*, 1972, 142–148. The granular carbon station at the Yonkers refinery of the Corn Industrial Division of CPC International is described.

* * *

**Use of resins as adsorbents in cane sugar refining.** W. R. TUSON. *Proc. 31st Meeting Sugar Ind. Tech.*, 1972, 149.—A brief examination is made of the use of resins for decolorization and demineralization in the cane sugar refining industry.

* * *

**Adsorption of sugar colouring matter on activated carbons.** M. I. DAISHEV and V. M. SHCHERBAK. *Izv. Vuzov, Pishch. Tekh.*, 1973, (2), 52–54.—Laboratory experiments in which melanoidins in water and 15% sugar solution were adsorbed by active carbon showed that, at high concentration, adsorption was not complete but continued until the carbon had been fully utilized, whereas at low concentration colour adsorption was practically complete, so that recommendations previously made on optimum contact time are contradictory. Addition of the carbon in one dose gave better decolorization than did addition in split doses. The amount of colouring matter adsorbed fell with increase in sugar concentration but rose with temperature, both phenomena being associated with the effect of viscosity.

* * *

**The waste treatment facility at the Crockett refinery.** P. J. LANGLEY and C. J. BOHLIG. *Sugar y Azúcar*, 1973, **68**, (5), 30–35.—See *I.S.J.*, 1974, **76**, 119.

* * *

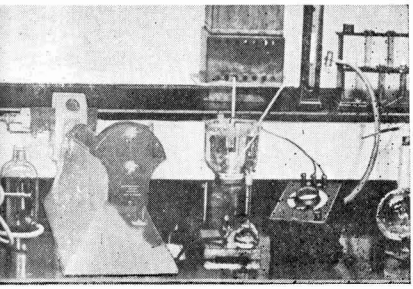
**Sugar refining in Florida.** ANON. *Sugar y Azúcar*, 1973, **68**, (5), 43.—A brief survey is presented of the processes at the three Florida refineries—Moore Haven, Belle Glade and Everglades. The first is the only one to have integrated cane crushing and refining facilities, while the second produces only liquid sugar.

* * *

**Decolorization of refinery sugar solutions in a continuous counter-current column.** M. FRIML. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973. Decolorization tests with bone char are described, from which relationships have been derived which describe the process under given conditions. Variables were colour content of the feed and output and throughput of liquid and solid phase. Experience was also gained on bone char transport and regeneration. The results have been applied to the design of a decolorization unit for a beet sugar factory of 2000 tons/day slicing capacity. An approximate economic evaluation of the process shows that it can compete with an active carbon- or decolorizing resin-based process.

* * *

**Influence of decolorization with ion exchange resins on physical and chemical properties of sugar refinery products.** S. Z. IVANOV, A. V. LOSEVA and G. A. CHIKIN. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—Treatment of refinery syrup with AV-16GS anion exchange resin gave a decolorization efficiency double that of other adsorbents, thus reducing wash liquor and ultramarine blue consumption. The sucrose crystallization rate in the treated syrup rose but thermal stability fell. The process permitted liquor pH to be maintained at an optimum of 7·0–7·5 by treating the resin with NaOH and ammonium chloride. Syrup surface tension fell, thus accelerating crystallization. Refined sugar quality was higher and automatic control of refinery processes facilitated.



# Laboratory methods & Chemical reports

**Investigations of sugar beet metabolism during the growth period. III. Glucose, fructose, galactose and raffinose.** M. BURBA and U. NITZSCHKE. *Zucker*, 1973, **26**, 356–366.—The four sugars in the title were determined by enzymic methods as a function of growth period, beet variety, location and fertilization with the aim of establishing changes in their contents during the growth period and possible association with beet "physiological maturity". Generally, raffinose increased from end-June to mid-November, high-yielding varieties containing up to 35% more raffinose than high-sugar varieties, although differences caused by location were three times greater than those due to variety. The raffinose content in three extreme varieties rose linearly with N application up to 300 kg N/ha, but this increase was unaffected by differences in plant density and increase in K application. Relatively high glucose and fructose contents were found in beet lifted early (mid-July), but by end-August the values had fallen sharply to about 15% of the July content. Reducing sugars constituted 58% glucose and 18% fructose. Galactose values fluctuated widely. 83 references are given to the literature.

* * *

**Investigations of the melting point of sucrose. I.** D. IVANČENKO, A. SMELÍK and Z. BÖHMEROVÁ. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973. Research work on the melting point of sucrose is reviewed. Discrepancies between results is attributed to thermal decomposition of the sucrose, to the action of the solvent used and to allotropic modifications of the sucrose. Methods for determination of melting point are discussed, the moment of destruction of crystal points and edges being taken as starting point. A new definition of melting point is proposed based on the maximum relaxation of intermolecular energy which can be detected by thermocouples. The effect of heating intensity on melting point determination is demonstrated by differential thermal analysis. Extrapolation of heating rate to zero and introduction of a concept of absolute melting point are suggested.

* * *

**Investigations of the melting point of sucrose. II.** A. SMELÍK, D. IVANČENKO and Z. BÖHMEROVÁ. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973. Since the melting of mixtures is a function of heating intensity, the validity of the time concept of KOFLER is questioned (this suggests a minimum time which is needed for precise determination of the melting point). Theories on the effect of impurities on melting and on the interactions of inorganic impurities and sucrose are regarded as an excuse for inaccuracies in determining the melting point of sucrose. The effect of glass and its alkaline components on the accuracy of determining the melting point of compounds having an active hydroxyl, aldehyde and ketone group is evaluated. Differences in the values obtained for sucrose are attributed to the method used to crystallize solutions at given concentrations. The value of differential thermal analysis in investigations on melting and in determining the melting point of sucrose is emphasized.

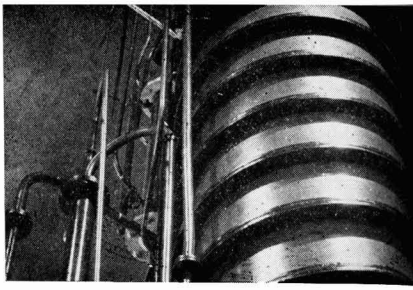
* * *

**Studies on sucrose destruction at temperatures above 100°C.** K. BOHN. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—The formation of sucrose decomposition products was examined with the aim of determining sucrose losses under evaporation conditions. Equations were obtained from partial regression analysis which permit calculation of the quantity of decomposition products formed as a function of heating time, temperature, pH and concentration of sucrose and buffering substances. Labelled sucrose was used to establish quantitative relationships between the amount of decomposition product formed and the quantity of sucrose decomposed. The relationship between the calculated losses and operating parameters is discussed. From data available on juice retention times and temperatures in an evaporator, losses of 0·01–0·05 kg sucrose/100 kg beet were calculated for 1st and 2nd effects.

* * *

**Occlusion of non-sugars during sucrose crystallization.** F. SCHNEIDER. *Paper presented at 2nd Int. Conf. Chem. Tech. Sugar*, 1973.—Crystallization by cooling, followed by washing, was used in investigations into non-sucrose matter occlusion in the sucrose crystal. A number of $^{14}C$-labelled non-sucrose substances as found in factory juices were used and potassium chloride, raffinose and water also measured. It was found that a number of substances were occluded to the same degree as water, indicating syrup occlusion in these cases. Some substances may be incorporated in the crystal in molecular form, particularly glucose, fructose and raffinose and, to a lesser extent, amino-acids, for which the distribution of the electric charge in the molecule is discussed. The smaller extent of glucose occlusion compared with fructose is attributed to the spatial relationships of the unit cell in the sucrose crystal. The formation of needle- and wedge-shaped sucrose crystals when raffinose is added is discussed in detail with regard to the structure of the unit cell in the sucrose crystal.

# By-products



**New perspectives for sugar cane.** C. K. LAURIE, L. A. JAMES and H. M. MAYERS. *Paper presented at* 1973 *Meeting W. Indies Sugar Tech.*, 12 pp.—Cane rind, pith and epidermis separation by a patented process is described[1] and the use of rind for manufacture of laminated timber, core panel and plywood veneers and of pith for animal fodder discussed. Reference is made to animal feeding trials in Barbados using the separated pith, and the economics of beef production compared with sugar production in the Caribbean are examined, showing the possible benefits of growing cane for fodder rather than for sugar.

* * *

**Preparation of glutamic acid with the aid of sodium chloride.** L. D. BOBROVNIK, R. TS. MISHCHUK and K. D. ZHURA. *Izv. Vuzov, Pishch. Tekh.*, 1973, (1), 164–165.—Details are given of a method tested for production of glutamic acid from electrodialysed molasses concentrate containing no more than 2·5% NaCl by volume. Hydrolysis yielded an acid and an alkali fraction containing HCl and NaOH which in turn hydrolysed the pyrrolidone carboxylic acid. The hydrolysate was then neutralized to pH 6·5, treated with active carbon, filtered and crystallized to yield a preparation containing 98·6% glutamic acid.

* * *

**Pasture for beef production. I. Different urea concentrations in molasses as a supplement to grazing bulls during the wet season.** J. L. VEITÍA, T. R. PRESTON and N. DELGADO. *Rev. Cubana Cienc. Agríc.*, 1972, **6**, 323–329.—Increase in the urea concentration in cane molasses fed *ad libitum* to grazing bulls caused a drop in molasses intake and dressing percentage, and, in one breed, a reduction in excess carcass fat. The urea content was in the range 0–5%.

* * *

**Substitution of maize by sugar cane in dairy cattle. I. Effect on milk production and composition.** I. JÉREZ and T. R. PRESTON. *Rev. Cubana Cienc. Agríc.*, 1972, **6**, 337–342.—Tests on replacement of maize by sugar cane in rations fed to lactating cows showed that a substantial increase in milk yield was obtained at a cane:maize ratio of 65:35, whereas a ratio of 35:65 gave only slight increase, while complete replacement of the maize caused a fall in yield to below that for the control. The effect on fat content was negligible. However, since the favourable results of replacing maize with cane do not agree with those obtained by other authors, it is suggested that the double Latin square method used should be replaced by a random block arrangement.

**The effect of different levels of butylated hydroxytoluene in diets based on crude sugar for broilers.** C. T. GONZÁLEZ, A. J. FERNÁNDEZ, R. RODRÍGUEZ and E. I. SALCEDO. *Rev. Cubana Cienc. Agríc.*, 1972, **6**, 347–349.—Addition of butylated hydroxytoluene as an antioxidant to raw sugar constituting 50% of a poultry diet had no significant effect on live weight, consumption or conversion at any of the 8 levels of addition (up to 140 mg/kg diet).

* * *

**Anatomical development of the gastrointestinal tract in calves fed diets based on molasses or concentrates.** N. PERÓN and R. RUÍZ. *Rev. Cubana Cienc. Agríc.*, 1972, **6**, 351–363.—Inclusion of cane molasses in diets fed to 8- and 16-week old calves caused increase in the weights of the rumen tissue, reticulo-rumen epithelium and of the rumen as well as the weight of the fresh rumen content, while the physiological and physical rumen volume also increased. The fresh and dry weight of the small intestine tissue and number of rumen papillae were noticeably smaller than when concentrates were fed to the calves.

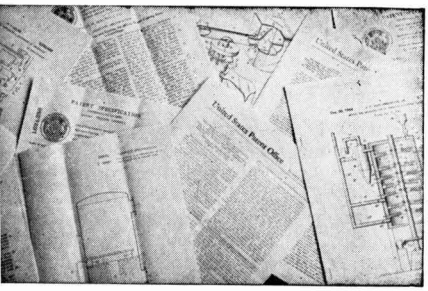
* * *

**Production of fertilizer from distillery spent wash.** A. C. CHATTERJEE *et al. Proc. 38th Ann. Conv. Sugar Tech. Assoc. India*, 1972, G67–G74.—A process is described and the economics discussed of concentrating distillery waste in a multiple effect evaporator to 60°Bx, drying this to a solid material in a counter-current hot-air dryer, and then incinerating the product in a boiler which provides the steam needed for the evaporation stage. The incinerated ash can be mixed with bonemeal and urea or ammonium sulphate to give a suitable mixed N-P-K fertilizer.

* * *

**Intensification of the beet pulp drying process.** M. G. PARFENOPULO. *Izv. Vuzov, Pishch. Tekh.*, 1973, (2), 88–90.—Tests demonstrated that the time required for beet pulp drying, which is divisible into two distinct periods (one of constant drying rate and the other, constituting 50–60% of the total period, a period of falling drying rate), can be reduced by 20–25% by raising the temperature in the second time section and using magneto-vibrations to "fluidize" the pulp so as to prevent scorching. Maximum effect, at constant initial pulp moisture, was achieved at 220°C, amplitude of 1·5 mm, frequency of 50 Hz, moisture content of about 250% on dry solids, 40 mm height of bed and a velocity of 1·5 m.sec$^{-1}$.

[1] *I.S.J.*, 1972, **74**, 123–124.



# Patents

## UNITED STATES

**Entrainment separator.** R. FREW, *assr.* COLONIAL SUGAR REFINING CO., of Sydney, N.S.W., Australia. **3,702,527.** 20th July 1970; 14th November 1972. See *I.S.J.*, 1972, **74**, 297–299.

* * *

**Cane planter.** M. CLEMENT, of Charenton, La., USA. **3,702,664.** 10th September 1971; 14th November 1972.

* * *

**Cane ripening.** L. G. NICKELL, of Honolulu, Hawaii, USA, *assr.* HAWAIIAN SUGAR PLANTERS' ASSOCIATION. **3,704,111.** 14th August 1970; 28th November 1972. Sugar yield of cane is increased by applying to it, 4–5 weeks before harvest, 5–10 gal/acre of an aqueous dispersion (containing 0·1–2% of a non-ionic surface-active agent) of an alkyl (methyl) phenoxy pyridazine [3-(2-methylphenoxy)-pyridazine].

* * *

**Beet planter.** I. F. OKOROKOV, G. P. BOGDANOV, K. A. SOROKIN, A. F. ONISCHENKO, P. E. ZIBOROV and S. N. PERSTNEV, of Kharkov, USSR, *assrs.* UKRAINSKY NAUCHNO-ISSLEDOVATELSKY INSTITUT SELSKOKHOZYAISTVENNOGO MASHINOSTROENIA PROSPEKT GAYARINA. **3,705,559.** 14th May 1971; 12th December 1972.

* * *

**Continuous process for decolorizing liquors.** P. SMITH and H. SUZOR, of East Roseville, N.S.W., Australia, *assrs.* THE COLONIAL SUGAR REFINING CO. LTD. **3,708,337.** 25th January 1971; 2nd January 1973. A water-insoluble, water-swellable powdered polyamide (nylon-66, poly-N-vinylpolypyrrolidone) is immersed in an aqueous liquid [water, (of pH $\lessdot$ 5)] and, when rendered flocculant, suspended as a pervious floating bed in a second aqueous liquid (a quiescent sugar solution, to remove loosely adsorbed water) contained in a column having a top inlet and a bottom outlet. Liquor to be decolorized is admitted at the top and on its passage to the outlet loses its colour to the polyamide particles which become progressively spent. The rate of admission and polyamide density are such that the particles are fluidized and a proportion of the spent particles are entrained in the decolorized column effluent, from which they are separated (and regenerated for return to the column), an additional supply of make-up polyamide being provided at the column inlet.

**Fermentation process for the production of citric acid.** J. L. SARDINAS, of Gales Ferry, Conn., USA, *assr.* PFIZER INC. **3,708,398.** 9th November 1970; 2nd January 1973.—In an aqueous medium containing carbohydrate, e.g. as cane molasses, citric acid is produced by propagation of a suitable yeast (*Nematospora coryli* ATCC No. 20292, *Sporobolomyces* spp. 20290 or 20291, *Sp. salmonicolor* CBS 490, *Rhodotorula glutinus* ATCC No. 2527, *R. rubra* CMI 38784, *Torula ramosa* ATCC No. 20288 or 20289, or *Zygosaccharomyces mellis* NRRL Y-1053) under aerobic conditions until a level of at least 1 g of citric acid per litre has been accumulated, followed by its recovery.

* * *

**Sugar recovery method and apparatus.** J. F. ZIEVERS, of La Grange, Ill., USA, *assr.* INDUSTRIAL FILTER & PUMP MFG. CO. **3,711,329.** 22nd February 1971; 16th January 1973.—An impure sugar solution such as molasses is heated to 170–180°F and contacted with bauxite to remove its monovalent ion content (by passing through a bed of granular bauxite). The treated solution is (filtered and) passed (for ion exclusion treatment) into a body of (strongly acid cation) ion exchange resin particles (a sulphonated cross-linked styrene divinylbenzene copolymer) capable of retaining in their pores a major part of the sugar molecules while excluding most of the other solutes. The resin particles are thereafter treated with water to wash out the sugar, giving a number of fractions, one of which, containing primarily sugar, is treated with active carbon, (again treated with bauxite) and evaporated to 60–70°Bx. A second fraction containing mainly sugar, and of $\lessdot$ 26°Bx, may be added to the above fraction before active carbon treatment. The bauxite after use is oven-heated to burn off adsorbed solids and may then be re-used.

* * *

**Method and apparatus for heating viscous sugar solutions.** T. A. KIERCE, of Irving, Texas, USA. **3,711,330.** 23rd August 1971; 16th January 1973.—A viscous sugar solution, e.g. molasses, is heated to 70–90°F within a closed container by drawing air from the space above the solution, compressing it, heating it to a temperature below 200°F (180–200°F), and distributing it through a series of pipes venting into the bottom of the container, the air flow (3–10 c.f.m. per 100 gallons of solution) being governed by

a device sensitive to the pressure and thus the liquid level in the container. The temperature of the gas and the flow in the various conduits of the distribution system are similarly controlled by appropriate sensing and control devices.

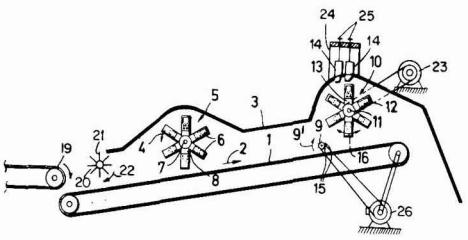
* * *

**Increasing the sugar content of crops with α-ureido-oxycarboxylic acid derivatives.** H. J. GERJOVICH, late of Wilmington, Del., USA (by D. J. GERJOVICH, executrix), *assr.* E. I. DU PONT DE NEMOURS & CO. **3,712,806.** 11th December 1969; 23rd January 1973. The sugar content of sorghum and sugar cane may be increased by application to these crops, 10–60 (20–40) days before harvest, of an effective amount of α-ureido-oxypropionamide (or its N-methyl or N,N-diethyl derivatives).

* * *

**Apparatus for preparing sugar cane.** W. DIETZEL, of Braunschweig, Germany, *assr.* BRAUNSCHWEIGISCHE MASCHINENBAUANSTALT. **3,713,469.** 10th December 1970; 30th January 1973.

Cane is delivered by a feeding conveyor 19 to the entry of an inclined conveyor which includes a belt 1 travelling in direction 2 and enclosed by a hood 3. The cane first passes under a leveller 20 comprising a horizontal shaft with fingers 21, rotating in the direction of arrow 22; it then continues to where it is engaged by the knives 6 of rotary cutter 5 which are mounted removably on arms 8 fastened to shaft 7 which is journalled in the side walls of hood 3 and rotates in the direction of arrow 4.




The partially comminuted cane continues up the belt and is engaged by the lifting drum 9 which rotates in the direction of arrow 9′ and is driven by motor 26 (which also drives the belt 2) at such a speed that the peripheral speed of its arms are at least 5% higher than the linear speed of the belt. The raised cane then engages with the second cutter 10 with similar shaft, arms and knives to those of the first cutter but which is driven in either direction by motor 23 and which is also provided with stationary impact blades 14 projecting through the hood 3 to an extent predetermined by adjustable set screws 25 and guide ways 24. The two cutters so comminute the cane that it may be fed to a diffuser without further preparation.

* * *

**Production of sucrose esters of fatty acids.** R. O. FEUGE, H. J. ZERINGUE and T. J. WEISS, *assrs.* U.S. SECRETARY OF AGRICULTURE. **3,714,144.** 29th May 1969; 30th January 1973.—Sucrose is melted and mixed, during 2–20 minutes, with (0·5–0·8 moles/mole of sucrose of) (methyl carbitol, methyl cellosolve or glyceride) esters of $C_2$–$C_{22}$ fatty acids (palmitic, stearic, oleic or linoleic acid or a mixture of these) and (2–40% on sucrose of) a catalyst consisting of the alkali-free sodium or potassium soaps of saturated or unsaturated fatty acids or the alkali-free lithium soaps of unsaturated fatty acids, or a mixture of these soaps. The reaction mixture is held under partial vacuum for 2–20 minutes at 170–190°C, which removes the alcohol or alcohol-like portion of the fatty acid esters. The reaction mixture is then cooled and purified by removing the uncombined sucrose and either removing the soaps or acidifying the latter and removing the alkali metal portions.

* * *

**Removal of impurities from technical sugar solutions.** E. MOEBES and H. HITZEL, *assrs.* SUGAR CHEMICAL CO., of Vaduz, Liechtenstein. **3,715,235.** 12th October 1971; 6th February 1973.—A technical sugar solution, e.g. molasses, is pretreated with (strongly basic) carbonate and/or bicarbonate anion exchangers in combination with an ammonium exchanger or weakly acidic cation exchanger in the H form; the pretreated solution is then treated directly [or after concentration and crystallization of part of its sugar content (to give a sugar content of 70–80% on solids)] with a cation exchanger in the H form (at 10°C to prevent inversion losses), whereupon the solution is recycled to the carbonate/bicarbonate anion exchanger(s) (which may or may not have been regenerated after the pre-treatment).

* * *

**Enzymatic method of manufacture of fructose from glucose.** Y. TAKASAKI and A. KAMIBAYASHI, of Chiba, Japan, *assrs.* AGENCY OF INDUSTRIAL SCIENCE & TECHNOLOGY GOVERNMENTAL. **3,715,276.** 23rd October 1970; 6th February 1973.—A glucose solution containing glucose isomerase is mixed with $MgCO_3$, $CaCO_3$, an anion exchange resin or an amphoteric ion exchange resin and the glucose converted to fructose in the presence of such material, which suppresses the non-enzymatic conversion of sugar to acid, so avoiding the need to regulate the pH (between 6 and 9) by addition of alkali.

* * *

**Fermentation process for the production of citric acid.** F. F. ROBERTS, of Stonington, Conn., USA, *assr.* PFIZER INC. **3,717,549.** 9th February 1971; 20th February 1973.—Citric acid is produced by cultivation of a *Candida*, *Endomycopsis*, *Torulopsis*, *Hansenula* or *Pichia* yeast in an aqueous carbohydrate (molasses)-containing medium under aerobic conditions [in the presence of an α-chloro or α-fluoro lower aliphatic mono- or di-carboxylic acid or a water-soluble salt or amide (fluoroacetamide or a fluoroacetate)]. Fermentation is continued until the citric acid content rises to at least 1 g/litre, after which it is recovered.

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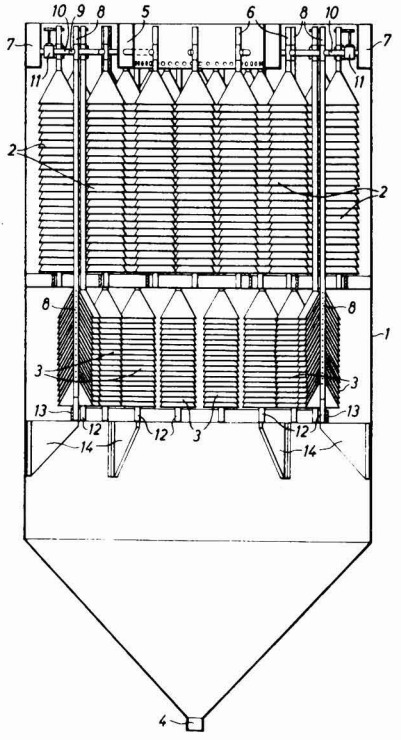
**Process and apparatus for the clarification of liquids.** N. B. BACH, of Vestervig, Denmark, *assr.* MIRRLEES WATSON CO. LTD. **3,718,257.** 21st June 1971; 27th February 1973.

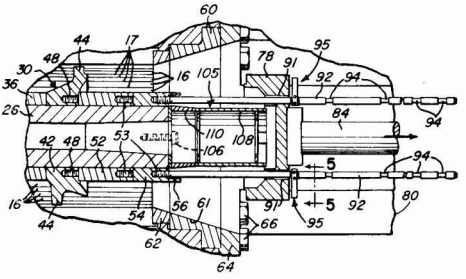
The clarifier comprises a tank 1 having a cylindrical upper portion, in which are located the primary cone trees 2 and the secondary cone trees 3, carried by supports 12, 13 and brackets 14, and a frustro-conical lower sludge-collecting portion, the latter having a sludge outlet 4. There are 36 primary cone trees 2 in three concentric rings, each cone tree consisting of 24 conical members of 18 inches maximum diameter, spaced 3 inches apart along a central pipe 6 which is perforated between cones through which the clear juice passes and is fed into an annular well 7 at the top of tank 1.




A set of secondary cone-trees 3 is located below the first set 2 for further separation of liquid from the liquid-sludge suspension falling from around the cone trees 2. The secondary cone trees are formed from 18 cones having a maximum diameter of 16 inches and spaced $2\frac{1}{2}$ inches apart on the lower ends of pipes 8, also perforated between cones, which discharge into well 7 by way of T pieces 10 and valves 11. Above the primary cone trees is a central launder from which the juice to be clarified is gently fed into the tank.

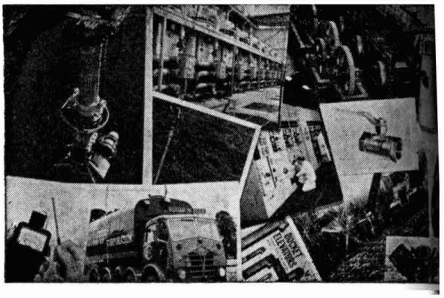
**Screw press for bagasse.** A. W. FRENCH and F. J. STARRETT, of Piqua, Ohio, USA, *assrs.* THE FRENCH OIL MILL MACHINERY CO. **3,721,184.** 9th July 1971; 20th March 1973.

The shaft of a bagasse press carries an end worm section 30 and rotates within a pressure cage formed by bars 16 having drainage slots 17. Between the worm 30 and the end of the shaft are collars 52, 54, each of which, like the end ring 30 are drilled and threaded on the discharge side. The end wall of the press is provided with discharge rings 60, 62, which have a frustro-conical inner surface 61 and are held in place by an annular plate 64 fastened to the end wall by bolts 66. Within the opening is located a frustro-conical pressure plug (not shown) which is mounted on the guide support 78 and is provided with a number of holes in the conical surface so that juice expressed from the bagasse in its passage between the plug and the ring 61 can drain into the internal space within the plug and so out through a drain hole in support 78. Pressure on the plug is maintained during pressing of the bagasse by a double-acting hydraulic ram operating through shaft 84 engaged with support 78.




When as a result of wear it is required to remove and replace worn parts, particularly the end worm 30, the hydraulic ram is operated in the direction of the arrow shown and the discharge plug removed from the guide support 78. A retaining plate is withdrawn from end of the shaft and a cylindrical extension 105 attached by bolts 106. The extension has a diameter slightly less than the shaft for most of its length 108 and a frustroconical section extending to the same diameter as the shaft at the end where it is joined. Holes are provided in support 78 for threaded rods 92 which are passed through and engaged with the threaded holes in the collar 54. The rods are provided with necks 94 of smaller diameter at suitable places and these are engaged by clamps 95. The continued return action of the ram and shaft 84 thus causes the support 78, clamps 95 and rods 92 to pull the collar 54 out of the press and onto the shaft extension 105. The rods 92 are unscrewed and the collar removed when the process is repeated for collar 52 and worm 30. Replacement with new parts is achieved by reversing this operation.

# Trade notices



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

**Molasses sprayers and pumps.** The Albany Engineering Company Ltd., Lydney, Gloucestershire, GL15 5EQ England.

Two devices have been developed by the company for spraying molasses onto animal fodder at temperatures as low as 15°C. The subject of a patent[1], the sprayers are available in two sizes: a rotary sprayer handling up to 1·5 tons of molasses per hr, which is powered by a 2-hp motor and is supplied with the molasses by an Albany rotary molasses pump, and a smaller model handling up to 16 gal.hr$^{-1}$ (100 kg.hr$^{-1}$) which is mainly used for mixing molasses with dried grass, although it has also been used for spraying syrups in the confectionery industry and in sugar refineries. Very good dispersion of molasses is possible with these sprayers, and large proportions of molasses can be added without lumps forming.

* * *

## PUBLICATIONS RECEIVED

**IRRIGATION EQUIPMENT.** SPP Agricultural Services, Oxford Rd., Reading, Berks., England.

Brochures available from SPP give details of general-purpose sprinklers, the "Rainger 7" irrigator, and side-roll equipment for mechanically-moving sprinkler line irrigation systems. The range of Sigmund Pulsometer pumps available for various purposes in irrigation as well as for solids handling in sugar factories is also described in a separate brochure.

* * *

**VACUUM FILTERS.** Metraco S.A., Rue du Beau-Site 13, 1050 Brussels, Belgium.

A 4-page brochure outlines the features of Metraco vacuum filtration plant and indicates the advantages of employing Metraco to design, build and install a complete station on a turn-key basis.

* * *

**GLASS FIBRE FILTER CARTRIDGES.** Johns-Manville, Celite Division, Greenwood Plaza, Denver, Colo., 80217 U.S.A.

A description and performance data are given for Johns-Manville filter cartridges made of glass fibre and claimed to be highly competitive as regards filtration rate, throughput and clarity of treated liquid.

* * *

**VACUUM FILTERS FOR CORROSIVE APPLICATIONS.** Stockdale Engineering Ltd., Rock Bank, Bollington, Macclesfield, Cheshire, SK10 5LB England.

Stockdale Engineering have introduced vacuum filters in which the contact parts are made of epoxy resin, thus permitting operation with highly corrosive materials or where complete protection against product contamination is required. Details are contained in leaflet NL 15.

* * *

**DUST CONTROL EQUIPMENT.** Tilghman Wheelabrator Ltd., Broadheath, Altrincham, Cheshire, WA14 5EP England.

Information on new Tilghman Wheelabrator dust control equipment is given in issue No. 7 of "Air Pollution Control News" published by the company. Included in the equipment are tubular filters, the "Bourdale" rotary filter, reverse-jet filters, wet-type dust collectors and fabric filter dust collectors.

* * *

**FILTER AIDS.** Winkelmann Mineraria S.p.A., Milano, Sesto S. Giovanni, Viale Casiraghi 422, Italy.

An illustrated folder and technical bulletin (No. 1) are available giving information on Winkelmann Mineraria filter aids; the firm offers a complete range of aids from diatomite (kieselguhr), perlite, bentonite, asbestos, cellulose, etc. and is one of the oldest producers of kieselguhr in the world, having started manufacture in 1913.

* * *

**TREATMENT OF FLUIDS AND EFFLUENT.** The Permutit Co. Ltd., 632–652 London Rd., Isleworth, Middx., England.

Literature available from The Permutit Co. Ltd. covers Type B9 reverse osmosis systems designed to provide a continuous supply of high-quality water up to 900 m$^3$/day per unit, and water and effluent treatment plant manufactured by the Permutit-Boby Division of the company.

* * *

**STELLA-META FILTERS.** Stella-Meta Filters, Division of The Permutit Co. Ltd., Laverstoke Mill, Whitchurch, Hants., RG28 7NG England.

Technical Publication No. 501 (P) provides information on the horizontal leaf filter type 122, vertical leaf filters type 111, 112 and 152 and horizontal tube filter type 123. Technical Publication No. 500 (P) describes the features and operation of the "Stellar" candle filter and "Metafilter" with special ring-type elements. Automatic operation of these two pressure filters is discussed.

* * *

**BRITISH GEAR MANUFACTURERS' ASSOCIATION BUYERS' GUIDE.** British Gear Manufacturers' Association, 301 Glossop Rd., Sheffield, S10 2HN England.

The 1973 edition of the BGMA Buyers' Guide contains, in its 74 pages, details of member companies responsible for the manufacture of many different types of gears, including a number of firms already well known in the sugar industry.

* * *

**TUTHILL PUMPS.** Tuthill Pumps Ltd., Belfield St., Rutland St., Ilkeston, Derbyshire, England.

Tuthill Series L small industrial rotary pumps, Series C general-purpose industrial pumps, reversing pumps (featuring a special automatic reversing action without use of valves), cartridge pumps (for applications where the pump is to be built directly into a piece of equipment) and Model SU V-belt driven pumps are described in a 11-page general catalogue, which also contains other relevant data.

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[1] *I.S.J.*, 1974, **76**, 125.

# ISSCT 15th Congress 1974

THE 1974 Congress of the ISSCT is breaking records set by previous Congresses; at the 13th March membership exceeded the previous (1971) record of 1565 by 200, while 275 papers had been submitted against 200 for the 14th Congress. Total attendance is likely to be above 1000 with 75% from outside South Africa. It was originally intended to house all delegates at the Elangeni Hotel in Durban but the number of registrations has meant that some will have to be accommodated at another hotel nearby.

Instead of all travelling by train to the Kruger National Park, about 300 people—mostly married couples—will depart by bus on the morning of 14th June, because congestion on the line prevented the use of a third special train to join the two leaving Johannesburg in the evening. After the visit to Malelane field and factory on the 15th June the train passengers will be accommodated for the night in camps in the Park, while the bus passengers will stay in hotels just outside the Park and will tour the Park on the 16th June, returning to Johannesburg on the 17th

Newsletter No. 6 issued by the Congress Secretariat gives details of the climate to be expected at the various locations in South Africa during the period of the Congress and gives recommendations as to clothing. It may be obtained from the General Secretary-Treasurer, Mr. J. L. DU TOIT, South African Sugar Association, P.O. Box 507, Durban, South Africa.

## Brevities

**Bagasse paper mill for South Africa**[1].—Following a feasibility study by a part of the UK Reed Group and a full-scale investigation by C. G. Smith & Co. Ltd., the two concerns are to finance jointly a bagasse paper mill at Gledhow, close to the present sugar factory. Full capacity will be 34,000 tons of paper per year and the mill will save South Africa an estimated R15 million in foreign exchange for imported paper. The factory should be on stream in April 1976 and reach full capacity two years later.

* * *

**Swaziland sugar expansion plans**[2].—Swaziland is to establish a further sugar cane growing area and a third sugar mill. The precise location of the project is yet to be decided, according to a recent statement by the Swaziland Minister for Industry, Mines & Tourism, when he addressed a delegation of the Swaziland Sugar Association in Mbabane.

* * *

**Greece sugar production, 1973**[3].—Sugar production in Greece in the 1973 campaign totalled 145,000 tons, produced from 1,350,000 tons of beets. Four factories were in operation; the fifth is under construction and should start operating in 1975.

* * *

**St. Kitts (London) Sugar Factory Ltd., 1973 report.**—Factory operations between the 4th March and 5th July produced 23,322 tons of sugar, equivalent to 23,829 tons 96° pol. All exports were sold to the UK at the negotiated price of £61 per ton f.o.b. and stowed. This tonnage of sugar was again disappointing and resulted from low rainfall and from the effect of low prices on cultivation. The absence of adequate rain has hindered the growth of the 1974 crop which will again be small and, on present estimates, unlikely to exceed 24,000 tons. Centralized management of the estates in 1973 is expected to provide more even and greater flow of cane to the factory.

## Japan sugar imports[4]

| | 1973 | 1972 |
|---|---|---|
| | (*metric tons, tel quel*) | |
| Australia | 621,711 | 653,599 |
| Brazil | 97,133 | 111,348 |
| Canada | 0 | 1,505 |
| Colombia | 24,270 | 59,143 |
| Cuba | 907,200 | 855,174 |
| Dominican Republic | 25,940 | 200,032 |
| Fiji | 17,358 | 21,179 |
| Korea | 118 | 1,130 |
| Philippines | 28,482 | 0 |
| Salvador | 0 | 21,769 |
| South Africa | 519,453 | 566,850 |
| Taiwan* | 130,135 | 133,472 |
| Thailand | 0 | 34,849 |
| Other countries | 116 | 118 |
| | 2,371,916 | 2,660,168 |

* Includes 4266 tons non-centrifugal sugar in 1973 and 3750 tons in 1972.

* * *

## Thailand sugar exports[5]

| | 1973 | 1972 | 1971 |
|---|---|---|---|
| | (*metric tons, tel quel*) | | |
| France | — | 13,440 | — |
| Hong Kong | — | 15,746 | — |
| Indonesia | 32,351 | — | — |
| Iran | 11,990 | — | — |
| Iraq | 10,581 | — | — |
| Japan | — | 34,961 | 44,810 |
| Jordan | — | 19,998 | — |
| Malaysia | 101,263 | 72,693 | 5,000 |
| Nepal | — | 5,987 | — |
| Pakistan | — | 41,978 | — |
| Saudi Arabia | — | 20,214 | — |
| Singapore | — | 2,031 | 17,790 |
| Sri Lanka | 23,571 | 76,531 | — |
| Sudan | — | 28,002 | — |
| USA | 17,180 | 16,808 | 16,572 |
| Vietnam, South | 61,358 | 68,918 | 60,828 |
| Yugoslavia | — | 9,501 | — |
| | 258,294 | 426,808 | 145,000 |

**Paraguay sugar production, 1973**[6].—Sugar production in 1973 reached 69,000 tons, the highest quantity on record for Paraguay. Production in 1972 was 52,000 tons and in 1974 is expected to reach 75,000 tons. Domestic requirements are put at 52,000 tons.

**Mexico sugar expansion plans**[7].—Testifying before the US House Agricultural Committee in connexion with new sugar legislation, the representative of the National Association of Sugar Producers of Mexico indicated that three new sugar factories would start operations during the 1973/74 crop season and that construction of another three factories would be started this year. Before the end of the 1976/77 season Mexico will complete another seven sugar factories, each of the thirteen new mills having a capacity of between 60,000 and 100,000 metric tons of sugar per crop.

[1] *S. African Sugar J.*, 1973, **57**, 624–625.
[2] *Standard Bank Review*, March 1974, 27.
[3] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (1), 7.
[4] *Lamborn*, 1974, **52**, 46.
[5] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (1), 8.
[6] C. Czarnikow Ltd., *Sugar Review*, 1974, (1166), 28.
[7] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (8), ix.

## Brazil sugar exports[1]

| | 1973 | 1972 | 1971 |
|---|---|---|---|
| | (*metric tons, raw value*) | | |
| Afghanistan | 10,559 | 0 | 0 |
| Algeria | 79,117 | 77,859 | 40,180 |
| Bangladesh | 48,290 | 35,955 | 0 |
| Bolivia | 0 | 42,400 | 0 |
| Chile | 54,820 | 26,098 | 7,738 |
| China | 367,597 | 410,609 | 0 |
| Cyprus | 2,179 | 0 | 0 |
| Egypt | 0 | 49,022 | 0 |
| Finland | 47,081 | 47,759 | 36,600 |
| France | 25,476 | 48,441 | 34,915 |
| Germany, East | 0 | 46,853 | 0 |
| Germany, West | 0 | 0 | 14,385 |
| Greece | 7,482 | 0 | 0 |
| Indonesia | 68,693 | 0 | 0 |
| Iran | 190,099 | 11,550 | 0 |
| Iraq | 221,565 | 49,508 | 47,254 |
| Israel | 2,462 | 0 | 0 |
| Ivory Coast | 1,074 | 0 | 0 |
| Japan | 129,015 | 112,283 | 12,000 |
| Jordan | 11,480 | 13,412 | 0 |
| Korea, South | 10,250 | 0 | 0 |
| Lebanon | 42,598 | 11,000 | 0 |
| Malaysia | 7,650 | 0 | 38,283 |
| Morocco | 105,431 | 55,404 | 69,115 |
| Nepal | 12,095 | 0 | 0 |
| Pakistan | 21,960 | 178,916 | 0 |
| Paraguay | 0 | 25 | 0 |
| Poland | 0 | 12,600 | 0 |
| Portugal | 58,250 | 9,971 | 0 |
| Rumania | 0 | 0 | 44,407 |
| Senegal | 0 | 14,450 | 25,171 |
| Singapore | 16,152 | 31,852 | 11,400 |
| Somalia | 0 | 8,480 | 0 |
| Sri Lanka | 111,590 | 80,553 | 10,653 |
| Sudan | 104,279 | 26,768 | 0 |
| Surinam | 1,634 | 1,064 | 0 |
| Syria | 53,629 | 32,825 | 25,000 |
| Tunisia | 28,160 | 62,736 | 45,200 |
| UK | 90,840 | 18,847 | 0 |
| Uruguay | 11,545 | 42,000 | 14,886 |
| USA | 445,583 | 621,241 | 597,684 |
| USSR | 438,154 | 325,289 | 0 |
| Venezuela | 37,008 | 0 | 0 |
| Vietnam, South | 73,382 | 94,327 | 152,506 |
| Yugoslavia | 39,435 | 34,075 | 0 |
| Zaire | 0 | 3,353 | 0 |
| | 2,976,614 | 2,637,525 | 1,230,377 |

**Malaysia sugar factory order**[2].—Maschinenfabrik Buckau R. Wolf AG., of Grevenbroich, Germany, has received an order for erection of a 3500 t.c.d. cane sugar factory in Malaysia, to start operation at the end of 1975.

* * *

**Ecuador Government control of the sugar industry**[3].—The Government of Ecuador, through the Empresa Nacional de Productos Vitales, has assumed control of the production and marketing of sugar, so as to avoid speculation. A 12% *ad valorem* tax has been imposed on the export of sugar.

* * *

**Lebanon beet sugar production fall**[4].—Adverse weather conditions, especially heavy snowfalls, delayed the campaign in the Lebanon for 25 days. The total quantity of white sugar produced in 1973/74 is no more than 10,000 metric tons, white value, compared with 22,800 tons in 1972/73. The average polarization on beet did not exceed 13% and purity was 84–85 The 1973/74 crop has proved to be the worst in the history of the Lebanese beet sugar industry.

* * *

**Bolivia sugar production, 1973**[5].—Production of sugar reached 380,000 metric tons in 1973 compared with 270,000 tons in 1972.

## Argentina sugar exports[6]

| | 1973 | 1972 | 1971 |
|---|---|---|---|
| | (*metric tons, raw value*) | | |
| Algeria | 23,498 | 0 | 0 |
| Chile | 57,244 | 0 | 0 |
| France | 13,296 | 0 | 0 |
| Germany, East | 0 | 0 | 19,500 |
| Indonesia | 28,808 | 0 | 0 |
| Iran | 48,760 | 0 | 0 |
| Iraq | 33,879 | 0 | 0 |
| Morocco | 23,062 | 23,221 | 8,000 |
| Sri Lanka | 26,305 | 26,167 | 0 |
| UK | 40,731 | 0 | 0 |
| Uruguay | 19,146 | 0 | 29,999 |
| USA | 74,797 | 77,830 | 63,639 |
| USSR | 0 | 16,015 | 0 |
| Vietnam, South | 30,725 | 9,675 | 0 |
| Other Countries | 49,172 | 14,226 | 0 |
| | 469,423 | 167,134 | 121,138 |

**Citric acid factory for Greece**[7].—A plant is to be erected at Platy for the manufacture of 10,000 tons/year of citric acid and 4000 tons of protein fodder from beet molasses to be supplied by the local sugar factories. The investment will be about 500 million drachmae.

* * *

**Rumania beet sugar crop, 1973**[8].—The beet harvest in 1973 fell to 4,365,000 metric tons as against 5,581,000 tons in 1972. This was due to a very low yield of 18·57 tons/ha, which compares with 28·39 tons in 1972 and indicates that the beet area had been raised from 196,500 to 235,000 hectares in 1973. Sugar production was 515,000 tons, white value, as against 520,000 tons in 1972.

* * *

**New bulk terminal for Brazil**[9].—A contract has been signed for construction of a sugar export terminal in the Port of Santos, according to a spokesman of the Ministry of Industry and Trade. Construction of the terminal, at an estimated cost of $40,000,000, will be half-financed by the Instituto do Açúcar e do Alcool.

* * *

**New Tanzania sugar factory**[10].—The National Agriculture and Food Corporation has announced the start of preparatory work for the erection of a new sugar factory near Bukoba. The factory is to start operation in 1977 and will have a designed initial capacity of 40,000 tons of sugar per annum.

* * *

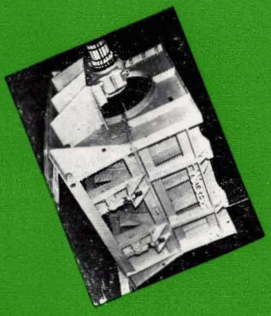
**Mexico sugar cane expansion**[11].—The Government recently authorized a three-year agreement to provide for increased guaranteed prices to sugar cane growers. An annual increase in sugar production of 150,000 tons is envisaged, and a national commission is to be established to coordinate the activities of the sugar industry.

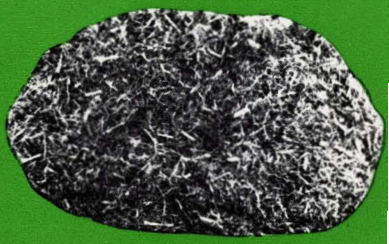
* * *

**Fiji sugar crop damage by flooding**[12].—Fiji's sugar crop has suffered extensive damage from flooding which has followed torrential rain in the main growing areas in the first half of March. Hundreds of acres of cane lie rotting because of poor drainage, according to a member of the Sugar Advisory Council.

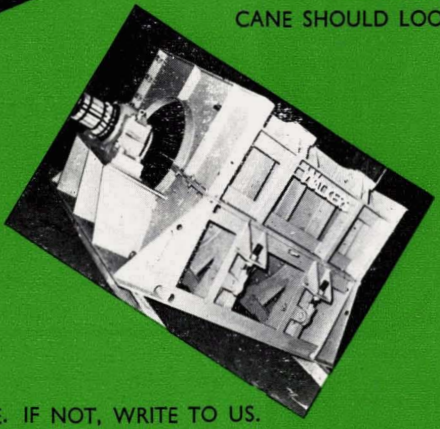
[1] *I.S.O. Stat. Bull.*, 1974, **33**, (2), 23.
[2] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (6), 6.
[3] *Bank of London & S. America Review*, 1974, **8**, 174.
[4] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (7), 9.
[5] *Bank of London & S. America Review*, 1974, **8**, 90.
[6] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (6), 2.
[7] *Sucr. Belge*, 1974, **93**, 101.
[8] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (6), vii.
[9] *Reuters Sugar Rpt.*, 15th February 1974.
[10] F. O. Licht, *International Sugar Rpt.*, 1974, **106**, (6), 6.
[11] *Bank of London & South America Review*, 1974, **8**, (85), 41.
[12] *The Times*, 18th March 1974.

# THE DAY IT RAINED SHREDDERS

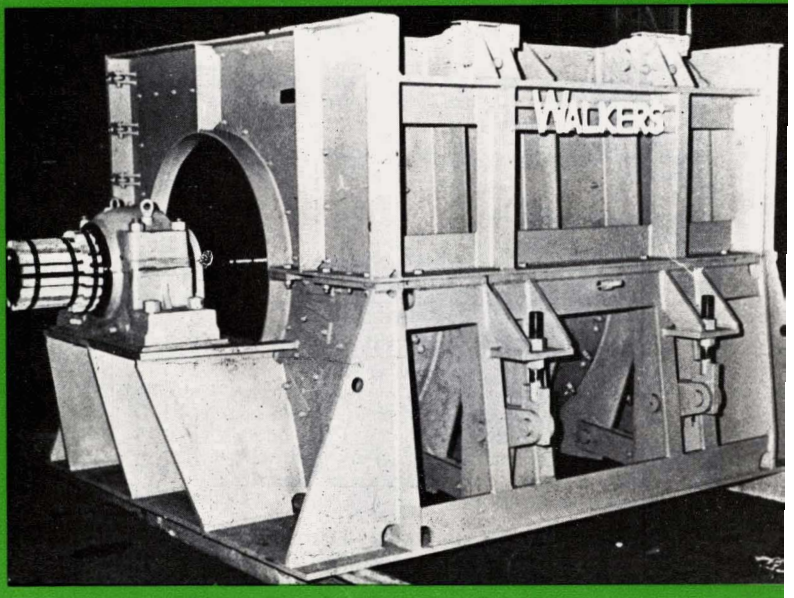




THIS IS HOW YOUR SHREDDED CANE SHOULD LOOK



WE HOPE YOU CAUGHT ONE. IF NOT, WRITE TO US.

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