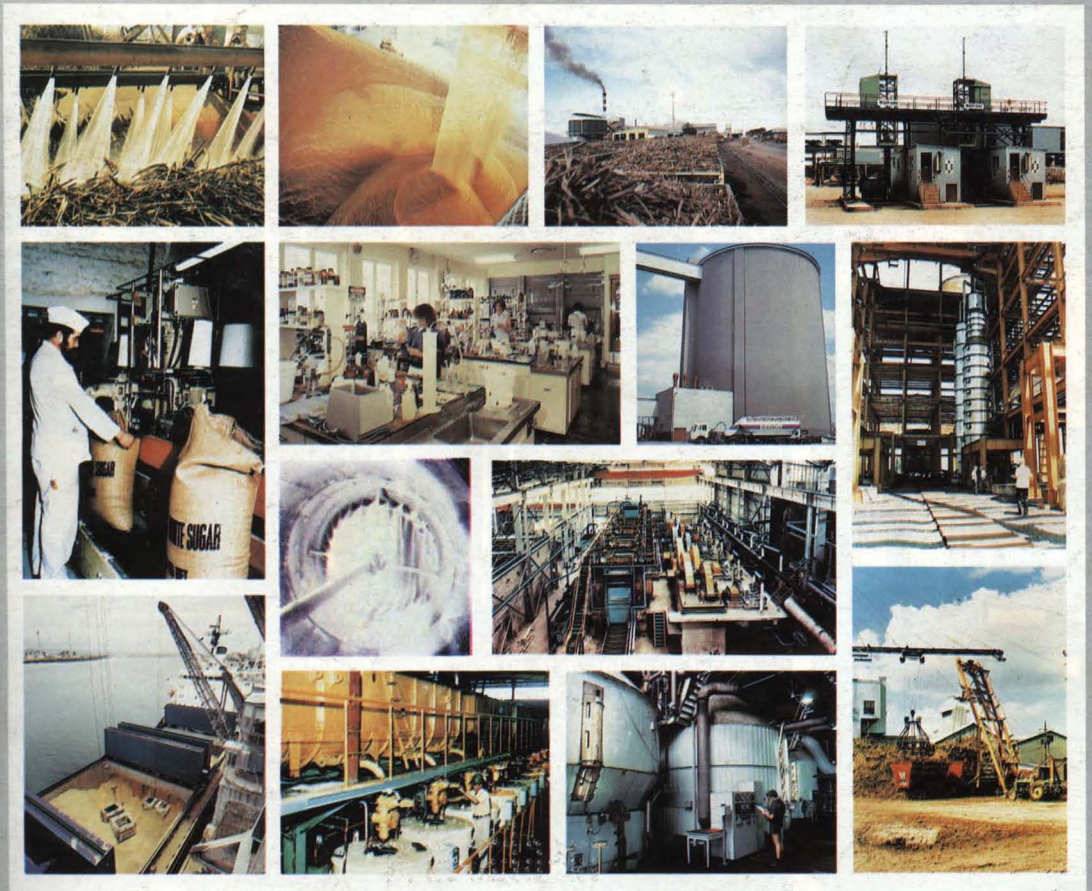


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INTERNATIONAL SUGAR JOURNAL

Volume 90
Issue No. 1071**CONTENTS****March 1988**

- 41 News and views
- 43 Product news
- 44 New books
- * * *
- Technical articles*
- 46 **ENGINEERING: A COMPUTER AIDED PLANT AND MAINTENANCE MANAGEMENT SYSTEM AT SIUICRE EIREANN CPT**
By M. J. Brennan, P. Rochford and F. Boylan (Ireland)
- 52 **PROCESSING: AFTER-PRODUCT BEET SUGAR PAN BOILING**
By J. C. de C. Thelwall (UK)
- * * *
- 57 Mexico sugar technologists meeting, 1987
- 58 El Salvador Seminar/Workshop on cane sampling, analysis and payment
- 59 - 60 Facts and figures
- * * *
- Abstracts section*
- 23A Cane sugar manufacture
- 26A Beet sugar manufacture
- 30A Laboratory studies
- 32A By-products
- 33A Patents

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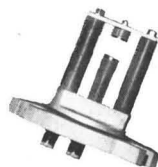
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News and views

World sugar prices

Following the considerable increase during the last two weeks of December, the London Daily Prices for raw and white sugar entered a consolidation phase and the LDP which started January at \$238.60 stayed between \$237.40 and \$245 up to January 20, while in the same period the LDP(W), which was \$242 on January 1, fluctuated between that level and \$250 per tonne. Strength was provided by estimates of Indian requirements, news of Cuban efforts to postpone shipments, purchases by China and those expected by the USSR.

The effects of drought in Brazil and higher requirements forecast for China resulted in a new rise and the LDP rose, to fluctuate between \$255.40 and \$265.40 during the rest of the month, closing at \$255.80 per tonne, while the LDP(W) rose to \$262 on January 20 but then remained at a discount of up to \$3 against raw sugar for the remainder of the month which it finished at \$252.40.

An Australian view of world sugar price prospects

World sugar prices should average about 10 US cents/lb in the September 1987/August 1988 season, according to the Australian Bureau of Agricultural and Resources Economics¹, a significant rise on 6.2 cents/lb average for 1986/87. With declining production, world sugar stocks should fall by 3 million tonnes in 1987/88 and by a further 2 million tonnes in 1988/89, to reach 32 million tonnes. This would indicate tight supplies during 1988/89 and very likely herald the beginning of another short-term boom in world sugar prices, as occurred in 1980/81, the Bureau said in its latest quarterly review of the rural economy.

It forecast world output at 102 million tonnes in 1987/88 against consumption of 105.5 million tonnes and production of 105.5 million tonnes against 107.5 million in 1988/89. It estimates that there is about a 50% chance that the average world price will be in the range 8.5 - 11 cents/lb in 1987/88 and 16 - 23 cents/lb in 1988/89. However, there is also a 20%

chance that the price in 1987/88 could be up to 1.5 cents lower or 4 cents higher than the above range, while there is a 20% chance that the 1988/89 range could be between 12 and 16 cents or between 23 and 32 cents/lb. The Bureau expects high prices to continue through to 1990; by that time major producers should have begun to expand production in response to the earlier high prices so that they should begin to fall back in 1991.

US sugar import quota for 1988

On December 15, the US Secretary of Agriculture announced that he had taken the "painful" decision to cut the sugar import quota for 1988 by 25% to just less than 750,000 tons, raw value, or a quarter of the quota of four years ago. The cut is required by a 1985 law which requires the USDA to run the sugar price support program at no cost to the US treasury. While domestic production increases - as it had done for several years, encouraged by the high level of support - imports must be reduced to match, and are likely soon to disappear completely since, according to the Secretary, Richard Lyng, "these trends... are moving us toward self-sufficiency in sweetener production".

The Administration has backed legislation proposals to reduce the level of price support and depress US production to allow higher imports but domestic sugar farming lobbies, aided by corn producer lobbies (whose profitable sweetener products are encouraged by the high support level for sugar), have blocked any such moves. The market was not affected by the announcement of the quota reduction since it had been expected, although it had been thought that the reduction would be only to 800,000 tons. The quota holders have protested against the cuts but, of course, to no avail.

The Philippines and Caribbean countries have been mollified, however, by news that the House and Senate have passed a bill which includes provision for the import, refining and re-export of 110,000 and 290,000 tons, respectively, of raw sugar from those areas. Under the

bill, sent for President Reagan's signature, the US would have to pay the costs involved in this system and it consequently has been opposed by the Administration, which regards it as a short-term palliative when a thorough reform is needed. The plan has been denounced by other countries such as Australia which says it intends to seek compensation under the GATT for such discrimination.

The individual country quotas set for 1988 are given below, together with corresponding quotas for 1987.

	1988	1987
-short tons, raw value-		
Argentina	30,100	39,130
Australia	58,100	75,530
Barbados	5,770	7,500
Belize	7,700	10,010
Bolivia	5,770	7,500
Brazil	101,500	131,950
Canada	7,700	10,010
Colombia	16,800	21,840
Congo	5,770	7,500
Costa Rica	13,110	17,583
Dominican Republic	123,200	160,160
Ecuador	7,700	10,010
Fiji	6,300	25,190
Gabon	5,770	7,500
Guatemala	33,600	43,880
Guyana	8,400	10,920
Haiti	5,770	7,500
Honduras	11,524	15,917
India	5,770	7,500
Ivory Coast	5,770	7,500
Jamaica	7,700	10,010
Madagascar	5,770	7,500
Malawi	7,000	9,100
Mauritius	8,400	10,920
Mexico	5,770	7,500
Mozambique	9,100	11,830
Panama	20,300	26,390
Papua New Guinea	5,770	7,500
Paraguay	5,770	7,500
Peru	28,700	37,310
Philippines	110,600	143,780
St. Kitts	5,770	7,500
El Salvador	19,766	26,020
Swaziland	11,200	14,560
Taiwan	8,400	10,920
Thailand	9,800	12,740
Trinidad	5,770	7,500
Uruguay	5,770	7,500
Zimbabwe	8,400	10,920
Speciality sugars	2,000	2,000
	757,880	1,003,430

¹ *Reuter Sugar Newsletter*, December 10, 1987.

Philippines sugar deficit²

It is ironic that the US should have instituted an export enhancement program whereby the Philippines has received an entitlement to 110,000 short tons, raw value, of extra exports, at a time when the 1987/88 crop target, originally set to reflect reduced outlets, has been subject to a severe drought and a series of typhoons which have reduced the crop to an estimated 1.26 million tonnes or about the amount required for domestic consumption. It would appear that imports of the order of 200,000 tonnes will be needed if the US outlet is to be satisfied as well as internal requirements. One result of the higher level of internal prices and improved prospects on the world market, is that cane plantings have increased for the 1988/89 season and sugar production from the crop is likely to show a marked recovery.

World sugar production estimates, 1987/88

F. O. Licht GmbH recently published their second estimate of world sugar production in the current crop year³ which now foresees an overall production of 104,053,000 tonnes, raw value, i.e. an increase of 222,000 tonnes over the revised 1986/87 total, whereas their first estimate in October last indicated a fall of 762,000 tonnes. The new estimate, to a record figure, is mainly the result of a higher crop in the Soviet Union, the world's largest sugar importer. The estimate for the USSR is raised from 8,150,000 to 9,700,000 tonnes and the difference more than outweighs expected reductions in the outputs of Brazil, China and Cuba.

Brazil crop reduction by drought⁴

The original production targets for 1987/88, set in May last year, included 5,311,000 tonnes, raw value, from the Centre-South and 3,193,000 tonnes from the North-Northeast. Subsequently, following a fall in demand for alcohol, the target for the North/Northeast was raised to 3,828,000 tonnes. The Centre-

South crop is complete and approximately achieved the target, but the North/Northeast has been afflicted by the worst drought in 20 years, which has cut the crop by proportions estimated for different places as up to 35% while increasing the sugar content (but not proportionately) and bringing forward the peak and end of production. C.

Czarnikow Ltd. estimates that the crop has overall been reduced by of the order of 15% to around 3.2 million tonnes and the overall national crop to about 8.5 million tonnes instead of the target 9,139,000 tonnes.

The significance of this is that most of Brazilian export availability comes from the affected area and therefore that Brazilian export availability in the coming months will be considerably less than previously forecast. Further, it seems almost certain that the drought damage sustained will have an impact on 1988/89 production.

White sugar trading in London⁵

The centre of gravity in the world white sugar trade is moving to London – attracted by the London Futures and Options Exchange's successful marriage of an innovative whites market with its long-established raw sugar futures. The London Fox white sugar contract, launched last July with an automated trading system, in January traded more than 5,000 lots in a single day as prices touched a 21-month high.

At the same time the Paris white sugar contract, which has been the mainstay of that market, has seen volume for the last quarter of last year at only half the level in the corresponding 1986 period. Meanwhile the New York Coffee, Cocoa and Sugar Exchange's fledgling white sugar contract has failed to take off, with only 903 lots traded between its launch in October and the close of the year, in spite of hectic trading in its raw sugar contract.

London is well-placed to dominate the sugar trade, with brokers handling about 66% of the world's 15 million tonnes physical trade. Between 50% and 66% of the London trade is in white

sugar – and 70% of London trade house business for whites was going to Paris before the advent of London's automated market. This was expensive in commission costs and levies. The cost per tonne of trading in Paris was up to four times more than London when the Fox contract was launched.

Initially, the physical market was cautious of London's automated trading system. But the low cost and long trading hours – 9.45 am to 7.10 pm – have proved attractive. Paris has admitted that London's new contract has been a factor in its falling turnover, although it claims that London figures are inflated by intra-market activity. However, the open interest in the London contract has risen steadily from a high of 20,457 contracts in August, to 33,747 contracts in January. Open interest in Paris has been steady – but has not increased – with 26,430 contracts in August and 25,705 in January.

The French have also acted to cut their costs. On February 1, a new law governing the country's commodity trading came into effect. Taxation on commodity dealings has been amended and capital gains tax has been cut to the same level as on other investments. But it will be hard to meet London's low costs and its ability to trade in both whites and raws is now attracting business from the US, where large amounts of speculative money are available with all that entails for market liquidity.

Sugar market information service

Computerization has permitted several improvements to the Daily Sugar Information Service offered by F. O. Licht GmbH. The service now consists of three parts: a daily report which can also be received by telex, telex or facsimile, covering world market developments and news, etc., miscellaneous new statistics, and updates of individual country sugar balances with detail of production, consumption, imports and exports. In addition weather surveys and crop prospects are reported as well as raw and white sugar trade flows. The annual charge is DM1995 but a trial 3-months subscription is available at DM 500. Those interested should get in touch with Dr. Helmut Ahlfeld, P.O. Box 1220, D-2418 Ratzeburg, Germany.

2 Czarnikow Sugar Review, 1988, (1769), 6.

3 Int. Sugar Rpt., 1988, 120, 55 - 65.

4 Czarnikow Sugar Review, 1988, (1769), 2 - 3.

5 Financial Times, February 2, 1988.

Product news

High pressure screening from Contra-Shear

At first sight the PI series screen looks just like the standard Contra-Shear unit with one immediate difference and that is the absence of an infeed tank. The PI series uses a manifold because the flow onto the screen face which in the usual Contra-Shear method is against the rotation of the screen is not at atmospheric pressure. The flow pressure is boosted to pressures which can be from 30 to 60 psig.

PI series screens have wire slots which can be supplied from 60 to 150 microns wide, the slots running longitudinally with drum. The drum itself can be adjusted at an angle to suit the application. The tilt is used to discharge the solids using the natural helix caused by the angle.

The action on the screen face is very efficient as the manifold jets are angled for a tangential approach which ensures a "shallow approach". Spraying water-borne solids onto a screen face for the purpose of separation is not new. It has been done with static screens for a number of years. However, using the PI technique – as is done with the Contra-Shear microfines screen – is a completely new and patented approach.

In operation the screen is kept clean by timer-controlled showering sprays installed inside and out, a system which has been well proven. This feature is in itself tremendously important as it cannot easily be carried out on static type screens and it can help to prevent blinding of the screen by product drying out on its face.

The screens can be built in stainless steel 304 or 316. All the running gear has been previously well proven on the Contra-Shear standard screens. The trunnions are heavy duty and featuring internal back-to-back purge relief bearings.

Two main sizes of screens are currently available, the first being 900 mm in diameter by 1500 mm long (3 ft x 5 ft) and the larger 900 mm in diameter by 1800 mm long (3 ft x 6 ft). Screen capacity varies of course

according to the application; the larger can handle flows as high as 6500 litres per minute (1731 US gpm)

Further details:

Contra-Shear Engineering Ltd.,
C.P.O. Box 1611,
Auckland,
New Zealand.

Multi-channel hygrometer

With their newly-introduced 1000E MC multichannel hygrometer, Michell Instruments Ltd. offer a most flexible and economical means of continuously monitoring dewpoint levels at up to nine process locations. The hygrometer is designed for applications requiring simultaneous monitoring at a number of process stages. It is user-expandable, simply by the insertion of additional modules into its front panel, each with an associated sensor. Each module delivers a 0 - 1.0V output, and contains a continuously-rated alarm relay with voltage-free contacts. The states of the various channels may be registered on analogue or digital display with associated selector switch, while individual channels register their alarm state on an integral LED lamp.

Operational specifications for the 1000E MC include display in ppm or °C dewpoint; resolution of 1°C above -40°C, and 2.5°C below; accuracy of ± 3°C above -70°C and ± 5°C below; and four optional ranges of -80 to -25°C dewpoint or 1 to 600 ppm V; -60 to -5°C dewpoint or 10 to 3000 ppm V; -40 to 10°C dewpoint; and -20 to +20°C dewpoint.

A zero depression facility enables the scale of any channel to be individually depressed, so that dewpoints wetter than the calibrated range can be monitored. They would otherwise cause the instrument to read off-scale. This feature is especially useful during plant start-up, when process gas dewpoints may be initially very high.

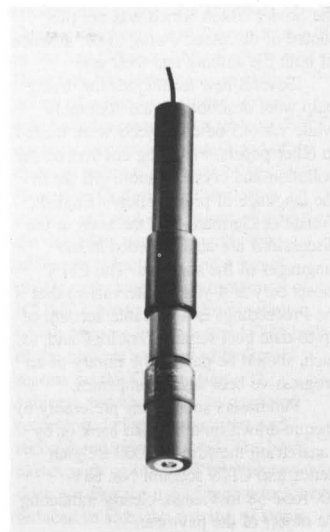
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Further details:

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Further details:

Semat Technical (UK) Ltd.,
Executive Park,
Hatfield Road,
St. Albans, Herts. AL1 4TA,
England.

New books

Proceedings of the 18th General Assembly of the International Commission for Sugar Technology

Ed. R. Pieck. 685 pp; 15.5 × 24 cm (Commission Internationale Technique de Sucrerie, Aandorenstraat 1, B-3300 Tienen, Belgium) 1988. Price 2000 Belgian francs.

This newly published book is a report of the 18th General Assembly of the CITS which was held in Ferrara Italy, in June 1987. It includes tributes to two distinguished former officers of the Commission, Prof. F. Schneider and Mr. D. Hibbert, and records the details of the Assembly including social occasions. Priority themes for the meeting were: sugar degradation; colour; and pulp, and many of the papers were on these topics, as will have been noted by the readers of our abstracts. It is a surprise to see included one paper from the Soviet Union which was not presented or discussed owing to the absence of both the authors and their text.

Several new techniques for drying pulp were described at the Assembly while various other subjects were treated in other papers, including environmental pollution and crystallization. All are in the language of presentation – English, French or German – and the texts of the discussions are also recorded in the languages of the speakers. The CITS meets only at 4-yearly intervals so that the Proceedings is a valuable account of up-to-date beet sugar technology and, as such, should be part of the library of all progressive beet sugar companies.

Purchasers should pay preferably by cheque drawn on a Belgian bank or by transferring the sum of 2000 Belgian francs into CITS account No. 681-0001652-58 in Tienen, clearly indicating the object of the payment.

Sugar year book, 1986

Anon. 336 pp; 9.1 × 13.4 cm (International Sugar Organization, 28 Haymarket, London SW1Y 4SP, England.) 1987. Price: £12.50.

This is the 40th Edition of this useful statistical record and, as for other ISO publications, deals only with centrifugal sugar. It assembles, on a calendar year basis, official data on sugar production, consumption, imports, exports and stocks for member countries of the International Sugar Agreement, together with information supplied by some non-member governments, and figures extracted from statistical publications or estimated. In almost all cases the figures are in tonnes, raw value. The figures cover 126 individual countries (the EEC being counted as one) while a series of general tables are included covering world data – production, imports, consumption, stocks in selected countries, prices, etc. As always, a remarkable amount of information is compressed into a small package, yet the clear printing makes it legible and a very comprehensive, detailed and authoritative data source.

The hunger crop: poverty and the sugar industry.

Belinda Coote. 124 pp; 14.5 × 21.0 cm (Oxfam, 274 Banbury Road, Oxford OX2 7DZ, England.) 1987. Price: £4.20.

Case studies are reported from Jamaica, Brazil and the Philippines which show how the local populations have suffered as a consequence of the deterioration of economic conditions for the sugar industry in these countries, following the decline of markets in the USA and Europe, largely the result of sugar policy in these areas. The author falls into the common trap of relating prices to those of the world free market as though the latter were standard instead of a highly artificial and variable price dependant on marginal supply and demand. Nevertheless, the lives of the people described are miserable and inspire sympathy. The author suggests solutions: reduction of EEC production to consumption level less the ACP imports, seeking alternative uses for sugar, and establishing a new and effective International Sugar Agreement. Third World governments are urged to

promote rural development, implement land reform, establish cooperative or outgrowers schemes, encourage and support trade unions, diversify land use, markets and crop use, while the developed countries should ease the debt burden of developing countries, compensate cane countries for loss of markets and redirect aid to support efforts to redistribute resources and adjust to shrinking markets. Whether these would be successful is debatable, however; hardship existed long before the EEC sugar policy was formed and even before any ISA was dreamed of. Land reform often leads to small patches of land which incur high costs of production because economies of scale are lost. The markets established by the EEC have been largely for white sugar, not the raw sugar available from the developing countries. Also whether the Community would be willing to become reliant on the ACP countries to meet 13% of its consumption requirements is doubtful; the whole purpose of the Common Agricultural Policy is to attain self-sufficiency.

Hawaiian sugar manual, 1987

Anon. 27 pp; 15.2 × 22.9 cm. (Hawaiian Sugar Planters' Association, P.O. Box 1057, Aiea, HI 96701, U.S.A.)

This is described as a handbook of statistical information but it, in fact, includes a great deal more, with details of Hawaiian sugar companies and their chief executives, a brief history of sugar manufacture in the islands and a map showing the location of factories, raw sugar terminals and cane lands, production figures for 1986, a survey of the industry in 1986, a graph showing the progress since 1960 of retail prices, costs and returns to growers. Wages and working conditions are summarized, as are approximate numbers of employees and their total man-hours since 1940. Industry organizations described include the HSPA, its Experiment Station and California & Hawaiian Sugar Co. Statistics of sugar and cane per acre, total acres, cane and sugar production,

etc. from 1908/9 are tabulated, while surveys and tables are provided on the US sweetener industry and use, sugar imports, consumption, industrial and non-industrial use, US sugar legislation, market, wholesale and retail prices, loan rates, and world sugar data. A glossary is included of sugar terms.

**Taiwan Sugar Research
Institute Annual Report,
1986/87**

Anon. 52 pp; 19.5 × 27.2 cm. (Taiwan Sugar Research Institute, 54 Sheng Chan Road, Taipei, Taiwan.) 1987.

During 1986/87 a total of 62 research projects were successfully carried out of which 42 were concerned with sugar cane agriculture and 20 with factory engineering and by-products development. Adoption of a personal computer for monitoring, controlling and recording of the sugar boiling process and the scheduling of pan house operations has been successfully performed at Huwei sugar factory, and the use of ion exchange resin for clarification of carbonation juice has given encouraging results during two years of study. A computer program for calculations of energy and material balances in a multiple-effect evaporator has been developed and can be used to determine optimum conditions of heating surfaces and vapour bleeding, for instance, at any factory. A rapid method was developed for determination of sugar traces in boiler feed water. The manufacture of different types of paper from bagasse mechanical pulp has been studied, while a system was developed for computer control of lysine fermentation, and lignin-absorbing bacteria have been isolated which can be used for treatment of waste water from a bagasse pulp plant. A new microbial gum has been prepared from sucrose and its properties studied, while a multiple-stage reactor comprising three fermentations in series with different yeast strains was examined and found to permit production of more than 10% v/v alcohol from molasses in an overall

retention time of 18 hours. A protoplast fusion technique has improved the activity of a lysine producing bacterium and work has been carried out on a water-adsorbent resin and the improvement of the strength of regenerated cellulose sponge. Dr. S. C. Shih retired from Directorship of the Institute at the end of October 1987 after nearly 17 years of valuable service to his country's sugar industry.

**F. O. Licht's International
Sugar Economic Year Book
and Directory, 1987**

Ed. H. Ahlfeld. 444 + 83 pp; 20.4 × 29.1 cm (F. O. Licht GmbH, P.O. Box 1220, D-2418 Ratzeburg, Germany.) 1987. Price: DM 150.00.

The latest edition of Licht's Yearbook follows the same pattern as previously, with updated information on international organizations and, in some cases, their national member counterparts. The largest section of the book is the directory of sugar authorities, traders, organizations, institutes, factories and refineries, etc. for no less than 128 countries. This section has been set in conventional type again and is much easier to read than the previous edition. It is followed by a series of articles on sugar economics, a review of new equipment and processes in the sugar industry, and articles on weed beet and on current trends in sugar cane mechanization. A number of descriptions are given – some in English alone and others in both German and English – of products and product ranges of a number of the companies advertising in the book. After a Spanish-English lexicon a Buyers' Guide is presented in which the advertisers are listed under their products in alphabetical order, followed by their address details. A separate book of world sugar statistics is held in a pocket at the back of the book and includes 1986/87 and earlier statistics and estimates of production, imports, exports, stocks, etc. on a world basis and for a number of important countries. Average prices on various markets and sugar consumption

levels in many countries are tabulated, as well as data on molasses production and trade. Licht's Yearbook is a unique and valuable publication which is full of authoritative and reliable information; it is well printed and bound and can be highly recommended.

**ICUMSA 19th Session
Proceedings**

xxiv + 475 pp; 14.8 × 23.1 cm. (International Commission for Uniform Methods of Sugar Analysis, c/o British Sugar plc, Research Laboratories, Colney, Norwich, Norfolk NR4 7UB, England.) 1987. Price: £28.00.

This conveniently sized book is a record of the most recent of ICUMSA's meetings which are held at 4-year intervals. The Session was held in Cannes, France, during May 25 - 30, 1986, with 117 delegates present from 28 countries. The book opens with photographs of the then President, General Secretary, and Treasurer, as well as the late Donald Hibbert, a Life Honorary Vice-President, an obituary notice of whom is included. After acknowledgements and a table of contents, accounts are presented of the opening session, meetings of the Executive Committee, the closing session and social occasions. A list of the delegates attending with their addresses is included, and a group photograph, together with mention of ICUMSA News; a regular newsletter which appears in this Journal. The bulk of the book is a record of Referees' reports on the Commission's 32 subjects, together with the proposed recommendations, discussions and recommendations adopted. The book closes with an index. While the reviewer does not like the use of typewritten text reduced in size, the spacing of this is such that it is not difficult to read and the layout is logical and clear. As an account of the work of the authoritative body concerned with analysis in the sugar industry, these Proceedings are an essential tool of the factory and refinery laboratory.

A computer aided plant and maintenance management system at Siúicre Eireann CPT

By M. J. Brennan, P. Rochford and F. Boylan

Introduction

Since the early sixties, planned maintenance systems have been in operation in Irish Sugar. A comprehensive system was introduced in Tuam in 1961 involving plant register and history cards, job cards with labour and material estimates, work progress and cost information. The system was applied to the other factories and indeed was given a considerable degree of thought, particularly under the job estimation heading where methods such as Work Study, MIM and Benchmark classification were given consideration. Such methods were however concluded to be too demanding on overheads and we preferred to remain with the type of estimates based on the experience and expertise of the technical and engineering staff.

Problems of continuity have displayed themselves in the factories relative to the total volume and complexity of work, the number of operations, the degree of capital and other work progressing simultaneously, the number of stores items, the length of off-season etc.

In Mallow a special effort was made in recent years to revise and update the system and this has succeeded in giving satisfactory control and efficiency at local level. The information gained from this exercise has been invaluable in guiding us to the next step.

Our experience with maintenance planning and control has led us to the following conclusions:

(1) A well-run system will contribute substantially to cost reduction.

(2) The normal "manual" system demands clerical and technical input to be both expert and consistent. Development of the necessary skills by the personnel involved is a demanding exercise and leaves the system person-dependant to a considerable degree.

(3) Such systems in our factories have been purely local in their application, without integration with the company costings and with no communication with other factories.

(4) All systems, no matter how efficient at their first introduction, will

inevitably require comprehensive reappraisals at periods of not more than five years.

A recent reappraisal by the factories of the systems in use coincided with a requirement to update the information being passed to the general ledger system of the company's financial accounts. This led to the recognition that future factory systems should be standardized and be capable of direct communication with each other and with the accounts system. Consideration of this and all the other needs of maintenance control led to the conclusion that only a computerized system held the possibility of fulfilling our requirements. Apart from the advantage of adequate space for storage of all necessary plant information; rapid and easy entry, updating and retrieval facilities; and efficient management information provision; computerized systems also offered ease of integration with other local and company systems, extension possibilities to cover the comprehensive range of management responsibilities, including capital work, packaging and factory services, and incorporation of other technical needs such as CAD and network analyses.

The installation of a pilot system at Carlow was authorized. The cost of procurement and installation was estimated to be under £100,000. This sum, while substantial, amounts to a very small percentage of a factory's annual maintenance expenditure and should be well repaid by results.

System objectives

In the implementation of a comprehensive computerized plant maintenance system, the main overall objectives for the introduction of these new facilities at this time can be summarized as follows:

(1) To create a detailed documented work program which will provide a solid basis for management planning, organization and control and decrease dependence on individual experience.

(2) To provide an automated and readily accessible cross-reference between a plant unit record and its component spare parts in order to reduce delays and

waiting time significantly.

(3) To facilitate better stock control and discipline in purchasing and procurement procedures, whereby stock-outs can be avoided on the one hand; and on the other, that obsolescence and uneconomical stock-holding can be monitored and controlled.

(4) To improve the overall cost-effectiveness of maintenance by enabling accurate resource requirement projections to be made in order to optimize manpower utilization and material usage.

(5) To increase plant availability during the campaign and in the packaging operation, through a series of routine preventive maintenance inspections, plant monitoring and recording of results.

(6) To continuously amplify to management the information available on the maintenance function by assembling a comprehensive history of all items of plant in terms of work carried out, materials and labour employed and total costs.

Operational requirements and characteristics

In setting out to select and implement a maintenance management system, a number of essential characteristics should be featured in order to enable smooth introduction and subsequent effective operation.

It was considered essential that the system be designed in such a way that all levels of personnel in the plant could feel comfortable with its operation. Very complex technical computer terms or operational stringency would not be acceptable. User friendliness is essential. Further, the system would have to allow easy access to all relevant data records, operating at the level of the operatives knowledge-base and not the reverse.

The system requires to be on-line, particularly in relation to maintenance spare parts. It is recognized that the system would very quickly cease to be regarded by maintenance personnel as a useful and reliable source of information if the data contained therein was not

Paper presented to International Sugar Technical Conference, Killarney, Ireland, 1987, here condensed.

fully up-to-date. It is also clear, of course, that implementing an on-line system is not in itself a guarantee of success; the procedures to operate the system effectively are equally, if not more, critical than the computer programs themselves.

A continuous unbroken information service is important, hence any necessary computer functions such as hardware maintenance, period-end procedures and systems back-ups would require to be executed at strategically opportune times.

From an overall administration viewpoint, the aspect of total integration of modules and functions within the maintenance system itself and also with other related systems such as cost accounting and general ledgers, was seen as critical. It is an absolute requirement that all source data be entered into the system once only and thereafter be processed and allocated by the system to update all appropriate records and files. Failure to meet this requirement would have been unacceptable.

Application software procurement exercise

The search for the computer-based maintenance management system began in mid-1986. Three options faced the Company, viz. to use consultants to develop the system, to develop the system in-house or to buy an off-the-shelf package solution. Following detailed investigation of the implications of each of the above options it was decided that the best approach was the third, i.e. a computer package solution suitably adapted to sugar factory needs.

In November/December 1986 an exercise was carried out at Irish Sugar to establish and document the essential requirements for a new computer-based plant maintenance system. This exercise was carried out jointly by the Maintenance and Computer Services Departments, under the direction of a Steering Committee consisting of Divisional and Factory Management.

On completion of this investigation a Request For Proposal for the supply of plant maintenance application software

to meet the Company's requirements was prepared. This document was issued to eight potential suppliers in Ireland and the UK. It provided a description of the business, operation and information requirements that it would be expected to support. Proposals were invited to meet these requirements, and the detailed information which the supplier was expected to provide in the proposal were clearly specified. Appendix A contains an outline of the main contents of the RFP document.

The advantages of this formal approach to procurement are:

(a) The preparation of a formal Request For Proposal document imposes the discipline of clearly establishing and setting out functional and operational requirements for the system being sought.

(b) A business-like and professional relationship is established with the potential suppliers and this is particularly important in the case of the chosen supplier at the crucial stage of negotiating contract, costs and support.

(c) The RFP is particularly useful from the vendor's point of view in that it provides an immediate insight into the organization and type of operation that the system is being expected to support.

(d) Use of a standard RFP facilitates the subsequent comparison of the proposals received from each supplier.

(e) Together with the assessment and evaluation summary, the RFP forms the basis for communication with senior management and for a recommendation to purchase.

In selecting the suppliers from whom proposals would be sought it was decided not to include those whose offerings were PC or microcomputer-based, and to restrict the circulation to minicomputer solutions. The main reasons for adopting this approach were that the following criteria cannot be satisfied by a micro-based system:

- (a) Automatic integration with existing system files and records, local and company-wide.
- (b) Accommodation of multiple on-line terminals.
- (c) Capacity requirement.

While awaiting response, personnel at Irish Sugar established the evaluation criteria against which the merits or demerits of each proposal would be assessed. These criteria would be used in both the qualitative assessment of each individual proposal, and also in the quantitative comparison of all the proposals.

Eventually, four tenders were received and analysed in detail, and where possible Irish Sugar Personnel visited existing users of the systems being proposed.

The qualitative assessment of each proposal was carried out considering many factors such as the supplier and his background, his performance during the proposal exercise, the quality and professionalism of the proposal, the expressed views and experiences of existing users, the quality and completeness of the software as demonstrated, the costs involved, etc.

The quantitative comparison of all four proposals was carried out using the criteria already decided upon. Each element was given an importance weighting, and each proposal was rated against that points weighting. The criteria and weightings are set out in Figure 1, together with a summary of the points allocated to each proposal.

The net result of the evaluation process was a decision in principle, pending a satisfactory trial period, to award a contract to Idhammar Management Systems of the UK. The concept and design of the system chosen originated in Sweden and is in use in some 130 installations in Europe.

Idhammar consultants were engaged to carry out a pre-project study in conjunction with maintenance and computer personnel at Irish Sugar. The objective of this exercise was to examine the maintenance environment at Irish Sugar and determine the necessary preparation that should be carried out prior to implementation. Issues such as coding of plant units, collating of plant unit specifications, preparation of spare parts lists, reorganization of works order descriptions and so on. The work carried out during the pre-project study was seen

Figure 1. Quantitative comparison of proposals

	Weighting	Proposal 1	Proposal 2	Proposal 3	Proposal 4
<i>Application considerations</i>					
Requirements fit on standard modules	40				
Year of origin	5				
No. of installed sites (any hardware)	5				
Ease of operational use	10				
Software demonstration performance	5				
Availability of additional facilities	15				
Operational support facilities	5				
End user development tools	15				
Total : Applications	100	87	53	38	90
<i>Technical considerations</i>					
No. of installed sites (proposed hardware)	5				
Source language employed	10				
Source code supplied	10				
Interface to other applications	20				
Interface to other equipment	20				
System documentation	10				
Security/standards aspects	10				
Modification flexibility	15				
Total : Technical	100	54	78	75	94
<i>Supplier/support constructions</i>					
Supplier stability rating	15				
Professional staff numbers	5				
Other user references	20				
Quality of proposal	10				
Training services/capability	10				
Consultancy services	10				
Support during tender	20				
Adherence to RFP	5				
User group facilities	5				
Total : Supplier/Support	100	69	57	37	86
<i>Costs considerations</i>					
Once-off - software	35				
Once-off - hardware	35				
Ongoing - software	15				
Ongoing - hardware	15				
Total : Costs	100	47	72	90	83
Overall totals	400	257	260	240	353

as a major input to the preparation of a phased implementation program.

Idhammar specialists were also engaged to provide preliminary training to enable personnel at Irish Sugar to operate the system effectively during the trial period and thus gain optimum benefit from it.

The implementation program was scheduled to commence on July 1, 1987 and will be implemented on a phased basis covering a period of approximately 18 months. The ultimate objective is to have all modules fully operational at all plants by January 1, 1989.

Application software modules

The Idhammar Maintenance Management System comprises seven modules. Together, these modules form a database of management information, the use of which is designed to enhance the efficiency of the maintenance function and the decision-making effectiveness of its management.

The main modules are:

- (1) Plant unit records
- (2) Spares stock control
- (3) Purchasing
- (4) Work Order planning

- (5) Preventive maintenance
- (6) Technical/economical analysis
- (7) Document records.

Plant unit records

The core of this module is a set of permanent records for every item of equipment in the plant. These records contain identity and descriptive data and include details on:

- (a) Unit number, name and other identity data,
- (b) Location of equipment and Machine Group to which it belongs
- (c) Original manufacturer and year



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of manufacture,

- (d) Supplier and supplier serial number,
- (e) Year of purchase and purchase terms,
- (f) Detailed technical specification,
- (g) List of associated spare parts, and
- (h) Spare parts stock balance.

Where a technical specification is common to a number of units the details need only be entered once and associated thereafter as appropriate with the relevant units. The same feature also applies in the case of spare parts or groups of spare parts which are applicable to more than one unit; details need only be entered once.

The system permits meaningful and descriptive alpha coding which is most useful from a user viewpoint. It permits ready access through VDU enquiry with excellent help and search facilities. There is ready access to supplier data which facilitates the expediting of service and delivery.

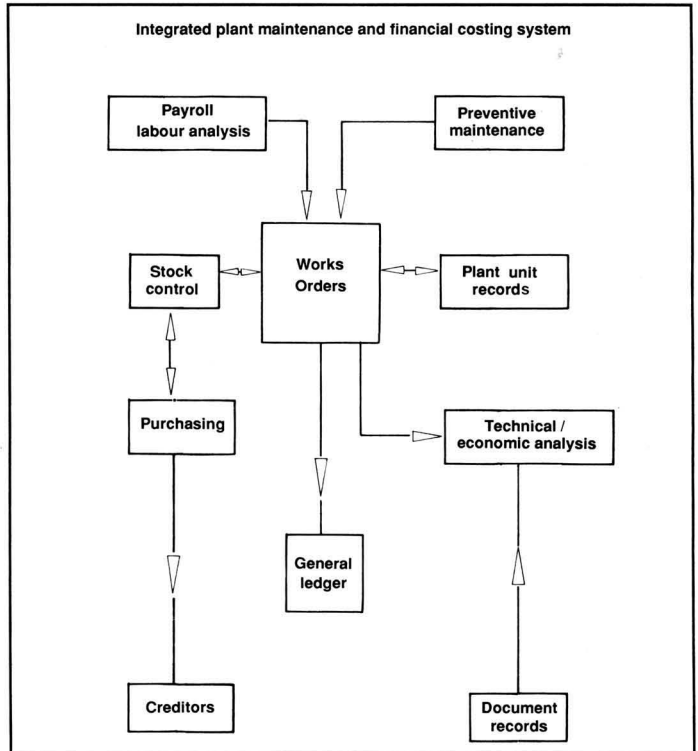
Integration with the Work Order module enables a full history of work details for each unit of plant to be accessed. Labour, materials and other costs, together with textual data, are available on VDU enquiry.

Spares stock control

The system facilitates the maintenance of identity, descriptive and balance information for each stock item held in the maintenance stores. Each spare part has its own unique code and description, with item enquiry being particularly flexible and easy. Helpful search facilities are particularly useful where an item code is not immediately available to or known by the person making the enquiry.

Procurement needs are catered for by supplier references and data, with control points such as re-order level, order quantity, minimum stock level, lead times, etc. The system interfaces with the purchasing module for the automatic generation of requests-to-purchase where stock has fallen below the re-order level.

There is a "where-used" enquiry to facilitate the fast determination of unit



dependencies on a particular spares item. Comprehensive stock statistics are kept regarding usage, rate of movement, number of stock-outs encountered, and obsolescence control.

Purchasing

This module facilitates the automatic generation of requests-to-purchase from the stock module, and enables them to be assembled into purchase orders and printed. It also caters for the creation of manual requisitions and purchase orders for both stock and non-stock items. Outstanding purchase orders are automatically reflected in stock availability on the stock module.

The system enables purchase orders to be traced by supplier, by item, or by order; it allows for alternative supplier data to be held and easily accessed and a full purchase order history can be

maintained. Easy-to-use enquiry and search facilities are available to all records.

Work order planning

This is the main processing module in the system; its most important features include the following:

(a) Creation and maintenance of a planned program of work which can be regenerated automatically before the commencement of off-season maintenance each year. The Work Orders which constitute this program can be revised, rescheduled and reviewed having regard to resource availability and environmental factors.

(b) Generation of management information to give up to-date assessment of progress, performance and costs.

(c) Performance of maintenance personnel and teams can be easily monitored and recorded.

(d) Actual *versus* budgeted costs can be monitored on all planned work.

(e) Work Order Job Cards can be produced containing work instructions and job reference material information.

(f) All costs are posted through the medium of Work Orders; material costs come automatically from the stock module; labour costs from a payroll interface and other costs are entered directly against the appropriate Work Order. Work results may also be entered in text form for historical reference.

(g) This module integrates fully with the stock control module, with the plant unit records module, and with associated accounting records.

(h) Comprehensive records are maintained of all Work Orders integrating with plant unit record module, building up history on each plant unit. This facilitates work planning for subsequent years.

(i) Capital projects can be programmed and monitored in the same way as maintenance.

Preventive maintenance

The basis of this module is the creation of a program of periodic inspections to monitor plant condition and performance. A PM inspection may result in the raising of a Work Order where maintenance or overhaul is deemed necessary or advisable.

As the main concentration of maintenance effort is carried out during the off-season when the work program is well defined and pre-planned, PM will really only be relevant during production and for on-going operations such as packaging, mobile plant and service equipment.

It is envisaged that machine condition monitoring program will be implemented at Irish Sugar to support and link to the PM module. In the longer term, it is expected that it will be possible to automate condition monitoring through the use of microprocessor-based sensory equipment and computer analysis.

Technical/economical analysis

This module maintains statistics on

all items of plant, and enables analyses of operational performance and maintenance costs to be reduced.

Individual units can be analysed covering a specific period of time with reference to work carried out and the associated costs.

There are also a number of "Top Ten" analyses which report details for the ten most expensive units of equipment in terms of maintenance cost relative to capital value.

Troublesome units will have their costs highlighted, thus enabling decisions to be made re changed inspection frequencies, altered maintenance routines or total replacement.

Document records

This module allows details of drawings and other documentaion to be stored in a special file. It is designed to facilitate communication between the maintenance department, design office and suppliers; and also to facilitate the maintenance of the file through additions, deletions and alterations. Information is provided on drawing numbers so that the correct drawings can be quickly obtained.

Implementation considerations and issues

In approaching the implementation of a plant maintenance management system there are a number of very important issues to be addressed. These issues will determine the long-term success or failure of the system; this will be measured by (i) the operational feasibility of the manual and computer procedures and (ii) by the achievement of the objectives and benefits sought.

Some of the main considerations are discussed below.

Coding

There are three major areas of coding which the company have addressed, viz. (i) the plant unit code (ii) the Work Order or job code and (iii) the accounting ledger code. Each plant unit record has a unique code, and it is desirable that this code should be as descriptive and meaningful as possible

while at the same time being short and concise. Irish Sugar believe that the system of coding chosen is ideal on both these counts.

Within the sugar factory there are a number of processing areas or sections e.g. the raw factory, the refinery, the pulp plant, etc. It is proposed that the plant units belonging to each area will have a code with a prefix indicating the section to which it belongs. For example, all units in the raw factory will have a code commencing with RF, those in the refinery, RE, those in the pulp plant, PP and so on. Access to the computerized unit records and identification of all units is greatly facilitated.

Irish Sugar currently operates a cost code system using codes which have been used very successfully for a number of years, and with which all plant personnel are extremely familiar. It has been decided to continue with these codes for the new Job/Work Order system.

As this Work Order code is the main one used in day-to-day operations for the purpose of posting material, labour and sundry costs, very little disruption will be caused by the introduction of the new facilities as they will continue to employ the existing codes. Costs and results data posted to a Work Order code will also be automatically applied to the plant unit to which the Work Order refers.

Finally material, labour and sundry costs posted to Work Order will automatically be applied to the accounting general ledger code which appears on the Work Order record.

The advantages of this coding system are: total integration of processing is achieved, data are entered once only, it facilitates familiarization and ease of operation, plant history records are automatically created, and accounting requirements are automatically catered for.

Existing stores spares codes will largely continue to be used in their present form when the new system is installed. It is proposed, however, to review the present spare parts descriptions to ensure that maximum

Cane sugar manufacture

Açucareira Corona S/A Usina Bonfim

Anon. *STAB*, 1985, 3, (4), 4 - 11 (Portuguese).

A survey of the title sugar factory/distillery is provided, including details of the cane estate of 43,000 ha and its climate, varieties, soil preparation, planting, etc., as well as the industrial sector from cane reception and weighing, through washing, preparation and milling, to juice treatment for the manufacture of sugar or of alcohol, evaporation, boiling, etc. Technical data for the 1983/84 season are tabulated.

Forecasting and providing adequate steam consumption for a strategy of operation of the pan section

T. Díaz B. and B. Avila. *ATAC*, 1985, (2), 14 - 17 (Spanish).

Operation of batch vacuum pans causes considerable variation in steam demand and a computer program has been developed which, applied to pan sequencing, reduces this variation.

Use of vapour bled from the evaporator for the stepwise heating of limed and clarified juices

D. Leal, A. Valdés and P. Friedman. *ATAC*, 1985, (2), 18 - 25 (Spanish).

Trials carried out at Pablo Noriega experimental sugar factory demonstrated that important savings were possible by bleeding of vapours from the different effects for heating of juice in several stages and that the benefits were greater the more stages of bleeding and heating were used.

Seeding by densimeter

E. Díaz G. *ATAC*, 1985, (2), 33 - 37 (Spanish).

Since 1966, pan seeding in Cuba has been on a basis of refractometric Brix, but the author recommends the use of a Baumé hydrometer and has developed a number of tables relating °Bé with

supersaturation at different purities, to be used to judge the seeding point at different vacuum levels.

Usina Santa Bárbara S.A. - Açúcar e Alcool

Anon. *STAB*, 1985, 3, (5), 4 - 6, 8 - 10 (Portuguese).

A detailed account is given of the agricultural operations, sugar factory and distillery of this 20,500 t.c.d. enterprise in Brazil, together with tabulated data from the 1984/85 season.

Factors that cause the deterioration of raw sugar in storage

F. G. Salcedo. *Sugarland*, 1986, 23, (3/4), 9 - 11, 15.

The adverse effects of processing parameters on colour formation in stored cane raw sugar and the various micro-organisms that may cause deterioration of stored sugar are discussed. Optimum conditions for sugar storage are then set out, covering pol content, moisture content, yeast count, pH, height of sugar pile, equilibrium relative humidity and storage period.

Advances in resin technology for more efficient sugar extraction from cane and beet molasses

U. Bharwada. *Sugar y Azúcar*, 1987, 82, (8), 27, 29.

The process of sugar recovery from molasses by a combination of chromatography and ion exclusion using resin of high bead size uniformity and separation efficiency in a pseudo-moving bed system is discussed. Factors that affect resin life and operation economics are examined; they include resin crush strength and the effect of hydraulic pressure, the frequency with which the resin is cycled between molasses introduction and elution, and molasses concentration (preferably >3% and <50% dry solids) and temperature (increase in which is accompanied by a fall in separation efficiency but also by a

decrease in viscosity and in microbial growth from resin fouling which can generally be prevented at approx. 60°C).

A visit to the sugar industry of the Republic of China

F. Cordovez Z. *Sugar J.*, 1987, 49, (12), 5 - 6.

A brief survey is presented of the Chinese sugar industry, where about 20% of the sugar is derived from beet and the rest from cane in 300 factories located in four provinces. The equipment and processes used at five factories visited by the author are described.

A tracer test for the flow pattern of a new rapid clarifier

C. H. Chen, H. C. Tso, T. P. Hsieh and R. Y. Chang. *Rpt. Taiwan Sugar Research Inst.*, 1987, (115), 43 - 50 (Chinese).

In an investigation of juice flow in a rapid clarifier at Hwalian sugar factory, the residence time distribution was determined by adding LiCl tracer to the inflowing juice and measuring its concentration in the outflowing juice by atomic absorption spectrophotometer. The results indicated an average residence time of 64.96 minutes, with almost complete absence of dead space and bypass.

Milling technology in the Australian sugar industry

K. S. Shah and K. S. Mokha. *Indian Sugar*, 1987, 37, 79 - 84.

An outline is presented of cane mills and milling technology in Australia followed by details of equipment and processing at eight sugar factories visited by the authors.

Some studies on Egyptian cane sugar. II. Physical treatment of clarified sugar cane juice using ion exchange resins

M. M. B. El-Sabbah and A. Z. Abd El-Latif. *Zuckerind.*, 1987, 112, 718 - 721.

One- and two-stage ion exchange treatment of sulphitation juice was investigated using eight different cation and anion exchangers in 4-hr cycles. Results are given in graph form, showing (for a strongly acidic cation exchange resin at 4, 6 and 8 bed volumes/hr and a weakly acidic cation exchange resin at 4 and 6 BV/hr) the amount of ash, Ca, Mg, total hardness (as Ca carbonate) and colour removed with time as well as the effect on pH, reducing sugars and total sugars as invert. The superiority of the strongly acidic resin over the weakly acidic resin in terms of ash removal is demonstrated; at the lowest flow rate the strong resin provided 100% Ca, Mg and hardness removal and >75% total ash removal. Colour removal by each of three anion exchangers tended to be greater than with the cation exchange resins; ash removal by the anion exchange resins could not be determined because of errors associated with the increase in pH. Direct, reversed and mixed bed systems with combinations of cation and anion exchangers were superior to the one-stage systems, with ash removal at 82 - 85% and colour removal at 60 - 69%.

Juice clarification

A. A. Zende. *Bharatiya Sugar*, 1987, 12, (8), 7 - 11.

An account is given of the history and development of clarification by defecation and sulphitation, including a comparison of modern equipment with that used 50 years ago, details of automatic control systems and mention of special juice treatment processes.

Energy conservation in the sugar industry

J. P. Mukherjee. *Bharatiya Sugar*, 1987, 12, (8), 19 - 20, 23.

After a brief look at the various pieces of power-consuming equipment in a sugar factory, the author examines ways in which steam consumption can be reduced, with particular mention of the benefit of a double-effect vapour cell or of vapour compression for an evaporator station.

Vacuum pan control systems

W. Lucynski. *Bharatiya Sugar*, 1987, 12, (8), 25 - 27, 29 - 30, 33 - 35, 37, 39 - 40.

Information is given on a Polish viscosity/consistency and a conductivity system for automatic boiling control, and details are given of application of the former type to A-masseците boiling and of the latter type to B- and C-masseците boiling at Pravara S.S.K. Ltd. Advantages of the schemes are listed, including a reduction in boiling time and in the formation of conglomerates and dust, maximization of crystal growth, decrease in steam consumption and in steam feed fluctuations (thus raising boiler efficiency), the ability to boil masseccites of lower purity, and improved molasses purity. A description is given of automatic boiling control in a Polish beet sugar factory.

Measures for effective reduction of steam consumption in the manufacture of white sugar

D. S. Lande. *Bharatiya Sugar*, 1987, 12, (8), 45 - 47, 49 - 50, 52, 57 - 58.

The author examines various aspects of sugar factory operation to show how steam consumption can be reduced by efficient processing, proper use of equipment, selection of more suitable equipment for a given task, use of automatic controls and greater attention to lagging, quality of lime, condensate utilization, etc.

Energy saving at Ponnii Sugars

B. S. Gurumurthy and N. Gunsekaran. *Bharatiya Sugar*, 1987, 12, (8), 59, 61 - 64.

Improvement in cane preparation brought about by the installation of fiberizers has been accompanied by increased energy consumption, whereas a mincer introduced at the factory of Ponnii Sugars & Chemicals Ltd. has given a Preparation Index of at least 80 without extra power consumption. Other energy

economy measures at the factory include a mist system for cooling of condenser water, installation of a continuous vacuum pan, the use of a thyristor-controlled variable-speed motor for a fully-automatic A-centrifugal and the introduction of pinion-less mill rollers.

Achievement of a lower final molasses purity

A. H. Patel, S. N. Patil and J. D. Mujumdar. *Bharatiya Sugar*, 1987, 12, (8), 69 - 72.

By graining low-grade masseccite on A-heavy molasses of 68 - 72 purity and developing the grain with A-heavy and C-light molasses, followed by cutting one half at 65 - 68 purity to a crystallizer and boiling the other half with B-heavy molasses to give a final purity of 54 - 57 purity, it has been possible to operate at an extremely high Brix and achieve a 1 - 1.5 unit drop in final molasses purity after continuous cooling, reheating and curing in continuous centrifugals.

Differential pricing and technology selection in Indian sugar manufacturing

M. Tribe. *Paper presented at Conf. on The Future of Small-Scale Sugar Processing*, 1987, 17 pp.

Analysis of the production costs and profitability of sugar produced by normal sugar factory operation and of gur and khandsari produced by the open-pan process suggests that the Indian government considers it best to allow investment in both large- and small-scale sectors, with a differential price and tax structure that implicitly allows such "dual development".

Scale considerations in sugar production planning

M. Tribe. *Paper presented at Conf. on The Future of Small-Scale Sugar Processing*, 1987, 14 pp.

Selection of scale with a view to minimizing sugar production costs in developing countries is discussed, whereby it is shown how the unit costs

of sugar go up as the factory size falls from 10,000 to 1250 tcd at the same capacity utilization, with the disadvantage of the smaller factory increasing with reduction in capacity utilization from 100%.

The Kenyan economy and development plans

M. Tribe. *Paper presented at Conf. on The Future of Small-Scale Sugar Processing*, 1987, 15 pp.

An outline is presented of the economy of Kenya and of development plans, particularly concerning sugar manufacture.

Sugar in Kenya and in the international economy

M. Tribe. *Paper presented at Conf. on The Future of Small-Scale Sugar Processing*, 1987, 14 pp.

After a brief examination of per caput sugar consumption in selected countries and of sugar production and trading by principal countries, the author analyses the sugar situation in Kenya over a number of years, with a summary of cane crushing and sugar production by its seven factories in 1985. The control of the Kenyan sugar industry and cane pricing are outlined.

Full production from large-scale sugar factories

G. Moody-Stuart. *Paper presented at Conf. on The Future of Small-Scale Sugar Processing*, 1987, 7 pp.

The importance of adequate cane supply (as dependent on good agronomy and efficient transport) and of proper factory design, maintenance and training of personnel is discussed in regard to operation of a sugar factory of at least 1000 tcd crushing rate.

Setting up a small-scale sugar complex

Anon. *Paper presented at Conf. on The Future of Small-Scale Sugar Processing*, 1987, 4 pp.

The financing of a small sugar factory to process cane from up to 1500 hectares, the choice of site, labour employment in cane growing and factory processing and the suitability of continuous diffusion as against discontinuous milling are discussed.

Small-scale sugar complexes are profitable

Anon. *Paper presented at Conf. on The Future of Small-Scale Sugar Processing*, 1987, 4 pp.

Nine reasons for the profitability of small-scale sugar factories are discussed, and the economic and financial aspects of a 450 tcd factory are analysed.

Small-scale sugar complexes

Anon. *Paper presented at Conf. on The Future of Small-Scale Sugar Processing*, 1987, 2 pp.

The benefits of small-scale sugar factories in developing countries are briefly discussed, and the advantages of the cane diffuser over the mill (which needs to crush at least 1000 tcd for efficient operation) indicated.

From the mill to the diffuser

Anon. *Paper presented at Conf. on The Future of Small-Scale Sugar Processing*, 1987, 2 pp.

The case for diffuser vs. mill is briefly set out, the advantages of the diffuser lying in the lower energy consumption and in the smaller weight of equipment (thus requiring none of the considerable civil engineering work needed with cane mill installations). The basic manufacturing process from diffusion juice treatment to bagging of the sugar is then outlined.

Diffusion - small cane sugar factories

Anon. *Paper presented at Conf. on The Future of Small-Scale Sugar Processing*, 1987, 4 pp.

The development of the DDS cane diffuser since the first commercial

installation in Tanzania in 1962 is outlined and performance data from Cruz Alta factory in Argentina are reproduced to demonstrate the advantage of the diffuser in terms of greater extraction and lower losses and fuel consumption than the average for Tucumán. The suitability of the diffuser for small-scale operations is discussed.

Improvements in OPS technology

I. McChesney. *Paper presented at Conf. on The Future of Small-Scale Sugar Processing*, 1987, 19 pp.

The open-pan sulphitation process developed in India for plantation white sugar manufacture is described with mention of improvements brought about by the cane expeller (a single-stage screw extruder which gave 85% milling efficiency at a cane throughput of 2 - 2.5 tonnes/hr), replacement of round with rectangular pans of greater surface, and the use of shell furnaces to burn wet bagasse. Scopes for further improvements are discussed as well as the suitability of OPS technology for Kenya.

Thoughts on the best solution for a 200 tcd sugar process

J. Somner and J. Pearson. *Paper presented at Conf. on The Future of Small-Scale Sugar Processing*, 1987, 7 pp.

The most suitable manufacturing process for a factory crushing 200 tcd is discussed, and the answer considered to lie in the use of the vacuum pan process with a 12-roller milling tandem (or equivalent diffuser) preceded by a hand-fed 2-roller crusher and followed by manual handling of the bagasse from the last mill for use as fuel in a gravity-stoker furnace. The equipment would also include a clarifier, juice and syrup sulphitation plant, a quadruple-effect evaporator supplying 1st effect vapour to the pans and manually-operated, self-discharging centrifugals having a low acceleration rate; the means used for sugar drying would depend on climatic conditions and be restricted to the limited amount of power remaining to drive e.g. a fan.

Beet sugar manufacture

The development of new technologies based on cavitation

A. F. Nemchin. *Sakhar. Prom.*, 1987, (6), 21 - 24 (Russian).

Three major trends in cavitation-based technology are indicated: the use of (i) the combined action of cavitation micro-bubbles formed behind supercavities and accumulation in process streams, (ii) the surface of a supercavity to intensify heat exchange processes, and (iii) cavitation self-oscillations created by periodic changes in the dimensions of the supercavities. Equipment based on (i) and developed in the Soviet Union which is applicable to sugar manufacture includes units already in use for dispersion and activation of lime and for intensification of liming as well as experimental equipment for preliming, filter-cake sweetening-off, beet washing, dissolving of sugar, etc. Experiments are being conducted on equipment using technology (ii) for carbonatation gas cleaning and cooling, deammoniation of condensed juice vapours, liming of syrup, carbonatation, etc. Supercavitation equipment based on (iii) has not yet been fully developed. Problems encountered in the development of the new technologies are discussed, and the working organ of a unit for milk-of-lime mixing is described which has raised the reactivity of the lime by 25 - 30% and thus reduced limestone consumption by 10 - 12%; a 25% decrease in the amount of water used for sweetening-off and a dramatic reduction in the time needed for melting have also resulted from use of similar equipment. Observations made during the course of various investigations are also discussed.

Experience in the design of a 1st carbonatation vessel and in conducting the process

L. G. Belostotskii, K. D. Skorik and L. I. Pankin. *Sakhar. Prom.*, 1987, (6), 24 - 26 (Russian).

Drawbacks in the design and use of conventional carbonatation vessels in Soviet sugar factories are indicated and

details given of a vertical, cylindrical vessel with a widened upper part and a conical bottom. The juice space is divided vertically into an outer section and a much narrower inner section, both being provided with spargers. Limed juice is fed tangentially into the lower part of the inner section and is treated by gas also fed tangentially above the juice inlet; the juice rises and, at an alkalinity of 0.3 - 0.5% CaO, spills over into the outer section where it is taken to an optimum pH and alkalinity. Since the pressure head in the inner section is lower than in the outer, when a valve at the base of the inner section is open, gassed juice from the outer section enters, mixes with the incoming limed juice and is re-gassed. When the valve is closed, sand is purged from the inner section, passes to the outer section and is then discharged. Results of trials showed a lower filtration coefficient than with a conventional carbonatation vessel and a slightly higher settling velocity, while gas utilization was much greater; 2nd carbonatation juice benefited from the new equipment in having a higher purity but lower colour and lime salts content.

Decolorization of thick juice plus remelt liquor with powdered active carbons

A. U. Dmitrenko, S. A. Brenman, Ya. O. Kravets, L. P. Zarudnev and S. A. Gurova. *Sakhar. Prom.*, 1987, (6), 35 - 37 (Russian).

While treatment with active carbon is seen as one way of raising the quality of white sugar obtained from beets of poor quality, difficulties have arisen in the removal of the carbon particles from treated thick juice before pan boiling. In tests at a factory using a 2-masseccuite boiling scheme, a suspension of carbon and perlite was added to unfiltered thick juice mingled with remelt liquor and the mixture pumped to precoated candle filters from which the filter-cake and carbon were added to 2nd carbonatation juice for decolorization while the melt liquor was transferred to the pan station. The reduction in colour content by

comparison with untreated, filtered thick juice is indicated.

Modernization of the vacuum filters at V. V. Kuibishev sugar factory

V. V. Spichak, N. F. Bobrakov, M. G. Shumakova and V. V. Buromskii. *Sakhar. Prom.*, 1987, (6), 43 - 46 (Russian).

Because of the limitation imposed at the title factory on the residual pressure in rotary vacuum filters by the temperature (85°C) of the suspension from filter-thickeners and hence on the pressure difference at which filtration takes place, the mud should have a dry solids content not exceeding 20% if the cake is to be formed quickly enough. However, to cut the time involved in the filtration cycle, particularly that spent on regenerating and replacing filter cloth, it was considered cheaper and simpler to abandon the use of mud pretreatment in settlers or filter-thickeners and to convert the vacuum filters to a belt type. Two different approaches to the design modification are described; one proved more successful than the other and improved filter performance in a number of ways.

Experience in the operation of FPI-1321K-01 continuous centrifugals

B. N. Tereshin. *Sakhar. Prom.*, 1987, (6), 46 - 48 (Russian).

Details are given of this Soviet centrifugal designed for B- and C-masseccuites and for affination, and advice is given on its operation under specific conditions.

The rate of CO₂ absorption in 1st carbonatation

V. M. Logvin, L. P. Reva, V. Yu. Vigovskii, G. A. Simakhina and Z. I. Logvin. *Rpt. Kiev. Tekhnol. Inst. Pishch. Prom.*, 1987, 9 pp.; through *Ref. Zhurn. AN SSSR (Khim.)*, 1987, (14), Abs. 14 R460.

The effect of initial CaO concentration in a limed sugar solution and of its viscosity on the CO₂ absorption rate is

examined. It was found that the absorption rate during carbonation depends on the initial lime concentration in the solution and on the solution viscosity, which in turn is governed by temperature. The data obtained suggest that the lowest absorption rate of the gas occurs during the period when 55 - 60% of the CaO has been neutralized. The results must be taken into consideration when sectioned carbonation vessels are being designed and dimensioned.

Modification of a lime kiln

L. D. Shevtsov *et al.* *Sakhar. Prom.*, 1987, (6), 49 - 51 (*Russian*).

Problems in the operation of particular Soviet lime kilns widely introduced into sugar factories during 1969/80 are discussed and means of improving their performance described, with details of results obtained after conversion at one sugar factory.

A combined evaporator

V. N. Gorokh *et al.* *Sakhar. Prom.*, 1987, (6), 52 - 55 (*Russian*).

Factors influencing juice evaporation are discussed and the advantages over a conventional multiple-effect evaporator of a mixture of single-pass, film evaporator units and conventional effects are indicated.

Reception and storage of sugar beet of complex condition

V. A. Knyazev. *Sakhar. Prom.*, 1987, (6), 55 - 59 (*Russian*).

The handling and storage of beets of low sugar content, of high dirt tare, with much leaf and weed trash attached and/or which has been irregularly topped, is discussed.

Choice of flocculant for increased removal of predefecation mud

V. A. Tsekhmistrenko, O. P. Tkachenko, S. P. Olyanskaya and I. A. Oleinik. *Sakhar. Prom.*, 1987, (7), 27 - 29 (*Russian*).

After determination of ionization constants for three Soviet flocculants and of the optimum pH at which they were adsorbed onto Ca⁺⁺-containing particles, one of the flocculants (KO-3) was used in further experiments on separation of predefecation mud in view of the coincidence of its optimum adsorption pH and the pH of predefecation juice (under which conditions the best settling and filtration are obtained). Results showed that the flocculant should have greatest effectiveness when added to the preliming zone where the added lime constitutes 0.10% on juice volume (corresponding to a pH of 8.9 - 9.5) or where 1st carbonation juice is recycled at 100% on predefecation juice.

Intensification of the 1st massecuite boiling process

V. V. Spichak, A. S. Pakhomova, T. E. Luk'yanova and V. O. Shtangeev. *Sakhar. Prom.*, 1987, (7), 30 - 31 (*Russian*).

Experiments showed that melting low-grade sugar in thick juice gave a higher Brix than conventional melting in thin juice, so that the Brix of the mixture of thick juice and melt liquor fed to the 1st massecuite pans was also higher than in many Soviet factories and allowed a reduction in steam consumption.

Sugar crystallization by a three-massecuite scheme with subsequent recycling of the sugars at Rakitnyanskii sugar factory

N. A. Arkhipovich, M. Takhle and A. F. Kirichek. *Sakhar. Prom.*, 1987, (7), 31 - 32 (*Russian*).

Under the conventional boiling scheme used at the factory, 2nd and 3rd sugars are melted and used for 1st massecuite boiling to white sugar. However, to avoid recycling excessive amounts of non-sugars and giving a white sugar of poor quality and high colour content, reboiling of 3rd sugar melt with 2nd massecuite was suggested; this resulted in 2nd and 3rd sugars of lower colour content than with the traditional scheme,

and hence a white sugar of improved quality.

Application of microprocessor technology in the sugar industry

A. I. Sorokin. *Sakhar. Prom.*, 1987, (7), 33 - 34 (*Russian*).

The value of the microprocessor in sugar factory operations, particularly with distributed control methods, is demonstrated by low-grade massecuite cooling with automatic maintenance of temperature conditions, whereby a maximum crystallization rate is achieved and hence the process time cut and molasses sugar reduced. Other fields of application include rapid analysis of factory products using instruments with built-in microprocessors, training of personnel by simulation of operations carried out by particular pieces of equipment, planning of experiments and mathematical modelling of processes combined with research data processing.

The use of microcomputers to determine process parameters in the boiling house

Yu. D. Kot and L. I. Shtangeeva. *Sakhar. Prom.*, 1987, (7), 34 - 37 (*Russian*).

Nomograms are presented for determination of process parameters involved in 1st and 2nd massecuite boiling and in low-grade boiling with and without supplementary precrystallization by cooling; a worked example is presented. For values other than covered by the nomograms, a microcomputer program can be used, and the sequence of calculations in the appropriate algorithm is explained.

Application of filter-cake instead of milk-of-lime as coagulant for treatment of flume-wash and gas scrubber waters

E. A. Khodurskii. *Sakhar. Prom.*, 1987, (7), 37 - 38 (*Russian*).

At four Soviet sugar factories, filter-cake

is used instead of milk-of-lime to treat flume-wash water and gas scrubber water, thus saving lime and fuel consumed in the kiln while approximately doubling the settling and clarification rate by comparison with conventional treatment; use of the filter-cake prevents foaming of the flume-wash water. At one of the factories, application of the system allowed one of a pair of settlement tanks to be taken out of service. No details are given of the quantities of filter-cake employed.

Use of low-potential steam

V. P. Adamenko, V. P. Khomenko, B. S. Margulis, A. V. Il'in and B. M. Margulis. *Sakhar. Prom.*, 1987, (7), 38 - 39 (Russian).

The use of a vortical steam ejector to compress steam that is of too low a pressure to be fed to the 1st effect of an evaporator is described. Details are given of the way in which the ejector works and reference is made to application of the system over three campaigns at a sugar factory.

The circulation effects of massecuite stirrers

F. Rieger, D. Havelkova, H. Weiserova and M. Brandejsky. *Listy Cukr.*, 1987, 103, 159 - 163 (Czech).

Knowledge of the pumping characteristics of a massecuite stirrer is essential for design purposes, and the theory of massecuite stirring is explained in terms of the energy input and output and resultant flow. While values of two dimensionless coefficients governed by stirrer geometry can be found by calculation in the case of screw-type stirrers, for other forms such as a paddle type they must be found experimentally; a method is described, and application of the results to an actual case is demonstrated.

An organic mixture separator

J. Dyntar and S. Dusek. *Listy Cukr.*, 1987, 103, 164 - 166 (Czech).

A description is given of a unit for separation of beet rootlets and fragments

from the material taken from flume-wash water; the beet pieces are then sent for processing. A separation efficiency of >95% is possible.

An improved scheme for raw juice purification at Palmir sugar factory

A. N. Kovtun. *Sakhar. Prom.*, 1987, (8), 6 - 11 (Russian).

Full details are given of the juice purification processes used at Palmir sugar factory, where two lines operated in parallel during a test period; the essential difference between the two lay in the liming of 1st carbonation juice and recycling of all the 2nd carbonation mud to preliming in one as against recycling of 1st carbonation juice or mud in the other. Results indicated the benefit of 2nd carbonation mud recycling in terms of increased purification efficiency (giving an average thin juice purity of 90.2 compared with 89.7 and an increase in white sugar yield of 0.05 - 0.06% on beet).

Removal of pulp from raw juice

B. A. Kutsenko and N. D. Khomenko. *Sakhar. Prom.*, 1987, (8), 11 - 14 (Russian).

The adverse effect of non-sugars in pulp remaining in raw juice is briefly discussed, and the point made that at many factories in the Soviet Union the juice is inadequately screened, so that the residual pulp content is 3 - 10 g/litre as against an official upper limit of 1 g/litre. A balance of insoluble non-sugars, pectin and araban is calculated for three cases: (i) where the screened juice contains 10 g/litre pulp and the pulp that has been separated is returned to the diffuser, (ii) where the pulp content of the screened juice does not exceed 1 g/litre and the separated pulp is returned to the diffuser, and (iii) where the screened juice contains no more than 1 g/litre pulp but the separated pulp is added to the exhausted cosettes; common to all three variants is a daily slice of 3000 tonnes of beet containing an average 5% of pulp and

other solid waste. The tabulated data show that the molasses sugar is increased by 0.090%, 0.070% and 0.006% on beet in (i), (ii) and (iii), respectively.

The effect of certain factors on the results achieved in sugar solution purification by adsorption on calcium carbonate

V. M. Leshchenko, L. I. Pankmin, A. R. Sapronov and A. M. Leshchenko. *Sakhar. Prom.*, 1987, (8), 14 - 16 (Russian).

The effects of a number of factors on juice purification efficiency were calculated using a series of material balance equations. The results showed that a diffusion juice draft of 120% was better than 140% in terms of non-sugars adsorption (all other parameters being equal) and that lime addition was optimum at 2.3% CaO on beet with the lower draft (compared with 2.5% at a draft of 140%). Milk-of-lime density had little effect on purification in the range 1.16 - 1.23 g/cm³, while recycling 1st carbonation juice to preliming had a negative effect on adsorption if the amount of lime added was unchanged; without juice recycling, 2% lime was optimum, whereas with recycling 4% was needed to give the same level of purification. These results agreed with trends in earlier factory experiments.

The effect on massecuite crystallization of the length of time and frequency of supersaturated solution feeding into a vacuum pan

I. A. Lyakhova, V. V. Mank, L. I. Trebin, A. P. Lapin and I. S. Lapina. *Sakhar. Prom.*, 1987, (8), 16 - 19 (Russian).

It was found experimentally that increase in the hydrodynamic factor, i.e. the ratio between crystals formed by the diffusion mechanism and by the kinetic mechanism during boiling, and in the ratio between the total time of syrup drinks and the overall boiling time results in crystals of greater uniformity; these

conditions are brought about by increasing the time taken to introduce each batch of syrup into the pan to the point at which the system can be regarded as a continuous one. On the basis of laboratory experiments, means were worked out for increasing the rate at which *B*-massecuite was boiled; optimization of the temperature conditions with continuous syrup drinks provided for overheating of the syrup by 3 - 5°C (compared with the average massecuite temperature) in the period after nucleation and by 5 - 8°C at the end of boiling, whereby the amount of vapour formed was optimum for a higher heat exchange rate. Optimization of the hydrodynamic conditions permitted increase in the massecuite circulation rate. Modification of a pan to allow run-off to be injected continuously into the massecuite immediately under the lower tube plate of the calandria gave a final massecuite Brix, mother liquor purity and mean crystal size that were the same as with periodical syrup drinks but the Brix changed at a greater rate and the overall boiling time was thus cut from 11.5 to 9.3 hours.

Sugar crystallization by cooling solutions of differing non-sugars composition

V. I. Tuzhilkin, M. V. Lysyuk, A. R. Sapronov and A. I. Sorokin. *Sakhar. Prom.*, 1987, (8), 19 - 21 (Russian).

The effect of non-sugars concentration on low-grade massecuite cooling was investigated by microcomputer modelling of the process which included the influence of the non-sugars on sucrose solubility and viscosity at a constant supersaturation of 1.1. The Brix and purity of standard molasses corresponding to massecuites of three different non-sugars concentrations were calculated using a special program, and the progress of cooling described with the aid of curves of temperature, viscosity and cooling rate (°C/sec) vs. time. The findings highlight the need for a universal approach to cooling to allow for varying non-sugars concentrations, and demonstrate the value of the

computer in helping to solve problems of this nature.

Experimental-statistical modelling of the relationship between crystallization rate and excess supersaturation in massecuite cooling

A. P. Kozyavkin and I. P. Mel'nik. *Sakhar. Prom.*, 1987, (8), 21 - 24 (Russian).

The specific crystallization rate for a given temperature drop and the corresponding amount of sugar crystallizing were determined in a laboratory crystallizer at excess supersaturations (the value by which saturation was exceeded) in the range 0.05 - 0.35 and a temperature in the range from 75°C to 40°C. The effect of excess supersaturation on cooling parameters was defined mathematically by computerized processing of the results and appropriate graphs plotted. The findings demonstrated the degree by which the specific crystallization rate rose with higher values of the excess supersaturation and temperature and showed how, at low excess supersaturations (0.05 - 0.10) at the start of the process, the specific rate was 7 - 9 times greater than in the final stage of cooling, while at excess supersaturations of 0.25 - 0.35 the crystallization rate was 11 - 12 times greater at 75 - 70°C than at 40°C. On the other hand, excess supersaturation had a lesser effect on the bulk crystallization rate because of the similarity in the amounts of sugar crystallizing at different supersaturations and temperatures. The much greater influence of excess supersaturation on the length of the cooling period was also demonstrated.

The application of programmable calculators to engineering calculations in sugar manufacture

B. N. Valovoi and Yu. A. Pustokhod. *Sakhar. Prom.*, 1987, (8), 24 - 30 (Russian).

The value of programmable pocket calculators as aids to technical

calculations in the sugar factory is discussed with the aid of a number of examples in which the keying sequences are explained.

Automation of evaporators with single-pass vessels

A. P. Ladanyuk, A. N. Chagarov and L. E. Boiko. *Sakhar. Prom.*, 1987, (8), 30 - 31 (Russian).

A mathematical approach to assessment of multiple-effect evaporator automation is used to demonstrate how micro-processor systems and computer technology can be used to raise the level of control to a considerable extent, thus optimizing operation.

Improving the operational reliability of vacuum-condenser plant

V. P. Adamenko and A. P. Adamenko. *Sakhar. Prom.*, 1987, (8), 31 - 32 (Russian).

Replacement of a header tank with a pump that delivers cooling water directly to the condensers used to raise vacuum in the pan and evaporator stations reduces the water requirement, energy consumption and loss of vacuum associated with the former system. Confirmation of these advantages is based on experience at the authors' factory.

Calibration of a radiometric density measuring device for the boiling process

R. Hempelmann and K. E. Austmeyer. *Zuckerind.*, 1987, 112, 695 - 698 (German).

The theory on which is based the density meter previously described for boiling control¹ is explained with the appropriate equations, including the relationship between density and dry solids content, and choice of output and correction for temperature are discussed. Application of the system depends on step-wise calibration, which is described. The meter is particularly applicable to the initial stages of boiling up to seeding.

¹ Austmeyer & Frankenfeld: *I.S.J.*, 1985, 87, 105A.

Laboratory studies

Comparison between the determination of sucrose by polarimetry and high performance liquid chromatography in samples of cane juice

S. G. de Melo, F. G. Pinto, G. Martins and I. C. Costa. *STAB*, 1985, 3, (95), 37 - 38, 40 (*Portuguese*).

Equal numbers (270) of samples of ripe and immature cane were burnt, cut and analysed immediately and after 96 and 192 hours, using both polarimetry and HPLC to measure the sucrose content. In the immature cane, the correlation between pol and HPLC sucrose fell from 0.9850 to 0.6121 after 192 hours, whereas with the ripe cane it fell only from 0.9662 to 0.9112.

Study on the chemical composition of molasses from the state of Alagoas

J. N. de Vasconcelos. *STAB*, 1985, 3, (5), 45 - 51 (*Portuguese*).

Analysis of molasses samples from 7 Alagoas factories revealed wide variations in their contents of C, Ca, Mg, N, P, K, Cu, Zn, Fe, Mn, Brix, pol and reducing sugars. C is the major macro-element and Fe the principal micro-element.

Rapid method for determining reducing sugars in raw sugar

J. A. Urrutia, R. Linares and E. Ramos. *ATAC*, 1985, (2), 37 - 44 (*Spanish*).

The colorimetric method for reducing sugars determination of Mattson & Jensen¹, which uses as its basis the formation of triphenyl formazan with the reagent triphenyl tetrazolium chloride (TTZ), has the inconvenience that the coloured product is insoluble in water and must be dissolved in iso-propyl alcohol before it can be measured. It has been found that addition of a surfactant, Tween 20, to the reaction solubilizes the triphenyl formazan, permitting its direct measurement and reducing the cost and time of an analysis. To 2 ml of a 1% sugar solution are added 0.5 ml. of a 1.5% solution of Tween 20, 0.5 ml of

0.5N NaOH, and 0.5 ml of 1% TTZ, and the test tube heated in a water bath at 100°C for 90 seconds, after which the absorption is measured at 490 nm. The reducing sugars content is read from a calibration curve obtained using known amounts of reducing sugars. By comparison with measurements using the Lane & Eynon method, and recovery of added amounts of reducing sugars, precision is found to be 96 - 100%, while iron has also been shown not to interfere with the measurement.

Methods of sugar analysis - thin-layer chromatography

A. Golc-Wondra and L. Vitez. *Nova Proizvodnja*, 1985, 36, (1 - 4), 35 - 38; through *S.J.A.*, 1987, 49, Abs. 87-704.

Two TLC methods, using cellulose MN 300 silica gel G as adsorbents, are described for separation and identification of sugars. Chromatograms obtained with standard mixtures of up to 10 sugars and with some food materials (including molasses) are shown. The method is simple and rapid and has several possible applications in qualitative analysis. Of the two adsorbents, silica gel G gave better results.

Determination of sugars with gas-chromatographic technique

A. Golc-Wondra and L. Vitez. *Nova Proizvodnja*, 1985, 36, (1 - 4), 87 - 91; through *S.J.A.*, 1987, 49, Abs. 87-705.

A simple GC technique was developed for the qualitative and quantitative determination of sugars. It used a Varian 3700 gas chromatograph with 3% OV-17 or OV-101 as stationary phase and flame ionization detection. Some chromatograms obtained are shown; each column gave good separation of sugars.

Potentiometric flow-injection determination of sugars using a metallic copper electrode

P. W. Alexander, P. R. Haddad and M. Trojanowicz. *Anal. Letters*, 1985, 18, (A16), 1953 - 1978; through *S.J.A.*, 1987, 49, Abs. 87-707.

Investigations showed that it was possible to use potentiometric detection with a metallic copper indicator electrode in the determination of reducing sugars by either flow-injection analysis or HPLC. Various sugars (including glucose, fructose, sucrose, arabinose, maltose, sorbose, lactose and xylose) gave an electrode response when injected into different carrier streams containing Cu^{++} ions in weakly complexing ligand (ammonia or tartrate) solutions. After HPLC separation, ammonia was the best ligand. A chromatogram obtained for a mixture of four reducing sugars is shown.

Determination of chloride, nitrate and calcium ions in sugar with ion-selective electrodes

M. T. Karim, F. M. Najib and M. S. Mohhammad. *J. Food Technol.*, 1986, 21, (5), 559 - 568; through *S.J.A.*, 1987, 49, Abs. 87-716.

Chloride, nitrate and calcium ion-selective electrodes were found satisfactory for determination of these ions in sugar factory products. Samples of white sugar, B-syrup, C-sugar and molasses were taken from a factory in Iraq which processed local beet and imported raw sugar. Interference by Br^- and I^- ions in Cl^- determination was eliminated by oxidation with 3M HNO_3 and passing-in air to remove the free Br_2 and I_2 formed. Cl^- should not be determined by ashing sugar, since this causes high losses of Cl^- . It was found that NO_3^- and free Ca^{++} ions could be determined directly in a sugar solution against calibration curves. Total calcium was determined after ashing of sugar samples; the ash was dissolved in 0.1M HCl and passed through an anion exchange resin to remove PO_4^{---} and SiO_3^{--} ions, and Ca^{++} was determined as before. Subtracting free from total calcium gave bound calcium, which was useful in monitoring the liming process. The three ions were also determined with acceptable precision without removing interfering ions using the method of standard addition and Gran's plot. Errors of the

¹ *Anal. Chem.*, 1950, 22, 182.

determinations for both direct and standard addition techniques were 3% for Cl^- and NO_3^- and 1 - 5% for Ca^{++} .

A rapid dextran screening test

M. A. Clarke, J. Bergeron and F. Cole. *Sugar y Azúcar*, 1987, 82, (3), 23 - 24.

A modification of the Tilbury haze test is suitable for screening cane as it arrives at a factory; while it is not an accurate assay and gives a value higher than that obtained with the Amstar haze test (since it determines dextrans plus some other polysaccharides), it can be carried out in under 5 minutes and is of value for distinguishing acceptable cane from questionable cane which can then be subjected, if desired, to a more accurate test. The procedure involves addition of 2 ml of 10% trichloroacetic acid and 1 g of analytical filter aid to 10 ml of cane juice to precipitate protein which is removed, together with suspended solids and a large part of the starch that is insoluble in cold juice, by filtration. The first 2 ml of the filtrate is discarded, and 5 ml absolute alcohol is added to the next 5 ml; after 2 minutes during which haze is allowed to form in the mixture, the amount of haze is determined colorimetrically or spectrophotometrically at 720 nm or by comparison of the turbidity with that of visual standards. In factory trials at two Louisiana sugar factories during the 1986 crop, 70 - 80% of the juice samples were acceptable and required no further dextran analysis.

Comparative tests on enzymatic and polarimetric determination of sucrose in selected sugar factory products

G. Westphal, J. Vogel and D. Pusch. *Lebensmittelind.*, 1987, 34, 73 - 75 (German).

Comparison between polarimetric and enzymatic determination of sucrose in beet molasses and thick juice samples showed that the latter technique (using invertase and glucose oxidase) gave higher values, particularly where the samples were not preclarified with lead

acetate or Carrez solution (zinc sulphate + potassium ferrocyanide). With both methods, clarification gave higher values. Statistical analysis showed that the scatter of values around the mean obtained enzymatically was greater than with polarimetry, while standard deviations for thick juice pol were greater than for molasses pol. Advantages of the enzymatic method are discussed; they include non-interference from other optically active substances, ability to determine sucrose down to 0.6 mM and lack of need for clarification since even turbid solutions can be analysed. Disadvantages include the restriction imposed by the measuring range of the glucometer used to measure the glucose content (thus possibly necessitating sample dilution), the need to adjust the pH to an optimum value for invertase, and a possible inhibiting effect on the enzymes by components in the samples. In addition, the reagents used are more costly than with polarimetry (although the costs can be reduced by e.g. using immobilized invertase, increasing the number of samples analysed per unit time and by automation).

An automatic optico-electronic new-generation saccharimeter for the sugar industry

A. L. Shoikhet *et al.* *Sakhar. Prom.*, 1987, (6), 39 - 41 (Russian).

Details are given of the A1-ESTs photoelectric saccharimeter which operates at a nominal wavelength of 589.3 nm and a range 0 - 30°S; accuracy is $\pm 0.06^\circ\text{S}$.

Ultrasonic investigation of aqueous solutions of sucrose

G. Berchiest, A. Amico, V. Amici and L. P. Lucio. *J. Mol. Liq.*, 1987, 33, (2/3), 157 - 181; through *Ref. Zhurn. AN SSSR (Khim.)*, 1987, (14), Abs. 14 R470.

The ultrasonic velocity and absorption of longitudinal waves and the mechanical resistance of aqueous sugar solutions of varying concentration at different temper-

atures and of a three-component mixture were determined. The moduli of rigidity and of displacement and the isothermal compressibility may be explained by the occurrence of aggregation. Introduction of ions into sugar solutions reduces the relaxation frequency and causes retardation processes to be protracted.

Microwave drying of shredded sugar cane

C. B. Sverzut and L. R. Verma. *Proc. Winter Meeting Amer. Soc. Agr. Eng.*, 1985, (3552), 1 - 20; through *Ref. Zhurn. AN SSSR (Khim.)*, 1987, (16), Abs. 16 R426.

A rapid method for accurate determination of the moisture content in samples of shredded sugar cane has been developed which involves the use of microwaves at a frequency of 2450 MHz. Results agree fully with those obtained by the standard method and by drying in a drying oven for 48 hours at 85°C. The new method permits a considerable reduction in the analysis time (to a few minutes). It is noted that from the moisture content can be calculated the sucrose content as a proportion of the total sample mass.

Analysis of sucrose content in beet crops

A. Malmberg and O. Theander. *Swedish J. Agric. Res.*, 1987, 17, (1), 3 - 7; through *Anal. Abs.*, 1987, 49, Abs. 10G8.

Results obtained by conventional automated polarimetric monitoring of sucrose in sugar beet were compared with values determined by HPLC, GLC and enzymatic methods. The enzymatic method generally indicated slightly higher values and GLC slightly lower values; HPLC gave lower values for fodder beets and higher values for other beets because the difference in dry matter content between fodder and other beets was not taken into account in the conventional method. The polarimetric method was, however, approved as sufficiently precise for normal routine analysis.

By-products

Influence of the total solids concentration and pH on the production of biogas from filter-cake

M. S. Leal, A. G. Núñez and M. T. Hernández N. *ATAC*, 1985, (2), 25 - 28 (Spanish).

Yields of gas obtained by anaerobic fermentation of filter-cake were greater at 6% total solids than at 8, 10 or 12% over a total time of 30 days at ambient temperature when the pH of the medium was not regulated. High sugar concentrations affected appreciably their anaerobic degradation at high solids concentrations since the accumulation of volatile organic acids caused a rapid fall in pH. At lower concentrations, less acids accumulation occurs and the effect on pH is smaller.

Preliminary study on obtaining protein concentrates from the leaves and tops of sugar cane

J. Romero R. *ATAC*, 1985, (2), 44 - 47 (Spanish).

Leaves and tops were pulped with distilled water brought to pH 8.3 with 1N NaOH (600 ml water per 300 g sample). The residue was separated, pressed and re-extracted, after which the two extracts were combined, screened, centrifuged at 1500 rpm for 10 minutes and the supernatant acidified to pH 3.5 with 1N HCl. The coagulated proteins were separated by centrifuging at 3500 rpm for 10 minutes and washed with 15 times their weight of distilled water brought to pH 4.0. The concentrate is 0.82% on fresh leaf weight and contains 43.6% of protein.

Comparative economic evaluation between the agroindustrial utilization of topped and untopped sugar cane in alcohol distilleries

A. C. Gemente, S. E. Ferrari, C. H. Lopes and E. R. de Oliveira. *STAB*, 1985, 3, (5), 27 - 29, 32 - 34, 36 (Portuguese).

A study, based on equations developed

by other authors, concludes that, by a small margin, it is more economical to top cane to be used for alcohol manufacture.

The effect of molasses addition to a vinasse medium on continuous cultivation of *Candida utilis* fodder yeast controlled on the basis of pH

K. Zmaczynski. *Przem. Ferm. i Owoc.-Warzyw.*, 1986, 30, (6), 5 - 7, 41; through *Ref. Zhurn. AN SSSR (Khim.)*, 1987, (12), Abs. 12 R348.

Laboratory studies were made of the effect of molasses addition to a vinasse filtrate (diluted to 6°Bx) on continuous culturing of *C. utilis* at 33°C, pH 4.5, aeration at 100 litres/litre/hr and a mixer speed of 800 rpm. The following nutrients were added (g/litre): $(\text{NH}_4)_2\text{HPO}_4$ 3.5, $(\text{NH}_4)_2\text{SO}_4$ 2.5 and 80% molasses at 5 - 30. The temperature and pH were held constant automatically at a given level. It was found that increase in the quantity of molasses from 0 to 30 g/litre caused a rise in fodder yeast concentration from 13.1 to 22.2 g/litre (from 0 to 10.2 g/litre on a molasses basis) but a fall from 13.1 to 12.0 g/litre on a vinasse basis, a yeast yield on vinasse of 10°Bx falling from 21.8 to 20 g/litre, a rise in molasses dilution rate from 0.218 to 0.325/hr, and an increase in yeast productivity from 2.81 to 7.2 g/litre/hr (from 2.81 to 4 g/litre on vinasse). Increase in the molasses addition led to a reduction in the utilization of vinasse components, which was economically unsound, despite the increase in productivity that resulted. Methods for determining the composition of the medium are given as well as the values of the process parameters as a function of molasses addition.

Development of a low-cost process of ethanol distillation and rectification

B. Chay P., D. Ayo R., B. Elegado F. and J. del Rosario E. *NSTA Technol. J.*, 1986, 11, (2), 37 - 41; through *Ref. Zhurn. AN SSSR (Khim.)*, 1987, (12), Abs. 12 R363.

An energy-saving method of distillation and rectification has been developed for alcohol using columns packed with various adsorbents (including bagasse chips), the adsorptive properties of which were investigated in the treatment of aqueous alcohol solutions of 4, 8 and 12% concentration and in distillation and rectification trials with grain mash. Results showed that the various adsorbents increased alcohol recovery to 93.4 - 97.4% as against 75% in the control (a column packed with pieces of glass), while the distillate concentration rose from 69.5% to 93 - 96% and the distillation period was lengthened.

Production of protein-carbohydrate feed supplements from molasses at Krasnyansk distillery

Yu. V. Kas'yanov, G. G. Gubrii and N. I. Glyantsev. *Ferment. i Spirt. Prom.*, 1987, (2), 9 - 11; through *Ref. Zhurn. AN SSSR (Khim.)*, 1987, (13), Abs. 13 R392.

Protein-carbohydrate feed supplements can be obtained using the existing distillery equipment at negligible cost. Incorporation of molasses in the finished product guarantees a high quality of preparation for animal feeding and also raises the nutritional value of the supplement. A layout of the equipment and the technology used are described.

Treatment of food processing effluents with yeasts

A. Huyard, D. Malnou and G. M. Faup. *Eau, Industrie Nuisances*, 1986, (98), 29 - 32; through *S.I.A.*, 1987, 49, Abs. 87-1066.

A process using an association of yeasts in non-axenic conditions was tested in the laboratory for the treatment of three types of effluent, one of which was vinasse from beet molasses. In batch tests using vinasse at various concentrations containing 7.9 - 74.5 g COD/litre, COD removal was 74 - 79%, except at the lowest concentration at which it was only 54%. In continuous tests over 15 - 30 days at loads of 33 - 87 kg COD/m³/day, COD removal was about 72%.

Patents

UNITED KINGDOM

Inhibition of microbial growth

Teroson GmbH, of Heidelberg, Germany. **2,165,229**. October 7, 1985; April 9, 1986.

A composition for killing or inhibiting the growth of micro-organisms such as occur in beet diffusion comprises a mixture of 4,5-dichloro-1,2-dithiol-3-one (DDO) and dibromonitropropionamide (DNBPA) in a DDO:DNBPA weight ratio of between 9:1 and 1:9 (4:1 - 1:4) dispersed in an organic solvent and/or water with one or more dispersing agents, emulsifiers and/or stabilizers. The total quantity of the active substance is 5 -15% by weight. The two active ingredients have a marked synergistic effect.

Vacuum evaporation crystallization

Fried. Krupp GmbH, of Essen, Germany. **2,185,421**. December 16, 1986; July 22, 1987.

In a batch crystallization system, thick juice passes through heat exchangers 6a and 6b (Fig.1) to a crystallizer 1 from which the massecuite is withdrawn and subjected to recrystallization in a cooling crystallizer 2 while vapour is withdrawn via pipe 25 to a concentrator 8. The massecuite then passes to centrifugal 3 for separation of the crystals and mother liquor; the molasses undergoes partial desalination in plant 4 (possibly after passage through a heat exchanger 6c and a filter 9) and is then mixed with thick juice in vessel 7 before passing to concentrator 8.

For continuous crystallization, the system includes a classifier 5 (Fig.2) which separates the crystals into under-

sized grain and finished grain; the latter is recrystallized in the cooling crystallizer 2 from which the crystals pass to centrifugal 3 for separation of A-sugar. The molasses from the centrifugal is subjected to the same treatment as in batch crystallization. The under-sized grain and vapours pass from classifier 5 to expansion tank 28 from which the solution passes to crystallizer 1 while the vapours flow to concentrator 8. Both batch and continuous crystallization may be in the form of 2-stage systems, or the system may be a 2-stage combined continuous/batch scheme. Crystallizer 1, concentrator 8 and cooling crystallizer 2 may be arranged one above the other as a combined unit.

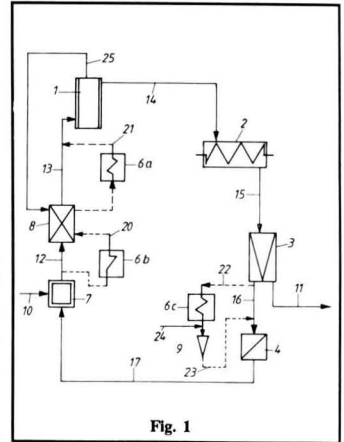


Fig. 1

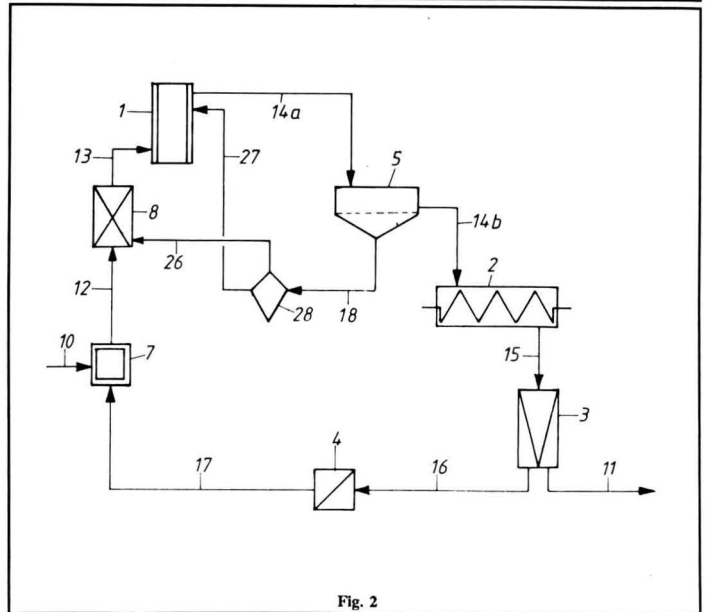


Fig. 2

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In the case of United Kingdom patents, copies may be obtained on application to The Patent Office Sale Branch, Block C, Station Square House, St. Mary Cray, Orpington, Kent, England (price £2.15 each). United States patent specifications may be obtained by application to Box 9, Patent and Trademark Office, Washington, DC 20231, U.S.A. (price \$1.00 each).

benefit can be gained from the extensive enquiry and search options which are available in the Idhammar system.

Collection/collation of plant unit data

There are three main categories of plant unit data that must be collected and entered onto the computer records; there is the basic identity data such as code, description, serial number, supplier, year of purchase, purchase price, etc. Then there is the technical specification data which are normally available from supplier documentation and, finally, there is the unit structure data which lists details of all spare parts associated with each unit.

This information is currently held on different media – cards, files, manuals and notebooks – and needs to be collated for computer entry.

In respect of the identity data it is proposed to complete a set of computer input documents with structured columns and boxes suitable for key entry.

In respect of specification data it is expected that, since most of the data are contained in printed manuals, the relevant data can be highlighted for a keyboard operator to type directly without having to transfer it to a formal computer input document.

Finally, information on component spare parts is currently held on record cards on which it is intended to key data directly. Careful post-entry editing will be required, however.

In approaching data collection and key-entry in this fashion it is hoped to minimize form-filling while at the same time achieving an acceptable level of accuracy and typographical quality.

Personnel training

Training in the use of new procedures and computer facilities is a vital factor in the successful implementation of any system. It is also an expensive item both in terms of direct costs of consultation fees and expenses, and also in respect of the time that personnel spend on training.

It is very often not possible to train successfully large numbers of people in single sessions, and if consultants are

retained to train all personnel in sufficiently small groups then the time required is extended and the costs escalated.

Irish Sugar have decided to adopt the approach of providing comprehensive training to a small number of key personnel who, as in-house experts, will then extend the expertise gained to all other relevant personnel.

This approach has two main advantages,

(i) The costs involved in hiring outside consultancy will be minimized, and

(ii) Highly trained in-house personnel, with their background knowledge of company operations, conventions and difficulties, are ideally placed to communicate in a relevant and practical fashion the application of the new system to Company requirements.

Customization of standard software

Irish Sugar set out with the objective of procuring a system that would meet their requirements fully, while eliminating the need to change the standard software.

This objective has been achieved almost entirely with just one or two minor deviations. The Company will, however, avail itself of report-writing and other query facilities to produce reports tailored to specific industry requirements.

The Computer Service Department will also provide some additional facilities of a non-standard nature, but again without making any changes to the Idhammar software.

This approach has many advantages but two are worthy of special mention. First, refraining from changing the proven software eliminates the risk of introducing bugs or problems into programs which were hitherto operating successfully. Second, it enables maintenance of the system by the supplier both in the event of faults occurring and also in the event of upgrades or new enhanced versions of the software becoming available.

Implementation sequence/tasks

Implementation of the system will

be undertaken at each factory location in the following phases:

Phase 1

- Collection of plant unit identity data
- Collection of plant unit specifications
- Creation of new stores records from the existing system
- Realignment of item descriptions as required
- Collection of supplementary stores data
- Key entry of plant unit and stores data
- Operations training on stores and purchasing
- Collection of supplier data
- Collection of accounts code data
- Design conversion from old to new stores
- Stores programming - Modifications, balance take-on
- Key supplier data
- Key account code data
- Training of stores operatives
- Decide on parallel run mechanisms
- Balance take-on/Commencement of parallel running of stores and purchasing
- Live running on stores, purchasing, and plant

Phase 2

- Creation of a set of standard computerized annual Work Orders covering the factory off-season maintenance program and any planned campaign maintenance.

- Design and programming of additional costing reports.

- Design and programming of non-standard modules, viz. transport, cost analyses and sugar packaging.

- Initiation of parallel running for the two new modules, Work Order and Technical/economical analysis, and for the non-standard modules (pilot area only).

- Creation of a set of preventive maintenance inspections for the campaign period and for the packaging operation.

Phase 3

- Extension of Work Order, Technical/economical analysis and non-standard modules to all plant areas.

Implementation of Document records module.

Selection and implementation of the automated time clock and labour data recording facilities for the purpose of time and attendance reporting and financial costings.

Phase 4

Machine condition monitoring
Computer aided design

Appendix A. Request For Proposal

Main contents

1. Details required in proposal

- * Hardware/operating software
- * Applications software
- * Costs
- * Delivery lead times

- * Support
- * Training facilities/Requirements
- * Customization of software

2. Description of current procedures

- * Beet campaign – Process and maintenance
- * Off-season maintenance
- * Capital projects
- * Factory services
- * Sugar packaging and despatch
- * Transport
- * Time office
- * Stores

3. New operation as envisaged

- * Factory areas included
- * Location of hardware/terminals
- * Input of source data
- * Enquiry and reporting facilities
- * Overview of operation

4. System requirements

- * Standard modules fully integrated
- * Interfaces with existing systems
- * Report writing/Query generation features
- * Detailed application requirements
- * Additional features

Summary

The installation of a computer-aided plant and maintenance management system is currently in progress at the Carlow Factory. As the system is not yet functioning fully, a comprehensive report on its performance must be reserved for a later occasion. This report deals with the background to the proposal and its present stage of implementation.

PROCESSING

After-product beet sugar pan boiling

By J. C. de C. Thelwall

(Fletcher and Stewart Ltd., Derby, England)

Introduction

In the chemical and food processing industry, there has been a move away from batch to continuous plant operation, because of the advantages of steady-state conditions and energy saving. The general progress of automation into the beet sugar industry and the demand for good thermal efficiencies have moved the industry towards continuous boiling.

The management of Zeil beet sugar factory of Zuckerfabrik Franken GmbH in West Germany, which produces 1320 tonnes/day of white sugar over an 80-day campaign, made the decision to stop their Quentin plant. This gave them the opportunity to review the after-product boiling, and they decided to install a new continuous vacuum pan, suitable for

operation at low temperature differences, without the high electrical load required by a stirrer.

A Tongaat-Hulett type pan was therefore proposed with modifications made in consultation with the Zeil factory to suit the local beet sugar conditions. A pan was designed and manufactured for the following duty:

Masseците flow rate	33 tonnes/hour
Masseците purity	75 - 77
Seed masseците flow rate	8 tonnes/hour
Calandria steam pressure	Sub-atmospheric
Pan absolute pressure	150 millibars
Purity drop across pan	13
Nominal masseците retention time	5 hours
Nominal seed crystal size	0.15 mm
Target masseците discharge Brix	95°

General design

A new 115 cu.m. pan was installed in the summer for the 1986 beet campaign. This pan is a horizontal vessel, the basic design of which is as shown in Fig. 1. The cross-sectional shape has been carefully designed to ensure a good masseците flow path. Considerable attention was given to ensure a good circulation free of any stagnant areas, but also considering the need for plug flow, which is necessary for uniformity of crystal size.

The masseците is heated by a vertical tubular calandria of a nominal 1150 sq.m. heating surface. The calandria is positioned just below the centre axis, with the masseците return

Paper presented to International Sugar Technical Conference, Killarney, Ireland, 1987.



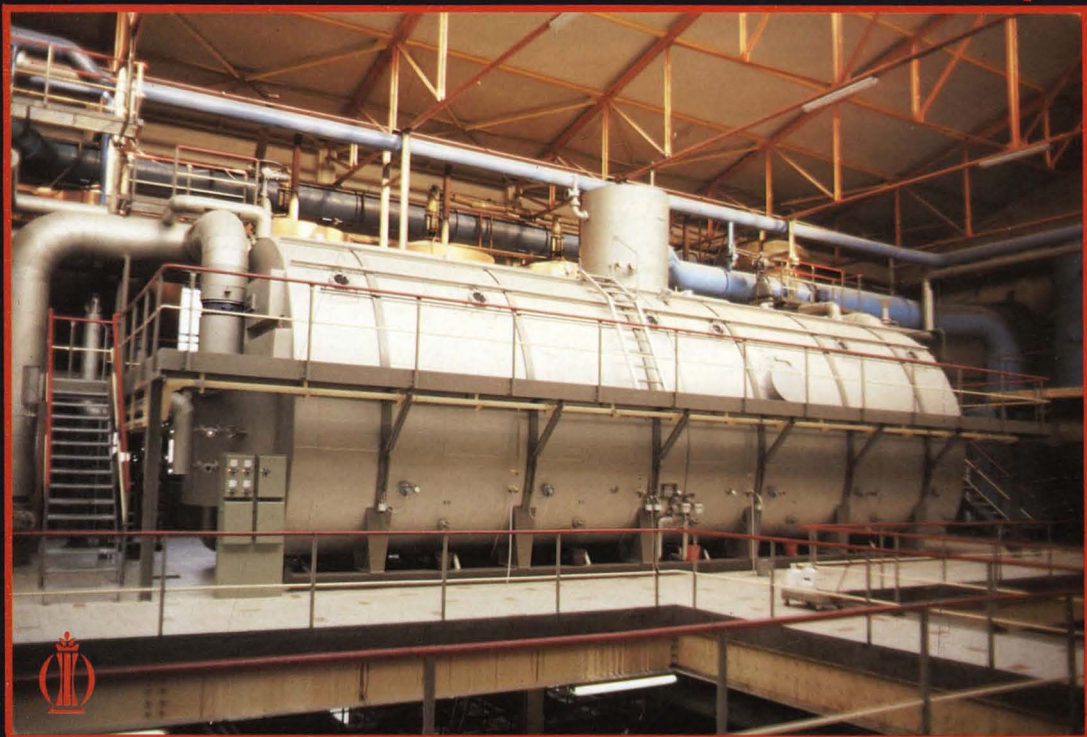
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FS Continuous Vacuum Pan in the Beet Sugar Industry



▲ Photo by kind permission of Frankenzucker-Zeil.

The first FS Continuous Vacuum Pan to boil after-product beet massecuites was installed at Frankenzucker-Zeil factory for the 1986 campaign.

Excellent results – high purity drop and massecuite discharged at over 94° Bx with easy curing characteristics. Calandria steam at sub-atmospheric pressure allowing constant steam demand and high thermal

economy for the whole campaign.

Good circulation without assistance.

Pan supplied by Wiedemann KG (FS licencees in Western Europe) and installed by Frankenzucker-Zeil.

FS

**FLETCHER
AND STEWART
LIMITED**

Norman House Friar Gate Derby DE1 1NU England
Telephone: Derby (0332) 372727 Telex: 37514 FS G
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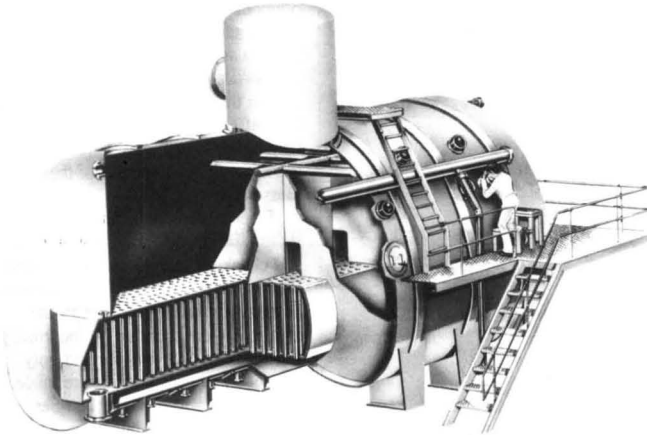


Fig. 1. Sectional pictorial view of pan

downtakes situated along the side walls.

The calandria is divided into two completely separate chambers by a central partition plate, with steam inlets at either end. The incondensable gases have been piped so that they can be vented either into the vacuum system or to the jigger steam line.

To achieve a good massecuite plug-flow characteristic, two concepts are commonly used. The first is to design the pan with a narrow but very long massecuite flow path, so that the mixing of crystal sizes is at a minimum. The second method is to divide the pan into a number of compartments or cells. The Zeil factory pan design incorporates both

these features by (a) having a good aspect ratio and (b) dividing the pan into separate compartments.

The 12 compartments are laid out as shown in Figure 2. Seed massecuite is pumped into the first compartment and flows through each compartment in series, via special transfer ports. The massecuite is finally discharged from the last compartment via a variable speed pump, controlled from level probes. The compartments are arranged so that the first six are heated by one of the calandria chambers and the remaining six by the other chamber. The advantage of this arrangement is that the two calandria pressures can be adjusted to take into

account the higher evaporation rate required at the early stages of the boiling, and to provide a greater temperature difference which is demanded by the increased viscosity and massecuite temperatures during the later thickening-up period.

Jigger steam sparger pipes, for assisted massecuite circulation, were provided under the calandria of each compartment. This vapour injection is under manual control and only operated when necessary.

Molasses is supplied to each individual compartment via a distribution manifold mounted on the bottom plate to ensure good mixing of the feedstock with the massecuite. There are arrangements to provide water if required through this manifold.

Pan instruments and controls

All functions were arranged under automatic control loops except for the massecuite flow rate, which was controlled by the operator with reference to the molasses supply situation and crystallizer space availability. Adjustment of the set-point of the calandria chamber pressures allowed manual control of the overall evaporation rates.

The absolute pressure in the pan was controlled using the conventional regulation of the injection water to the condenser.

Because after-product massecuites have a relatively low purity and a high ash content in the mother liquor,

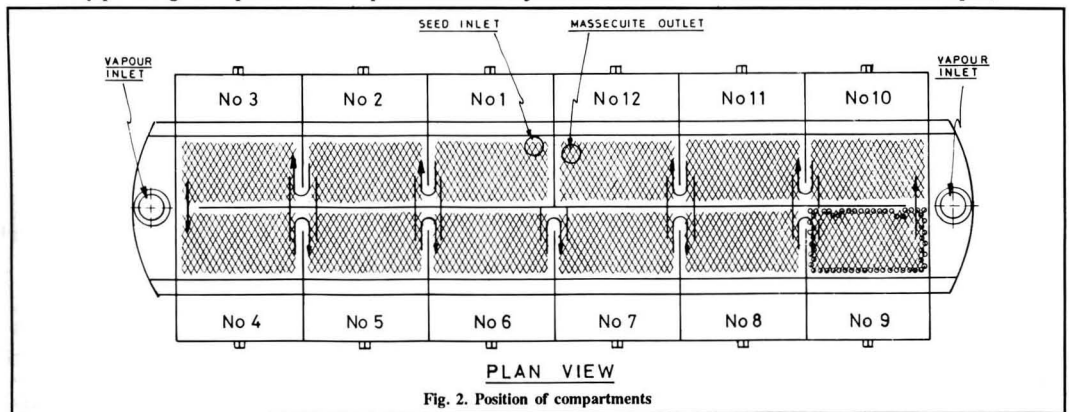


Fig. 2. Position of compartments

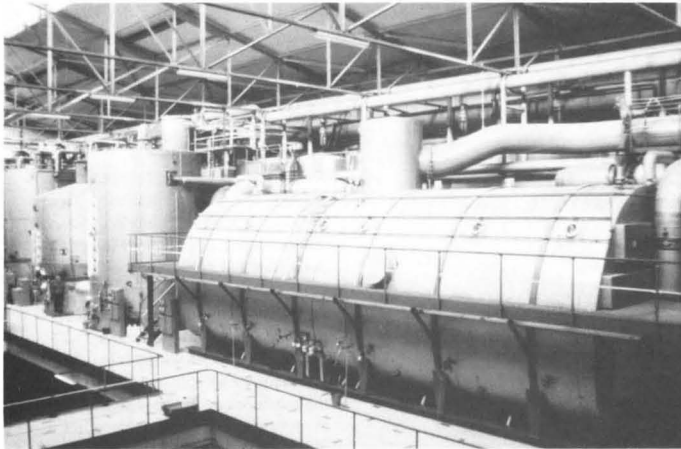


Fig. 3. Continuous pan showing steam inlet (right) and seed preparation pan (left)

conductivity measurements were used to monitor the rate of molasses feed to the individual compartments. The final Brix-ing-up in the last compartment was monitored by using a nuclear density meter mounted in the massecuite outlet pipe.

In the event of any molasses feed failure, provision was made in the supply piping to enable any compartment to be put on a water feed as a temporary measure.

Magnetic flowmeters were installed in the various pipelines to measure: (1) the molasses feed, (2) the water feed, (3) seed massecuite at the inlet to the pan, and (4) both condensate outlets.

Seed massecuite is pumped into the pan by a variable speed metering pump. The pump speed is controlled from a ratio controller which compares the flows of seed massecuite with that of the feed molasses.

Sample proof sticks were provided in each compartment, to allow the operator to check the boiling operation.

The overall operation of the pan can be easily viewed on the simple mimic diagram when called-up on the main control VDU.

Installation

The new 115 cu.m. continuous pan (Figure 3), together with a 53 cu.m (80-tonne) batch pan for seed preparation,

replaced six 40 cu.m. (60-tonne) batch pans. Characteristics of the continuous pan are detailed below:

Nominal heating surface/volume ratio	0:1
Inside minor diameter	4.9 m
Main shell length	13.97 m
Calandria material	304 SS
Calandria tube diameter	100 mm
Length over calandria	15.85 m
Overall height	6.8 m
Overall width over stiffeners	5.2 m

Some of the old after-product pans were removed to make space for the new installation. The crystallizers from the previous installation were re-used and operate as a continuous unit by overflow of massecuite from one unit to the next. The main shell of the pan was lifted into position in one piece via a temporary opening in the factory roof. A small access platform was built around the continuous pan to allow the operator to view the boiling through the sight glasses.

The condenser, external save-all and vacuum pump were re-used from the previous installation.

Operation

To allow a three-day proving trial to be carried out before beet slicing commenced, a quantity of intermediate run-off had been held over from the

previous campaign. During this trial period, turbine exhaust, which was slightly superheated, was used in the calandrias.

On the initial start-up of the pan, and until effective massecuite boiling commenced, problems were experienced with foam on the surface of the massecuite.

Prior to commencement of the beet slicing, it was decided to drain the pan, and check for any leaks and apparent cross-feeding in certain compartments. Some of the partition plates in the manifold were found to be incorrectly fitted, but as time was limited only temporary modifications were made.

The pan was re-started on September 25, 1986 and ran through the whole campaign until December 12 without cleaning or any other stops.

Massecuite

Because the purity of the juice was lower than normal the quantity of massecuite handled by the pan was greater than had been specified. However the pan was able to handle this extra throughput quite easily and the calandria was operated at sub-atmospheric pressure throughout the campaign. The average purity of the massecuite during the whole campaign was 78.3 with crystal content of the massecuite of 37%.

Figure 4, which is a Brix/Temperature trend chart over a 5-hour period, shows clearly the stability of operation. Curve 1 is the Discharge Brix measured in the outlet pipe on a scale of 85 to 100°Brix and Curve 2 is the calandria steam temperature on a scale of 0 to 120°C, while Curve 3 is the massecuite temperature in No. 11 compartment on a scale of 0 to 100°C.

As with cane sugar massecuite, the thickening-up during the final stages is very time-dependent, resulting in virtually no feed entering the last four compartments.

Molasses feed

The molasses feed to the pan was unheated and normally between 80 and 81°Brix. The feed lines and their valves

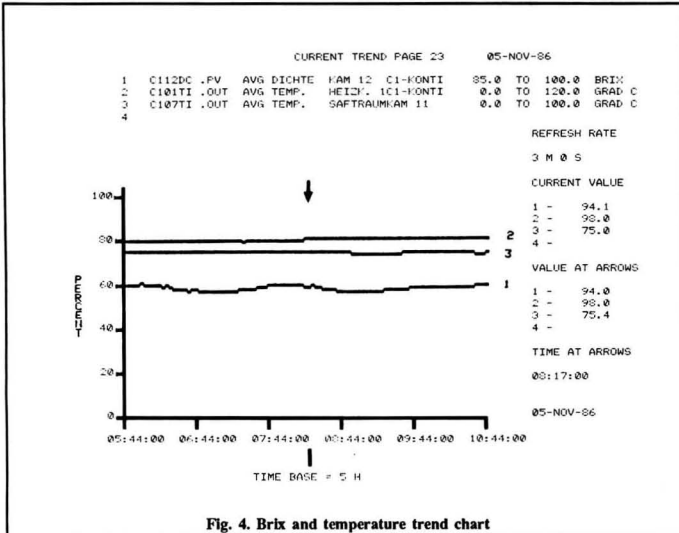


Fig. 4. Brix and temperature trend chart

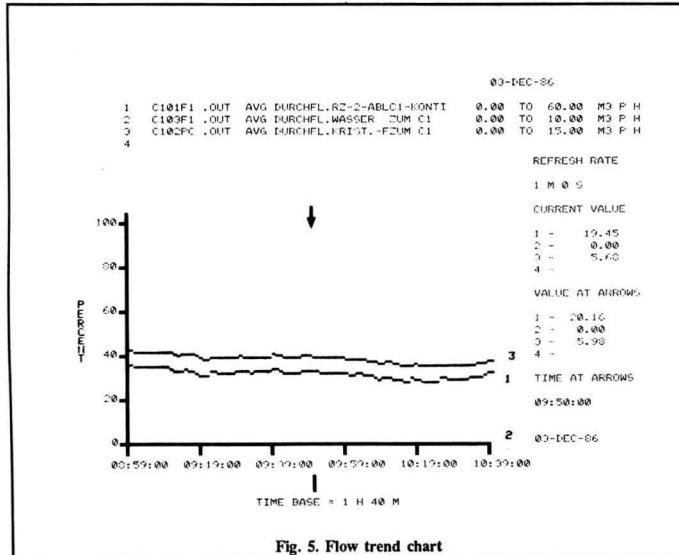


Fig. 5. Flow trend chart

were too small for the high throughputs at which the pan was operated, resulting in the valves in the early compartment being virtually fully open.

Again the steady-state operating conditions are demonstrated in the trend chart (Figure 5) which covered a period

of 1 hr 40 min. Curve 1 shows the molasses (feed) flowrate on a scale of 0 to 60 m³/hr, Curve 2 is that of water feed to the pan on a scale of 0 to 10 m³/hr, and Curve 3 shows the seed massecuite flow rate on a scale of 0 to 15 m³/hr.

Evaporation

The massecuite throughput of the pan is controlled by regulation of the evaporation rate which is indicated by the two condensate flowmeters. To alter the evaporation, the calandria steam pressures are raised or lowered, as can be seen in the two trend charts of Figures 6 and 7. In these charts, curves 1 and 3 are the calandria pressures and 2 and 4 are the condensate flow rates. Chart 5 is relative to an evaporation rate of 1.8/1.55 m³/hr with a calandria pressure of 750 millibar and Chart 6 to 3.05/3.09 m³/hr with a calandria pressure of 860 millibar.

Continuous vacuum pans have a very low massecuite hydrostatic head, resulting in lower massecuite temperatures in the locality of the calandria. With the additional advantage of being able to install a larger heating surface to volume ratio, the continuous pan can operate very satisfactorily at sub-atmospheric calandria steam pressures.

The Zeil pan was designed to operate with 4th vapour in the calandria. The actual calandria pressure varied between 750 millibar and 990 millibar (absolute) depending on the throughput.

With the high Brix molasses feed the pan was operated at an evaporation rate of approximately 3 m³/hr for each calandria chamber. Thus the total evaporation was in the region of 6 m³/hr.

Circulation

The massecuite circulation in the pan was very good, and no assistance from the jigger steam was necessary, except when thickening-up in the last two compartments. Some assistance to the circulation may have been provided by the small amount of air entrained in the feed molasses during curing which then flashed off in the pan.

Jigger steam was tried in some of the compartments using the discharge from the noxious gas vents. It improved the circulation and evaporation rates but, as the natural circulation was good, it was not considered necessary.

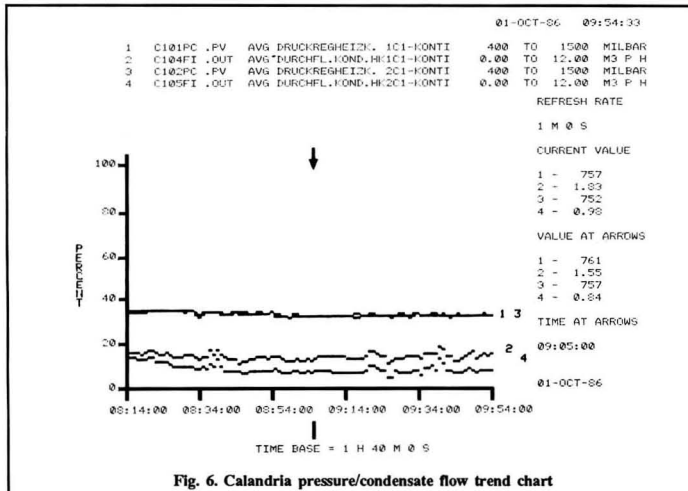


Fig. 6. Calandria pressure/condensate flow trend chart

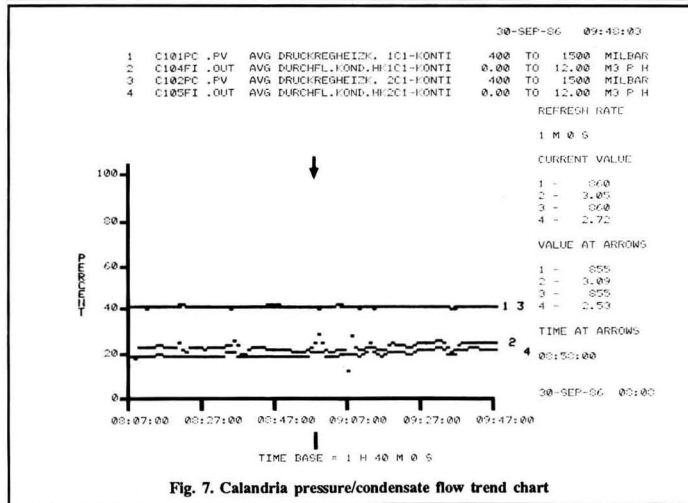


Fig. 7. Calandria pressure/condensate flow trend chart

Performance

Seed massecuite, with the average crystal size of 0.12 mm, was prepared in a conventional batch pan and the crystals grown in the continuous pan to an average size of 0.26 mm MA. The massecuite cured well in BMA continuous centrifugals to give a clean crystal and a final molasses purity of 58. A high Brix molasses was used for the pan feed, in order to achieve the maximum thermal efficiency in the system.

The Brix of the massecuite discharged from the pan can be seen in Table I, and varied between 93.9° and 94.5°. Larger feed lines are to be installed to the first set of compartments, to allow a greater rate of molasses feed at an earlier point in the boiling sequence, which will permit compartments at the end of the sequence to achieve 95°Brix massecuite at the outlet.

The average purity drop of the molasses across the pan over a forty-day period was 14.2, or 1.2 points greater than that originally specified. Even when using a smaller seed crystal size, the pan was able to operate at flow rates greater than originally specified.

Incrustation

No problems of sugar incrustation below the massecuite liquid level were apparent. There was no appreciable fall-off of the calandria heat transfer coefficient over the whole campaign. There was, however, a gradual build-up of sugar on the lateral partition plates, on the longitudinal division plate and on the transfer port baffle plates above the massecuite liquid level. The incrustation

Table I. Average results from Zell laboratory

Date	After-product massecuite				Molasses feed		Final molasses	
	Brix	Purity	Crystal, content, %	Purity drop in pan	Brix	Purity	Brix	Purity
1/11/86	94.4	78.2	37.4	14.2	81	77.7	84.1	57.7
2/11/86	94.5	77.8	37.2	14.4	81.1	77.2	84.0	58.2
3/11/86	93.9	77.2	37.6	15.1	81.1	76.8	84.3	57.8
4/11/86	93.9	78.4	36.7	14.0	80.4	77.9	83.9	58.0
5/11/86	94.1	78.3	36.4	13.7	80.6	77.8	84.1	58.3
Average for 1986	94.2	78.3	-	14.1	80.7	78.0	85.3	58.4

on the central division plate and partition plates presented no problems and was easily removed during the boil-out at the end of the campaign. The build-up on transfer ports between some of the centre compartments did break away, and fell onto the calandria tubeplate, where the sugar eventually dissolved. On one occasion a large piece partly blocked a transfer port, resulting in a slight increase in the massecuite level of the upstream compartments.

For the forthcoming campaign (1987/88) these baffles are to be reduced in height so as to present a smaller surface area above the liquid level.

Conclusion

The pan has performed very well over its first campaign and operated above the designed capacity. It confirmed that this type of pan can operate with a high thermal efficiency, allowing the use of sub-atmospheric calandria steam pressures, without the need of mechanically assisted circulation.

The massecuite cured easily on the continuous centrifugals to give a final molasses purity of 58. However, no direct comparison was possible with the previous results from earlier campaigns, because the old batch pans were fed

molasses treated by the Quentin plant.

The easy operation of the pan was due to the steady-state conditions of a continuous process and allowed the operators to master the controls quickly.

Acknowledgements

I would like to thank Zuckerfabrik Franken GmbH for permission to use the laboratory results and to reproduce the print-outs from the control instrumentation. I would also like to thank the management and staff at the Zeil factory for their kind and most valuable assistance.

Mexico sugar technologists meeting, 1987

After some years of inactivity, the Sugar Technologists Association of Mexico (ATAM), held a very successful and well-attended Convention at the city of Córdoba in the state of Veracruz from October 21 to 24, 1987. With the exception of two social gatherings, all meetings, working sessions and lunches were held at the Institute for Sugar Cane Improvement (IMPA), in the outskirts of the city. Over 400 delegates, mainly

from all areas of Mexico, attended the Convention. There were just a few international authorities invited, as the case of Dr. Alfonso L. Fors, past Secretary of ATAM and one of the men engaged in the reconstruction of the Association during the early 1970's.

On Wednesday October 21 delegates registered at the Headquarter Hotel in Córdoba and were welcomed by a cocktail party the same evening. On the

following morning the convention was officially inaugurated by Ing. Eduardo MacGregor, Chief Executive of Azúcar S.A.

The working sessions were divided into four groups: Agriculture, Process, Engineering and By-products and Sucrochemistry. The section dedicated to processing was under the chairmanship of Ing. Isaac Bazan, past-President of the Association and key executive committee officer in the reorganization of the ATAM in the early 1970's. The following papers were presented:

1. Detection of entrainment in condensed vapours.
2. Conversion of atmospheric columns to vacuum in alcohol distillation.
3. The continuous pan.
4. Deep bed filters.
5. Sampling and analysis as tools in a cane payment system.
6. Various cane payment systems in relation to quality of raw material.
7. Liquid invert sugars.
8. Effect of temperature on liquid ring vacuum pumps.
9. Implementation of the double seed system in B and C-masseccutes with continuous centrifugals at Ingenio Tamazula.



10. Basic principles of filtration in refineries.

The Engineering Section was moderated by Ing. Juan Pérez Vázquez, Factory Manager of Ingenio Adolfo López Mateos. The papers were:

1. More yield and efficiency with minimum effort.
2. Prediction of breakages.
3. Calibration systems for instruments in sugar factories.
4. Woodward speed control governors – Operation, installation and maintenance.
5. Detection and prevention of failures in carriers.
6. The fourth mill roller.
7. The use of humectant as an imbibition aid.
8. A combustion additive.
9. Energy availability of bagasse in Mexico.
10. Results obtained in the treatment of boiler water with organic products.
11. Energy savings.
12. Energy diagnosis of thermodynamics systems in a sugar factory.
13. Bagasse combustion in a fluidized bed.

The By-products and Sucrochemistry Section was led by Ing.

Luis E. Zedillo Ponce de Leon, Research Officer at IMPA in Mexico City. The papers presented in this area were numerous mainly because of the present interest of the Mexican sugar industry in the development of by-products and sucrochemistry. The name of this Convention itself was designated as "Mexico – Sucrochemistry – 1987", and the following papers were presented:

1. Program for the diversification of the Mexican sugar industry.
2. Strategies for the reconversion and re-evaluation of the Mexican cane system.
3. Evaluation of biotechnological alternatives for the diversification of the Mexican sugar industry.
4. Impact of biotechnology on the sugar industry.
5. Production of dextran gum from sucrose by glucosyl enzymes.
6. The production of corn sweeteners.
7. Experience in the production of high test molasses, as an alternative to diversification of the industry.
8. Fermentation of L-lysine at laboratory level.
9. Anaerobic fermentation of agro-industrial products for animal feed.
10. Developments in the project for

distillery waste treatment.

11. Effect on its digestibility of treating bagasse with alkaline peroxide.
12. Production of protein by bagasse fermentation.
13. Production of inoculants using sugar cane by-products.
14. Technological aspects of the utilization of filter muds and distillery wastes for agricultural purposes.
15. Utilization of filter muds in cane fields.
16. Utilization of bagasse for cellulose pulp.
17. Utilization of distillery wastes for the production of methane.
18. The utilization of distillery wastes.

During the last day of the Convention, Dr. Silverio Flores, Director of the Institute (IMPA) gave, in a plenary Session, an account of the varietal situation in Mexico since the breeding work at Tapachula was commenced by Ing. Alfonso González Gallardo during the late 1950's. Immediately after this, awards and diplomas were conferred on authors and other personalities. All activities came to an end with a typical Mexican lunch at the IMPA installations.

El Salvador Seminar/Workshop on cane sampling, analysis and payment

The Sugar Industry Institute (INAZUCAR), the principal official autonomous organization of the sugar industry of El Salvador, recently held a 4-day Seminar/Workshop to establish uniform patterns for field sampling and analysis, but most of all, for the operation of a new cane payment system during a trial period. All managers and field superintendants, as well as other personnel of the different factories, attended this Seminar/Workshop. A number of international authorities were invited as instructors.

The program began with a very brief ceremony in which Dr. Ramon

Avalos Navarrete, President of INAZUCAR, welcomed the participants and introduced the instructors. Immediately after, Mr. Victor A. Vasquez, Agricultural Coordinator of INAZUCAR, explained the mechanics of the event.

Mr. Jose A. Burgos, Director of the GEPLACEA variety program in Mexico City, followed with an extended discussion on sugar cane varieties, mainly explaining the program recently established by GEPLACEA to introduce or exchange clones among the member countries. After a short recess at mid-morning, Mr. Luis E. Palomo, Field

Superintendent at Central Izalco, talked about the progress of the variety improvement program there, followed by Mr. Milton R. Amaya, who discussed the same activity at CENTA (National Centre of Agricultural Technology), for which he is responsible.

During the late afternoon, five groups were created to discuss and submit proposals for the different matters which had been and would be discussed during the Seminar/Workshop.

On the second day of activities the participants and instructors travelled by buses to San Francisco sugar factory, approximately 70 km north of the

capital city. After a brief welcome by the Mill Manager and local authorities, the participants travelled to a nearby fields where Dr. Alfonso L. Fors, of Inter-American Sugar Cane Seminars, Miami, Florida, USA, gave a talk and practical demonstration on sampling of canes to be used in a system developed by himself for the rapid determination of ripening.

Immediately after, the group moved to the factory laboratory for the preparation of the sample and the analytical procedures. These activities took up most of the morning, after which lunch was offered by the mill management.

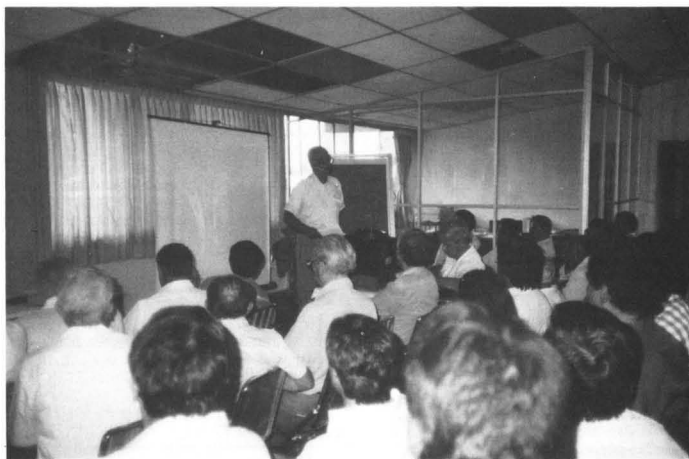
During the early afternoon Mr. Oscar Rivera, of the Quality Control Department of INAZUCAR, showed the participants the installations for the core sampler and support laboratory at the mill yards, explaining some of the procedures involved in this system. The group returned to San Salvador late in the afternoon.

On the next day the participants again met at the Conference Room of INAZUCAR where the morning program was in charge of Dr. Fors and Mr. Pedro Walte, Advisor to the Production Manager of INAZUCAR. Dr. Fors talked about the different aspects of cane delivery, transport, and mill-yard handling. Mr. Walte discussed a similar topic but specifically applied to the conditions at El Salvador.

After lunch Mr. Armando Escobar of the Purchasing Department at Ingenio Izalco, delivered an extensive talk on the procedures used at that factory for receiving cane from the different farmers. This particular sugar factory only owns 4% of the cane and has over 1500 cane suppliers.

The day's session concluded with discussions and recommendations for the leaders of the five groups previously organized.

During the last day of the Seminar/Workshop, Mr. Carlos Rivas, Advisor in Communications and Technology Transfer at AID-STEC, CENTA, used the morning to explain methods and means of communication in



Dr. A. L. Fors during presentation of his paper

the transfer of technology to cane farmers, with special emphasis on group dynamics.

After a lunch again given by INAZUCAR, Mr. Salvador Peña Valle, Coordinator of the INAZUCAR cane payment system, explained the guidelines that the sugar industry of El Salvador is using for cane payment during the 1987/88 crop. There will be a period of three years before establishing a fixed cane payment system; however, for the 1987/88 crop the guaranteed price of a tonne of cane will be approximately 13 US dollars. There will be a premium over this guaranteed price for high quality cane paid to those farmers who surpass the standards established. There were additional guidelines offered by Mr. Peña Valle, which were extensively

discussed by the participants.

In order to facilitate cane quality determination, core samplers have been installed in the mill yard of several factories at El Salvador.

All working activities of this Seminar/Workshop were ended by a farewell speech from Mr. Ivan Segovia, General Manager of INAZUCAR. An informal cocktail and buffet was offered by INAZUCAR to participants and members of the private sugar industry of El Salvador. INAZUCAR, the Instituto Nacional del Azúcar, operates four sugar factories (Ingenios Central Chaparrastique, El Carmen, La Cabana and La Magdalena), while Ingenio Jiboa is state-owned and the private sector includes Ingenios Ahuachapan, El Angel, Izalco and San Francisco.

Facts and figures

Reduced Dutch sugar production¹

The 1987/88 campaign in Holland finished in December with a sugar production estimated at 975,000 tonnes, white value. The sharp reduction from the previous campaign's 1.2 million tonnes is largely the result of a self-imposed cut of 10,000 hectares in the beet area to 127,000 ha. Average sugar content was lower at 15.5% against 16.0%, but root yield was higher at 54 tonnes per hectare against 52 tonnes. Dirt tare had risen sharply to 25% from the 10-year average of 20%. Early planting intentions indicate a beet area of 125,000 ha for 1988.

Raw sugar as animal fodder²

Approximately 180,000 tonnes of raw sugar are being used annually in Colombia for mainly poultry and pig feed. So as to ensure that it is not utilized for other purposes it is denatured with soybean or cotton cake or rice flour. The raw sugar partly substitutes for sorghum, corn and other raw materials in the fodder; it has a high energy content and improves the flavour, which has resulted in a significant increase in weight gain and in the feed efficiency.

1 F. O. Licht, *Int. Sugar Rpt.*, 1988, 120, 10.

2 *GEPLACEA Bull.*, 1987, 4, (12), Sugar Inf. 1.

Facts and figures

Furfural from bagasse in Brazil¹

Rhodia S.A., a wholly-owned subsidiary of France's Rhone-Poulenc group, is reported to be planning to invest \$65 million over the next four years in research and development projects using locally produced raw materials. One of the main projects in progress is refining the present experimental production of furfural from bagasse for use in the manufacturer of resins. A plant is probably to be built in São Paulo.

British Sugar capital investment in 1988²

Appropriations of £46 million have been authorized for new capital projects in British Sugar plc for the current financial year, substantially more than the previous year. Design work on many of the 1988 projects is well under way and some construction work at factories has already started. The major part was to begin immediately after the end of the campaign. Almost half the money for new capital projects will be spent at four factories; this includes about £4 million for a new effluent treatment plant and beet yard reorganization at Bardney, a £5 million for a new boiler and turbo-alternator at Cantley, and £2 million for pulp drying equipment at Kings Lynn. At Ipswich factory, £10 million will be spent on the first phase of a new steam and power generation system, a new evaporator station of six falling film units, and new energy saving equipment. The capital investment program also incorporates a large amount of instrumentation and computer operations to improve control procedures.

West Germany campaign results, 1987/88³

The 1987/88 campaign in West Germany closed before the end of the year, with a total of 19,227,388 tonnes of beet sliced, against 20,450,725 tonnes in 1986/87. The sugar content was considerably lower, at 16.30% against 17.93% in the previous campaign, and 1987/88 output of white sugar was only 2,341,206 tonnes against 2,714,686 tonnes previously, while raw sugar output fell from 458,020 tonnes to 365,241 tonnes in 1987/88. Thus, overall production fell from 3,448,593 tonnes, raw value, in 1986/87 to 2,941,790 tonnes, a reduction of nearly 15%.

Pakistan alcohol from molasses

There are eight distilleries in Pakistan with a combined capacity of 215,000 litres/day; of these five are attached to sugar factories with three autonomous units. One of the latter produces about 20 tonnes/day of alcohol for use in cellulose acetate manufacture, while another produces restricted amounts of potable alcohol, and the third makes about 40 tonnes/day of alcohol. The latest distillery is that attached to the Khazana sugar factory in the North West Frontier Province. Manufactured by the Heavy Mechanical Complex Ltd., of Taxila, it has a capacity of 25,000 litres/day of alcohol and uses a dual atmospheric/vacuum technology. Its cost of 27.5 million rupees included 40% in foreign exchange. Molasses consumption in Pakistan is about

75,000 tonnes/year out of a production expected to reach 695,000 tonnes in 1988.

Sugar Industry Technologists 1988 Meeting

A first notice of the 1988 SIT meeting has been distributed by Bruce Foster, the new Executive Director. It is to be held at the Hyatt Regency Hotel in Savannah, Georgia, and will occupy May 8 - 11, a visit to the Savannah sugar refinery being scheduled for May 11. A preliminary list includes papers on the safety aspects of sugar silos from Béghin-Say, on reverse osmosis from Amstar Sugar, applications of leucrose from Pfeifer & Langen, and mist eliminators in pans and evaporators from Koch Engineering. To obtain the reduced convention rate at the hotel a reservation should be made by April 16 and readers wishing to attend should get in touch with Mr. Foster as soon as possible at P.O. Box 632, Ste.-Thérèse de Blainville, Québec, Canada (Telephone: +1-514-621-3524).

Pakistan sugar imports reduction⁴

Pakistan will need to import 500,000 tonnes of sugar in the 1987/88 financial year (July/June), compared with 650,000 tonnes in 1986/87, according to the State Trading Corporation. Demand is estimated at 1.8 million tonnes against 1.6 million tonnes in 1986/87 while production is expected to be about the same at 1.3 million tonnes. The imports of the last season permitted a build-up of stocks and carryover of 330,000 tonnes so that only 170,000 tonnes would be needed to meet demand; however, imports of 500,000 tonnes are likely in order to maintain a buffer stock.

Costa Rica alcohol production expansion⁵

Plans call for a substantial increase in 1988 of alcohol production in Costa Rica, which reached 2.1 million litres in 1987. It is part of a program to replace gasoline as fuel. The government has also been promoting alternative industrial applications of cane-derived alcohol, to compensate for the sharp cut in the US sugar import quota.

New Australian distillery

CSR Limited has announced plans to build a large new distillery in North Queensland. The new facility, to be located at Sarina, near Mackay, will cost \$Aus 23 million and will replace an old plant currently operating on the site. It will be the first molasses alcohol distillery to be built in Australia in 45 years. It will use cane molasses as feed for the manufacture of high quality alcohol and a concentrated form of vinasse suitable as a liquid fertilizer for local cane farmers. When completed in mid-1989 the new distillery will be large by world standards and will enable CSR to expand domestic markets for industrial and potable alcohols as well as to seek new opportunities for exports.

Bagasse utilization in the Dominican Republic⁶

Of numerous projects for alternative uses of bagasse - animal feed, syrups, etc. - only the

energy program has been well defined. A five-year development plan includes construction of three thermal plants, at Rio Haina (60 MW), Barahona (37 MW) and Boca Chica (25 MW), at a cost of US \$150 million. With the feasibility studies already completed, the financial plan is now under consideration. The Barahona plant should start operating by the end of 1989. Turbo-generator and condenser equipment for the Ozama and Consuelo sugar factories will increase their capacities to 13 MW each. The program will allow the Consejo Estatal del Azúcar (CEA), once its own needs are covered, to sell 740,000 MWh per year, 400,000 during the season using bagasse as fuel, and 340,000 MWh in the off-season using coal. The CEA has abandoned for the moment the idea of producing alcohol from cane, the cost of production being too high, but is to collaborate in a study of producing alcohol from molasses for domestic use as fuel.

Brazil sugar exports, 1987⁷

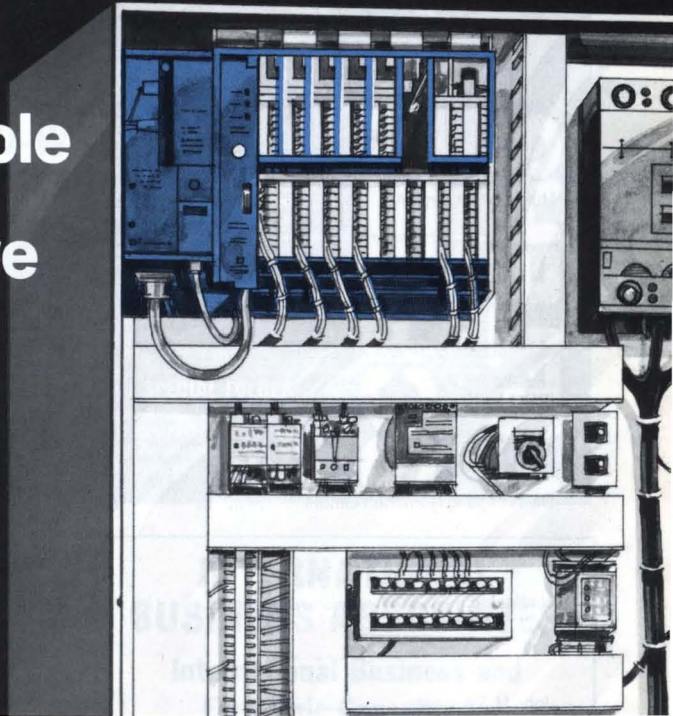
	1987*	1986**
	tonnes, raw value	
Algeria	103,207	227,748
Angola	17,162	0
Bangladesh	0	14,291
Bulgaria	25,000	14,291
Cape Verde Is.	10,285	0
Chile	15,806	5,466
EEC	43,800	2,725
Egypt	28,092	119,264
Finland	12,000	0
India	223,505	308,950
Indonesia	77,023	0
Iran	135,813	196,603
Iraq	348,676	340,534
Jamaica	21,652	0
Jordan	44,863	41,139
Kenya	30,661	47,351
Malaysia	17,800	0
Morocco	124,000	28,000
Nigeria	239,202	134,835
Pakistan	0	147,045
Paraguay	2,393	0
Peru	90,723	54,997
Somalia	0	61,615
Sri Lanka	35,668	42,786
Sudan	34,521	0
Surinam	0	1,082
Tunisia	25,200	23,991
Turkey	0	15,049
Uganda	31,125	16,207
US	121,568	140,365
USSR	520,554	567,800
Venezuela	43,750	0
	2,424,049	2,554,438

* Includes white sugar figures converted to raw value
** ISO figures

- 1 F. O. Licht, *Int. Sugar Rpt.*, 1987, 119, 599.
- 2 *British Sugar News*, December 1987, 3.
- 3 F. O. Licht, *Int. Sugar Rpt.*, 1988, 120, 9.
- 4 *Public Ledger*, November 20, 1987.
- 5 F. O. Licht, *Int. Molasses Rpt.*, 1987, (21/22).
- 6 *Amerop-Westway Newsletter*, 1988, (1/70), 13.
- 7 F. O. Licht, *Int. Sugar Rpt.*, 1988, 120, Stats.58.

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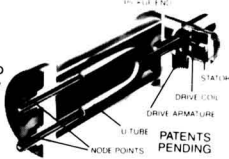
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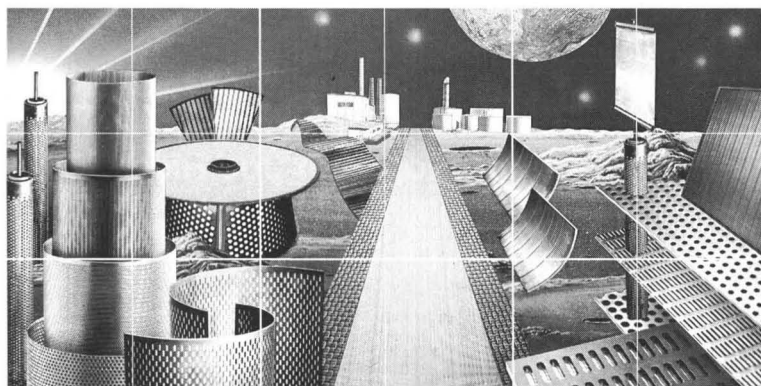
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- (1) Rotating soft sugar continuous blender, SS, 5' x 10'
- (1) Mikro #BMA atomizer pulverizer, Ni-resist, 100 HP
- (20) Rotex 40" x 80" 2-deck sifter screens
- (7) AAF rotoclone dust collectors, SS, fan up to 100 HP

- (1) Link-Belt 9' x 36' Roto-Louvre cooler, w/Roto-clone collector
- (3) Hersey 6' x 25' 2-drum rotary granulator/cooler combinations
- (1) Wet sugar blending system, SS contacts, approx. 1200 cu.ft., w/10 horiz. SS mixing screws, hyd. drives
- (1) Liquid sugar blend station...APV plate type exchangers/pasteurizer, SS, BAC cooler, SS, 23,000 gal. FRP tanks, 12,000 gal. horiz. epoxy tanks, sucrose tanks
- (2) Hesser fillers for 5 lb. bags, automatic, w/bundler

SUPPORT AND GENERAL PLANT EQUIPMENT

- (1) Combustion Eng. boiler, 130,000 #/hr.
- (3) Turbo generators; 1500, 625 kW
- (1) Worthington air compressor, 14' x 13 HBB, 75 HP
- (1) Joy #WGD-9 vert. air compressor, 75 HP, 1980
- (2) C-P horiz. air compressors, 100 HP
- (2) Alvey palletizers for...25lb./50 lb./100 lb. bags
- (1) St. Regis #76 swivel stacker
- (1) Parsons scale, 4,000# drop
- (3) Redler conveyor loops, 40 - 55 TPD
- (1) Hoffman vacuum blower, 20 HP
- (1) Nash CL402 vacuum poump, 25 HP
- (1) "Magliner" loading ramp, 16,000#, 5' x 36'

LIQUIDATION...Former Lantic 5000 TPD Beet Sugar Factory Near Montreal, Quebec, Canada

SUGAR BEET RECEIVING AND PREPARATION

- (1) Marcel Mouyard beet receiving system with hoppers, conveyor, stone catcher, etc., 1982
- (1) BMA-Harland beet pump, 450 HP motor
- (1) Putsch sharpening station for slicer blades
- (1) Tare Laboratory, 1982, testing equipment by Biologie
- (4) Truck scales, 50, 80 ton

DRYING, DEWATERING, PELLETIZING

- (3) California pellet mills, 75 HP
- (3) Trough belt conveyors for pellets; 18" x 35'; 18" x 60'; 18" x 225' (w/traveling stacker)
- (1) BMA 66" SS curved dewatering screen

LIME SYSTEM

- (1) Eberhardt vertical lime kiln, rated 200 tons per day w/rotary lime slaker, milk tank, skip hoist loader, pumps
- (1) Mikro #4TH pulverizer, stirrup hammers, 75 HP
- (2) Siemens CO₂ gas pumps, SS contacts, Terry 350 HP
- (2) Sihi CO₂ gas compressors, SS contact parts, common base and 430 HP motor
- (1) Nash CL3001 CO₂ compressor, SS contact parts, 400 HP motor, steel skid packaged

CLARIFICATION

- (1) BMA 3600 TPD clarifier with controls and accessories
- (1) Dorr-Oliver 1400 TPD clarifier, 20' dia. x 5-cell
- (3) BMA rotary vacuum "mud" filters, 10' x 12'6", scraper
- (3) Putsch vertical pressure leaf filters, approx. 90 sq.m.
- (5) BMA vertical pressure leaf filters, approx. 60 sq.m.
- (1) Ion exchanger system w/rubber lined tanks, piping, pumps, controls, etc.

- (5) Sihi vacuum pumps with 120 HP motors
- (1) Sihi vacuum pump with 75 HP motor

EVAPORATORS, CRYSTALLIZERS, VACUUM PANS

- (1) BMA evaporation system, approx. 90,000 sq.ft. total surface area, w/(20) juice preheaters, sizes up to 2,000 sq.ft. and (5) vapor bodies. SS tubes. W/control panel, pumps, piping, etc.
- (8) BMA 1200 cu.ft. vacuum pans w/agitators, drives and automatic controls. Copper tubes.
- (5) BMA 9' x 30' horiz. crystallizers
- (6) Sweetland size #12 filters, can take up to 72 leaves, now set for 36 leaves

CENTRIFUGES

- (2) BMA automatic batch centrifuges, Type P1000 w/timers, controls, etc., 1200 RPM, 44" baskets, heavy duty. **NOTE:** The above centrifuges were overhauled and updated in 1978-79.
- (2) Silver 36" continuous centrifuges, new 1980

DIFFUSERS

- (1) BMA Vertical diffuser, rated 5000 tons per day... complete set up with instrumentation, controls, etc.
- (1) Silver 1500 tons/day slope type diffuser available separately or with the property
- (1) BMA cossette mixer mdl. 4000 X 7000

SUPPORT AND MISCELLANEOUS ITEMS

- (1) Servo-Balans molasses scale, 650# per batch capacity
- (1) Raw sugar trough belt conveyor, approx. 24" wide x 250'
- (1) Keystone-Volcano 160,000#/hr steam boiler, 230 psi, #6 oil/gas, w/controls, etc., 1982

PERRY

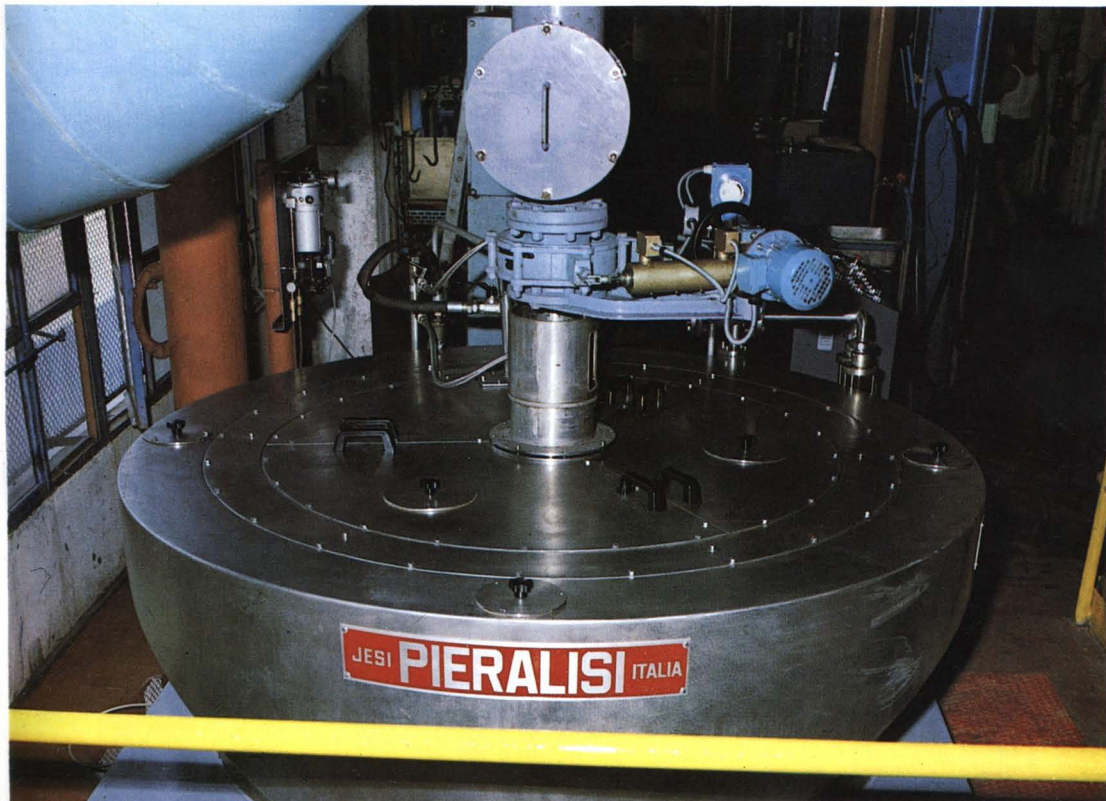
EQUIPMENT COMPANY, INC., WORLD HEADQUARTERS

Mt. Laurel Road, Hainesport, NJ 08036, U.S.A.

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CONTINUOUS CENTRIFUGALS



Specially designed for a sugar refinery wanting to step up production and cut running and maintenance costs, the **SCP-C5** is the biggest continuous centrifugal for treating sugar massecuite available today.

The **SCP-C5** is equipped with programmable logic control equipment and with special devices for the formation of artificial



massecuite in the centrifugal and of Bx-controlled syrup.

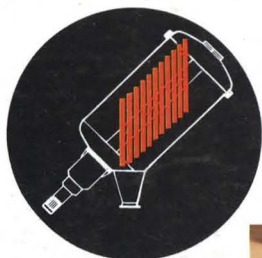
The machine body and the basket are made entirely of stainless steel. The oil-mist system is used for lubrication.

The **SCP-C5** – a truly great machine – has joined the Pieralisi family of centrifugals for the treatment of beet floating waters and carbonation juices.

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Putsch **Plate Filter**

The Darlings of the plant

Schematic drawings show filter in operation with plates in horizontal position and during cake removal in vertical position.

An unorthodox design: Filter is mounted at an angle of about 45°. In operation: Filter plates stay in a horizontal position. For cake removal: Central shaft is turned slowly.

Therefore:

- Safe filtration
- Easy cake removal
- Filtering surface completely clean after each cycle
- High capacity
- Fully automated
- Easily serviced
- Operation preferably with precoat, also with active carbon
- Ideal device for polishing sugar juices, such as thick juice, clairce, standard liquor etc.



After all - it's performance that counts.
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