THE
INTERNATIONAL
SUGAR JOURNAL

VOL. XLVII. OCTOBER, 1945 No. 562

Notes and Comments.

Mr. Clinton P. Anderson on Sugar.

At a recent press conference held in New York, Mr. CLINTON P. ANDERSON, the newly appointed U.S. Secretary of Agriculture and War Food Administrator, discussed the outlook of his Department on food problems generally. He stated that one of their policies would be to publish the truth about the present situation as they understood it. "The people are entitled to know how much food there is in the country, where it is, and where it is going . . . . . In the case of a shortage, they are entitled to know whether it occurs from the failure of Nature, a so-called Act of God, or from official negligence and stupidity . . . . The prospect is grave, and America cannot feed the world, even with a maximum agricultural production. In view of a prospective low corn crop, she may have difficulties in feeding herself."

Turning to the subject of sugar in particular, the Secretary announced that he had appointed Mr. MILTON S. EISENHOWER, President of Kansas State College, and brother of the distinguished soldier, to work on a plan to coordinate the sugar activities of the Department of Agriculture and the War Food Administration. He said that the U.S. had made an offer to Cuba for the purchase of the 1946 crop (reported to be 3·45 cents. per lb., f.o.b.), which had not yet been accepted. He had no authority under the present law to purchase Cuba's 1947 crop, but was recommending to Congress legislation that would permit him to do so. Thus far he had been disappointed in the attitude of Cuba, America's "natural and logical source"; but he stated that if negotiations failed in that direction, "we can step up our Western beet sugar production . . . . and plant more cane in Louisiana and Florida." With regard to the Philippines, Mr. ANDERSON anticipated that sugar would be available from that country in 1947, but the actual amount was uncertain, and probably would be small.

Commitments for supplying sugar to Europe for 1945 had been pared down since the time when it first became evident that Cuba's production this year would be reduced because of drought. The European picture was subject to change by developments, the latest advices being that Russia's production would be larger than anticipated[1]; while if France had transport and coal available her production would also be largely increased. Java was another unknown factor, for when supplies from that area were again available they would greatly ease the situation. No sugar controlled by the United Nations was being sent to Sweden, but 60,000 tons from British sources would be sent to Spain, because of a commitment that was a part of the economic warfare programme. He concluded: "In view of the very difficult situation facing the United States, we shall review present requirements and consider very carefully any new commitments with the object of increasing the quantities of rationed commodities available for civilian use."

Mirrlees Watson acquires Blairs.

It is announced that the Mirrlees Watson Co., Ltd., of Glasgow, have acquired the ordinary share capital of Blairs, Ltd., of Govan. Each Company, however, will retain its own individuality and management. It is hoped by this merger to: (1) Strengthen a most important section of the sugar machinery industry to enable it to reduce costs to meet competition abroad, to increase the country's exports, and to develop and improve the products and service of home customers; and (2) to increase efficiency in the industry by co-operation in research and development work, and by interchange of experience. By these means the two Companies intend not only to maintain, but to improve the services available to customers both at home and overseas.

Colonial Universities.

In 1943 the Secretary of State for the Colonies appointed two commissions to report on the problem of higher education in the colonies. The first, under the Chairmanship of Mr. Justice ASQUITH, was

[1] *I.S.J.*, 1945, p. 170.

charged to consider the general principles which should guide the development of higher education in the colonies and the foundation of colonial universities. The second, of which Col. WALTER ELLIOTT was chairman, examined the problem in four of the British dependencies of West Africa. In addition, a committee visited the West Indies under the chairmanship of Sir JAMES IRVINE, and they in due course issued a report.

These reports are now published. The West Indies Committee has recommended the creation of a university college, later to become a university, with faculties of arts, science and medicine. It is proposed to establish it in Jamaica. The West African report is not unanimous, the majority recommending three university colleges, in Nigeria, Gold Coast and Sierra Leone, provided with schools of medicine, agriculture, forestry and animal health to serve all British West Africa. On the other hand, the minority advocate a single West African university which would include the schools proposed by the majority, as well as an institute of education, and a school of engineering, together with three territorial colleges, working up to intermediate standard.

In these reports, therefore, we have a comprehensive plan for the development of higher education in the colonies. It will admittedly be a costly scheme on the standards of staffing and equipment now proposed. Thus, the University of the West Indies will involve a capital cost of about £1,130,000, an endowment of £500,000, and a recurring cost of £130,690 : while the majority proposal for West Africa would involve a capital and recurring cost of the order of £1,500,000 and £250,000. But other problems than mere finance will probably have to be solved. As *The Times* points out, it may be increasingly difficult to recruit in this country staff of the necessary quality for the new colleges and universities. Experience has moreover shown the difficulties to which such staff may be subjected by isolation from the normal current of academic life. It is hoped that a solution may be found by enlisting the joint interest of the home universities, which would be represented for the purpose by an Inter-University Council for Higher Education in the Colonies. It would give it aid in arranging for the delegation by home universities of members of their own staffs for periods of service in the colonies, a kind of intellectual lend-lease.

New Uses of Sugar.

A list of some of the grants and projects established by the Sugar Research Foundation of New York, have already been given[1]; but others are now announced, among which may be mentioned the following :

Prof. MELVILLE L. WOLFROM, of the Ohio State University, Columbus, Ohio ; $8,000 per year for three years ; to study the separation and identification of the non-sugar constituents of molasses from beet and cane. Prof. CARL NEUBERG, Washington Square College, New York ; $3,600 for one year ; to study the preparation of glycerin from sugar by modified fermentations, and of various types of invertase concentrates from yeast. Prof. ANDREW VAN HOOK, Lafayette College, Easton, Pa. ; $475 for one year to study the rate of crystallization of sucrose and the effect of various impurities as salts and molasses constituents upon it.

Prof. W. H. PETERSON, College of Agriculture, University of Wisconin ; $6,600 for three years to study the growth of industrially useful micro-organisms in various types of molasses with special reference to discovering what materials inhibit or restrict growth, and finding some means of removing or counter-acting them. Dr. DORA STERN, Literature Consultant ; $4,000 for one year ; to devise a system for classifying sugar derivatives and compile a catalogue of those derivatives which have been described since 1930. NATURAL RESOURCES RESEARCH INSTITUTE, University of Wyoming ; $4,000 for one year; to investigate the extraction, purification and utilization of pectin from the pulp of sugar beets and to prepare and study products derivable from beet pectin.

Dr. WALTER D. BONNER and Dr. RALPH F. PHILLIPS, of the University of Utah ; $1,500 for the summer of 1945 ; to study the production of certain glucose derivatives of possible industrial value directly from sugar and molasses. Dr. GEORGE R. COWGILL, Yale University Medical School ; $3,600 for one year ; to conduct a survey of the vitamin content of various products of the sugar industry as they reach the market, including raw sugars, soft sugars, molasses, white sugars and high test molasses. Dr. F. W. ZERBAN and Dr. LOUIS SATTLER, of the New York Sugar Trade Laboratory ; $4,000 for one year ; for further investigation of the unfermentable constituents of molasses, beet as well as cane.

Dr. GEBHARD STEGEMAN, of the University of Pittsburgh ; $7,000 for one year ; for the precise measurement of a number of physical constants of sugar and sugar solutions, the collection and critical examination of data now available in the literature and compilation of such data into a form readily utilizable by industrial chemists. Prof. JAMES M. NEILL, Cornell University Medical College, New York ; $4,500 for one year ; to further study the serologically active polysaccharides which occur in white sugars used as food. In all, the projects of the Foundation now total 32 and the amount pledged for them is $375,000.

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[1] *I S.J.*, 1945, pp. 170-171

Termite-Proofing of Timber for Use in the Tropics.

Termites are the most injurious wood-feeding insects in the world, and recognizing the great importance of their effective control, investigations have been carried out by the Department of Scientific and Industrial Research, Forest Products Research Laboratory, Princes Risborough, near Aylesbury, Bucks. Information was elicited which cannot but fail to be of importance to all living in tropical climates, and it appears well worth while giving a summary of the principal conclusions arrived at by this Laboratory. Preliminarily, it is pointed out that there are about 1,700 known species of these insects which are often, but erroneously called white ants; they, in fact, belong to the *Isoptera* order, and are not always white in colour which varies from a creamy grey to dark brown or even black in parts.

As is well known in tropical countries, these pests live on wood or materials containing cellulose. In order to study methods of preventing damage, the termites were grouped according to habitat as follows :—(1) *Ground Dwellers*: (*a*) subterranean termites which are the most injurious economically; 95 per cent. of all the damage in the world being caused by this species to timber and woodwork in buildings; (*b*) Mound-building termites. (2) *Wood Dwellers*: These are entirely confined to wood and h ardly ever enter the ground.

The prevention of damage by the first group of termites can be effiectively carried out by simple structural precautions; that is complete insulation from the ground of all untreated woodwork. Shields, guards or metal caps are incorporated in the foundations to act as barriers, preventing the construction of their earth-like shelter tubes over unpalatable materials.

For timber in contact with the ground, service tests in different parts of the world have shown that coal-tar creosote applied under pressure is the most effective preservative. Termites have not been known to penetrate properly impregnated timber. For satisfactory results the creosote must conform to certain standards[1], (B.S. 144) and a certain minimum quantity must be retained by the wood after treatment. For example, in timber in contact with the ground an absorption of 10–12 lb. per cu. ft. is required, but for internal use where freedom from "bleeding" is important, a retention of not more than 6–8 lb. per cu. ft. may be specified. When pressure treatments are impracticable, hot and cold open tank treatment may be used, but this is not an equivalent alternative to the pressure method.

When objection to the use of creosote is raised, timber in contact with the ground may be impregnated with other preservatives, particularly those containing arsenicals. Protection will only last, in these instances, depending on the extent of leaching of the toxic elements. Timbers so treated are of course unsuitable for food packing. Recent work in the U.S.A. has shown that solutions of chlorinated phenols in light fuel oils are promising preservatives, even for use out of doors. These materials are not as yet obtainable in this country, on a commercial scale. Metallic naphthenates, particularly copper naphthenate, are finding increasing use for the prevention of termite attack. It is however recommended that frequent inspections be made where practicable, even after chemical impregnation.

For timber not in contact with the ground, impregnation under pressure with a reliable preservative is essential for permanent protection. Non-pressure methods, such as dipping, spraying or brushing will give temporary protection, depending on the depth of penetration of the material. As the result of recent experiments however, brush applications of aqueous solutions ($\frac{3}{4}$ oz. per U.S. gal.) of inorganic compounds such as copper sulphate, zinc and barium chlorides and cadmium nitrate have been suggested for the protection of furniture and structural timbers in new buildings from the attacks of the common West Indian dry wood termite, *Cryptotermes brevis*.

Pressure impregnation in this country, is available for Wolman salts (arsenicals) only, a special preparation of which is recommended by the manufacturers. This treatment colours the wood a light yellow-brown which may fade to a greenish brown tint, but leaves it clean and paintable. A proprietary preparation consisting of an acid solution of cupric chromate is being used at present in the U.S.A. for treatment of timber not in contact with the ground.

Non-pressure treatments with pentachlorphenol in light petroleum oils are specially suitable for interior use and for finished articles, without swelling or shrinkage of the wood. A certain minimum period of immersion is necessary if this treatment is to be effective. Paint alone is not a permanent deterrent but if of the heavy enamel type, it is always an additional preventative, especially against dry wood termites.

No commercial woods are regarded as immune from attack, but the heartwood of a number of species has been found to be highly resistant. Timbers resistant in one country cannot be relied upon to be equally so in another, due to the various species of termites concerned. Plywood also presents the same difficulties of immunization, but not enough information on this subject is available. For fibre and composition boards, tests have shown that arsenicals and pentachlorophenol are effective preservatives. Where boards are held together with a plaster binder of fine cement, tests have shown these materials to be resistant to attack. (A bibliography of 14 works on this subject is cited dating from 1936 to as recent as 1943).

[1] *British Standards Specification*, p. 144.

Influence of Nutrition on Physical Efficiency.

At a meeting a few months ago of the Old Students' Association of the College of Agriculture, Mauritius, Mr. F. A. WILSON, B.A. presented a notable paper in which he skilfully summarized our present-day knowledge of physiological matters of premier importance to employers of labour everywhere, especially in the tropics.[1] Its points were the following :

Energy.—That the body requires energy to live, move and work, and in so doing obeys the same laws of energy transformation as the steam and internal combustion engines, represents one of the most fundamental discoveries in the study of man. The average person has a basal metabolic rate (i.e., the minimum energy required to keep the heart beating and the lungs breathing) of about 1680 kg. cal. per 24 hours, to which 10 per cent. is added to allow for the action of food. Living an ordinary life without manual labour, 600 cal. more are required, thus giving about 2400 cal. Engaging in various duties, might increase this to 3700; persons in the tropics would expend about 300 cal. less., i.e., making about 3400 in the 24 hours[2] Now, to perform a given amount of work, a man must derive the requisite energy from his food. If there is under-nutrition, i.e., an insufficient calorie intake or an inadequate vitamin quota, he loses weight, and in time is unable properly to perform the duties required of him[3]. He has a feeling of fatigue, and his unrest and dissatisfaction may become marked.

Proteins.—It was formerly erroneously believed that muscular power was generated at the expense of muscle substance, an increased activity demanding an increased consumption of protein-rich foods. But to-day it is known that the fuel of muscle is carbohydrate, and that although the body can in fact burn protein to obtain energy for muscular effort, the protein has first to be converted into carbohydrate[4]. Provided therefore that a man's body is sufficiently developed muscularly for the kind of manual work he is to perform his protein need is not different from that of a sedentary worker. In densely populated regions, the dietary is often protein-poor, and does not permit of the development of an appropriate musculature. Such suboptimal muscular development does not necessarily mean that the worker will not be able to live and dig, but simply that he will be taxed and strained to carry out such tasks. This in the long run reduces efficiency and capacity. An important factor to be taken into account in tropical countries is the increased metabolism of protein due to malaria and other infections, and its increased demand.

Minerals.—Magnesium ions are essential for the breakdown of muscle glycogen into lactic acid, which sets free the necessary energy for muscular contraction, a role which can be played by no other element. Phosphates are also essential, since various organic combinations form indispensable chains in the breakdown of glycogen. Calcium is important, being controlled by the parathyroid gland, which in turn is effected by the phosphorus content of the diet, and by vitamin D[5]. Both Ca and P are commonly inadequately supplied in human dietaries. Iron and copper are necessary for the formation of haemoglobin, the red pigment which conveys oxygen from. lung to tissue and muscle.

pH.—During muscular activity large amounts of acids are produced, but a very slight change in the *pH* of the blood would provoke disastrous results. A normal *pH* is maintained by the buffering of the proteins and alkali-protein salts, while the blood bicarbonate also participates. Fatigue following muscular effort is due at least in part to the accumulation of acid products, and if the " alkaline reserve " (the total available alkali of the blood) is reduced it will persist longer. Foods as meat, fish, eggs, etc., containing protein tax the a.r. whereas most fruits and vegetables have the contrary effect. Even acid fruits are alkali-producing, since the organic acids are easily burnt up to CO_2 and H_2O, leaving their alkaline minerals in the system. The ideal diet should provide an excess neither of acid nor of alkali. Tubers, cereals, vegetables, fruits and milk with occasional meats achieves this object, being in fact traditional of the land-working peoples of the world.

Vitamins.—Since these substances function catalytically in the most important bodily processes, the deficiency of any one of them has widespread repercussions on the physiology of the body as a whole. Vitamin A deficiency is common in tropical countries, and the wider use of shark liver oil, a very rich source, would be of great benefit in overcoming it. D is normally adequately supplied by the bountiful sun. Members of the B and C groups play a decisive role in muscular efficiency. Deficiency of the B-group is wide-spread in rice-eating countries, and preberiberi symptoms may be exceedingly common, one of its most characteristic symptoms being an aversion to work ; accusations of "laziness" may thus be pathological in origin. As for vitamin C, it probably acts in collaboration with B_1 and B_2 in tissue and muscle respiration. A common incapacitating disease in Mauritius is tropical macrocytic anaemia, which is certainly of dietary origin, due probably to deficiency of vitamin B (pyridoxine).[6] Yeast is very effective in its treatment. Little is known of the extent of deficiency of vitamin E in human beings, but it appears that muscular dystrophy is due to it. In conclusion, it has been shown the level of nutrition affects physical efficiency, which is synonymous with saying that if a man is to be capable of working properly and healthily he must have the right kind of food. This is not utopian from the practical aspect; it is attainable. Employers of labour can read material benefits from its attainment.

1 *La Revue agricole* (Mauritius), **22,** No. 4, pp. 161–170. 2 " Science of Nutrition." LUSK. 1928. Also *League of Nations Technical Commission,* Publication 11, 1936. 3 "Nutrition in the Colonial Empire." (H. M. Staticnery Office) 1939.
4 Cuthbertson : *Nutrition Abstracts and Reviews,* 1940, **10,** 1. 5 MCCOLLUM *et al* : " Newer Knowledge of Nutrition." (Macmillan) 1939.
6 VILTER *et al.* : *Nature,* **1940, 145,** p. 388.

Experimental Work in Agriculture.

Report of the Sixty-fourth Annual Meeting, Hawaiian Sugar Planters' Association, 1944.

The Report covers another year of war and the experimental work bears evidence of the fact both in its character and extent. Considerable attention has been devoted to the wider issues of an isolated territory largely forced to depend on its own resources, to meet its own requirements in the matter of food and to guard against the dangers arising from the breakdown of its isolation. The amount of work especially devoted to sugar cane has, consequently, been considerably curtailed.

Entomology

The usual surveys of the incidence of pests in the plantations have been continued with very favourable results. Very little damage was caused during the year by any insects, no new pests have been discovered and those which have been responsible for outbreaks in the past were quiescent. For many years particular attention has been given to the biological control of the various pests and the introduction of potential parasites and predators systematically carried out. To this fact the satisfactory position in respect to pests must be largely attributed.

The Cane Root Grub (*Anomala orientalis*). This grub remains well under control with no indication of spreading to a wider area. The cause is dual ; the expansion of the variety 32·8560, which is highly resistant to borer attack, and the efficiency of the long-established parasites, both of the beetle and the grub.

Armyworms (*Laphygma exempta* and *Cirphis unipuncta*). These two pests have been quiescent for several years and, latterly, positively scarce. The reason appears to be the establishment of three relatively new parasites ; *Aplanetes marginiventris* and *Meteorus laphygmae* introduced from Texas in 1942, and *Eucelatoria armigera*, which gained entrance probably on Californian vegetables and established itself prior to 1942. A favourable feature concerning these parasites is the fact that they attack several kinds of caterpillars which feed on common weeds and there is, therefore, a reserve of parasites in the event of any prospective outbreak of army worms.

Miscellaneous insects. The major subsidiary pests are, the sugar cane leaf hopper, the cane aphis, the leaf roller, the Chinese grass-hopper and two species of mealybugs. All these are well controlled by imported parasites. The cockroach parasite, *Ampulex compressa*, introduced from New Caledonia in 1940, has established itself and spread well beyond the areas of liberation.

Bufo marinus. This toad, introduced from Puerto Rico in 1932, is now found everywhere in the lowlands. The longevity of this toad has been determined on specimens hatched out in 1933. Though some have died, seven still remain alive giving a record of 11 years, the longest life of any toad of which there is record.

Quarantine. The Hawaiian islands are particularly well situated for successful biological control owing to their isolation but, with the coming of the aeroplane, that isolation has largely broken down. Strenuous efforts have, in consequence, been made to prevent accidental introduction of potential pests and a close quarantine service has been established under which all planes are subjected to inspection, the passenger insects collected and recorded. During the year 1943-44, 5,125 insects were so collected of which 173 were alive on arrival and only five species not known in Hawaii, and none of these potentially harmful. A number of those found dead, however, were less innocent insects and, among them, the mosquitos *Anopheles punctulatus*, a notorious vector of malaria, and *Aedes vigilax*, a fierce biter. Other insects included *Sessinia livida*, an oedemerid beetle causing acute irritation to the human skin and *Anomala aeneiventris*, a potentially dangerous root grub. Much time was devoted to supplying information and instruction to those responsible for the health of the large influx of troops to the islands, included in which work was the systematic collection of insects attracted by light traps and the identification of these.

Pathology.

The breakdown of isolation already mentioned applies also to the question of the risks of importing fungoid diseases, but the regulation of the import of seeds and plants still remains the major form of protection. Particularly is it desirous to ensure that any sugar cane seed or varietal material imported is free from disease. Though methods of improving the ways and means of introducing such material were considered, this activity was dormant during the the year, for no importations were made.

As in the case of entomology, a plantation inspection service was maintained and the position disclosed was fairly satisfactory. Partly this was due to the spread of 32·8560 which, owing to its resistance to eye spot, has rendered free areas seriously affected when under H 109. Mosaic, too, was conspicuous by its absence owing to varietal resistance. Leaf scald is being brought under control by the same means. Chlorotic streak remains a problem but its control is a cultural one, the rectification of the drainage system in low lying areas.

Fiji disease, gumming and downy mildew, particularly the first, are the foreign diseases to guard against which special precautions are being taken. These follow two lines; plantation staffs are being instructed in the symptoms of the diseases so that their identification at an early date will be facilitated should they gain an entry, and a co-operative scheme has been developed under which new varieties are tested for resistance in those countries in which the disease prevails, so that pre-knowledge of their reaction to disease may be had and a programme of control inaugurated in the event of entry.

Among the subjects of wider interest studied were the diseases of truck crops. Of particular interest, as raising curious economic difficulties, was the study of a disease of the prickly pear (*Opunita megacantha*) by a variety of *Fusarium oxysporum*, the symptom of which is the rotting of the pads. The prickly pear is a weed in the plantations and, as such, any disease which would control it, is to be welcomed. But it also occupies uncultivated tracts at a distance from cultivation, tracts which form grazing grounds where water is scarce and the cattle rely on the suculent pads of the plant for their water supply. Here, then, the plant is an economic asset to which disease is harmful. A detailed account of the disease and its economic bearing has been published[1].

Other studies include the production of yeast for food from molasses and the preparation of penicillin, that recent discovery of such value in surgery. Various strains of *P. notatum* have been found to make excellent growth without incubation and solutions and gauze dressings have been prepared. Other preparations from onions, garlic and yeast have been found to inhibit the growth of pathogenic bacteria not affected by penicillin.

The resistance of the more important commercial varieties to the six major local diseases and the three foreign diseases, downy mildew, gumming and Fiji disease, has, in the vast majority of cases, been determined and the results are tabulated for the 15 varieties of which over 1,000 acres are grown. The most widely grown variety, 32·8560, is very highly resistant to eye spot, mosaic and root rot, highly resistant to leaf scald, downy mildew and gumming, moderately resistant to brown stripe and chlorotic streak but highly susceptible to Fiji disease. It is superior to the next most extensive variety, 32·1063, which is very highly resistant to mosaic only and the reaction of which to downy mildew and Fiji disease has not been determined, while it is very superior to H 109, that former standard cane, which is highly susceptible to eye spot, brown stripe, downy mildew and gumming, very highly susceptible to Fiji disease and highly resistant to root rot alone.

Physiological studies have been limited to the investigation of the effect of inoculation with extracts prepared from the green leaf-hopper and corn leaf-hopper of healthy plants of 32·8560. Such extracts were known to produce galls, later producing shoots, and also to stimulate normal buds in the region of inoculation. 11 stimulated buds and 9 induced buds, together with checks, were grown for 16·5 months during which period marked differences were observed. On harvesting these strains were analysed and results recorded in lb. sugar per foot of line. The yields from the 11 stimulated buds ranged from 1·9 to 4·5, from the induced buds from 1·9 to 3·7 and, from the checks, from 1·6 to 1·9. The highest yielding strains are being carried forward into plots to check whether high-yielding commercial strains may not be obtained by these means. The reaction of the plant to extracts of other insects is also being followed.

Genetics.

An increase in the breeding programme has followed the easing of the situation but crossing has been limited to "melting pot" methods which require relatively little labour. On the other hand, large-scale shipments of seedlings to the various islands has become possible. Resistance to Fiji disease in commercial varieties has assumed importance and trials in Queensland have shown that, of the commercial varieties, only POJ 36, with 32·1063 as yet undetermined, is resistant. The Indian Chunnee is outstandingly resistant and the incorporation of this in the parentage will be one of the major planks in the prospective programme.

In the selection work particular attention is being devoted to "toughness" in the belief that both yields and quality are affected by the amount of fracturing at the base during lodging. Toughness is roughly determined by bending the standing stalks until they approximately reach the horizontal position, when a brittle stalk will snap off and a tough one show no sign of fracture. 32·8560 is classed as moderately tough.

While none of the newer seedlings challenge 32·8560 over the whole range of conditions, certain of them appear superior under special conditions: 32·9624 (UD 110 × POJ 2878) has repeatedly equalled 32·8560 under irrigated conditions and would be a good stand-by alternative; 33·9405 (28·4615 × POJ 2878) is very similar to the above but appears better adapted to the poorer irrigated areas; 35.1515 (31·1389 × ?) has shown to advantage under difficult conditions and is particularly promising on the thin soils; 35·2154 (32·210 × ?) has done best in the windward irrigated lands and the mauka leeward lands; 37·1933 (32·8560 × 34·1874) has consistently outyielded 32·8560 in the makai leeward lands and it has good juice, but it tassels heavily and its open growth means good weed control; 37·4888 (33·7673 × ?) is adapted to lands where normally tasselling is heavy, since it arrows lightly; 38·2915 (32·8560 × POJ 2878) has registered gains of sugar over 32·8560

[1] *Hawaiian Planters' Record*, 1944, **48**, p. 59.

at all irrigated stations, due to yield rather than juice quality. Its semi-flat habit, however, renders it an unattractive cane from the cultural standpoint; 38·4744 (32·8560 × 32·1063) has outyielded 32·1063 on the thin, less fertile soils of the Hilo and Hamakua districts. It tassels lightly and has a leafy top giving good weed control.

The acreage figures of commercial plantings show an additional 26,521 acres under 32·8560, making a total of 97,471 acres; 32·1063 occupied second place with 24,192 acres, a gain of 2,811 acres; H 109 lost 10,963 acres at 19,851 acres; Yellow Caledonia occupied fourth place with 15,398 acres, being a loss of 2,451 acres.

A considerable amount of work was given to the breeding of truck crops.

Agriculture.

It is in the co-operative activities for the conduct of experiments in fertilization and agricultural practices generally that the influence of the war continues to be felt most strongly. It was possible to harvest only 39 tests while the number of active tests was reduced to 95. The major studies concerned nitrogen and have already been reviewed in some detail[1]. Other observations of interest include the following :—

Losses due to delayed milling. Poorly burned cut cane which could not be trucked owing to bad weather and incurred, in consequence, a delay of 4 to 5 days showed (two experiments) for tons cane per acre, a gain of one ton and loss of 10 tons (125 to 115 tons), for purity, losses of 5·7 (78·3 to 72·6) and 6·2 (84·5 to 78·3) and for tons sugar per acre, losses of 2·2 tons in both cases. All these results, with the exception of the single small gain in tons sugar per acre, are significant.

Interaction between irrigation and nitrogen. A crop of 32·8560 harvested at 27 months received in one case irrigation on the basis of 250 day-degrees intervals and, in the other, on a basis of 450 day-degrees. In both, nitrogen dressings of 150 and 250 lb. per acre were given. The results were as follows :—

Irrigation Interval	Tons Cane per Acre		Tons Sugar per Acre	
	150 lb. N.	250 lb. N.	150 lb. N.	250 lb. N.
250 day-degrees ..	110·9	122·3	11·15	12·16
450 day-degrees ..	114·4	111·2	12·52	11·12

The differences in the case of the 250 lb. N are significant, those for 150 lb. N are not. It would appear from the above that there is no measurable gain from the higher irrigation rate and nitrogen dressing. The conclusion has considerable practical bearing both from the aspect of saving in water and man-days spent in irrigation.

	250 day-degrees	450 day-degrees	Saving
No. of Rounds	29	21	—
Acre-feet of Water ..	62·86	41·91	20·95
Man-days Irrigating..	32·43	22·10	10·33
Acres per Man-day ..	5·75	5·31	0·44

Owing to the curtailment of the field experiment programme, additional attention has been devoted to "skirmish" tests in pots or small plots. A-N-L, a dolomite-treated ammonium nitrate, was tested against sulphate of ammonia, using *Panicum barbinode* as indicator, on Makiki, Manoa and Kailua soils. A-N-L proved superior on Makiki soil but the results in the other two cases were negative. A further test compared the result of leaching with the equivalent of 4·5 in. rain at 10 and 20 days after dressing and planting. Irrigation after 10 days resulted in a considerable loss, particularly marked in the case of A-N-L, but, after 20 days, there was no loss in either case, the gain from A-N-L being significant. It would appear that, by 20 days, the readily leachable nitrate nitrogen of this fertilizer had been taken up by the plant. A further leaching experiment compared non-leached with leached before planting (a) with 9 in. water once and (b) with 9 in. water in three irrigations of three inches at three-day intervals. Analyses showed a considerable loss of nitrate nitrogen, greatest in (b), but no significant differences in the cane crop harvested at 12 months.

A few of the other "skirmish" tests may be referred to. The sixth crop of a comparison of acid and basic residue fertilizers, using the cane variety 31·1389, showed a slight superiority of the acid residues which was not enhanced when lime was used to neutralize the potential acidity. The depth of planting (1, 3 and 5 inches) showed marked differences according to variety and soil. On Manoa soil there were no differential effects. On Makiki soils, 31·1389 and 32·8560 gave higher yields at 5 inches but, at this depth, H 109 failed to germinate. The effect of sulphates was traced into the first ratoon crop and the same result as in the plant crop was found, namely that on Manoa soil more cane and sugar from better juice followed application of sulphates while the reverse effect resulted on Kailua soil. The cause of "spottiness" in cane growth in the field was sought by adding 2 and 4 per cent. undecomposed trash one week before planting, and the respective depressions in yield were, cane 4·3 and 8·4 per cent. and sugar 5·0 and 12·4 per cent. A further cause was sought in irregular distribution of fertilizer, the effect of nitrogen in 1, ½, ¼ and 0 standard doses at 2 months with subsequent similar treatment being irregular reductions in yield below the standard.

H.M.L.

American Crystal Sugar Co.—Net income for the year ended March 31st, 1945, of $579,468 is reported compared with $473,745 earned in 1944. After allowing for preferred shares, earnings amounted to 54 cents per share of common stock, against 24 cents in 1944. Profits from sales of sugar and dried beet pulp amounted to $844,539, and income from other sources to $1,205,216. The company operated all eight of its factories in the 1944-45 campaign and produced 2,286,888 bags (100 lbs.) of sugar compared with 2,085,605 bags the previous season.

[1] *I.S.J.*, 1945, p. 181.

Some Indian Gleanings.

Varietal Developments. Losses from Top Borer. Composting Schemes.

The main sugar cane growing track of India lies in the eastern and mid-Gangetic plain and is centred on Bihar and the United Provinces. Cultivation of the cane extends, however both East and West; to the East across Bengal into Assam, to the West, into the Punjab, the plain of the five rivers. An account of sugar cane cultivation in Assam is given by H. K. NANDI and H. N. PAL[1].

Assam is a hilly tract with two main valleys; to the North, the Assam valley traversed by the Brahmaputra, to the South the Surma valley. Sibsagar and Kamrup in the former, and Cachar and Sylhet in the latter are the two centres of sugar cane production in this Indian Province. The area under cane is small in comparison to that of the main tracts, some 40,000 acres, and the whole crop is devoted to the production of gur. Though the area is sub-tropical, its climate is well suited to the sugar cane, lacking as it does the hot dry weather characteristic of the Gangetic plains and a generally favourable rainfall, particularly between March and May. The soils, too, are highly suitable, being alluvial and often enriched by silt carried down by the rivers. Yet yields average only 10 to 12 tons cane per acre and the explanation lies in the fact that the crop is grown by poor cultivators and consists of standard thin canes, teli, bogapura and khagri.

The work of improvement has been concentrated at the Jorhat farm situated on old alluvium in Upper Assam. The soil here is a reddish, sandy loam characteristic of the old alluvium and is capable of yielding a good return if supplied with nitrogen, a satisfactory dose being 120 lb. N as cow dung (300 mds.) and 50 lb. N as mustard cake (1,000 lbs.).

In the process of finding more suitable varieties a number have been accepted for a time, only to become unpopular later. Among these are striped Mauritius, D 74, B 6308 and B 376. POJ 2714 and, to a lesser extent, POJ 2878, have succeeded these and several of the Coimbatore canes are gaining in favour. Among these Co 419, a late ripener, has given the highest yield yet recorded, 54 tons per acre, and Co 421 a medium ripener, 50 tons; both are becoming popular. Co 355 and Co 356, both medium ripeners, and *Sorghum* crosses, are promising and have been recommended for wider planting. The yields quoted above are for plant canes, but ratooning capacity is also a matter of some moment, as ratooning is a common practice in the area.

The progress made in improvement on the above lines is, however, hardly reproduced in general cultivation and there is here an example of the difficulties attendant on raising the standards of agricultural practice of an unorganized host of poor cultivators. Yet there is a big field for the development of the sugar cane, for Assam is not self-sufficient in the matter of gur and produces very little sugar, the imports of these two commodities amounting annually to 50 lakhs.

VARIETAL DEVELOPMENTS.

It is some quarter of a century since the discovery that the sugar cane could be crossed with the wild *kans* (*Saccharum spontaneum*) and, during that period, a revolution has been effected in the breeding of varieties suited to the sub-tropical tracts of India and, more generally, carrying resistance to the major diseases of the crop. Varieties carrying *spontaneum* "blood" are now grown in practically all the cane growing countries of the world. *S. spontaneum* is a protean plant with many local variations in the wide area through which it occurrs, and it is felt that the potentialities in this direction have not been fully explored and that further improvement of the present sugar cane varieties may be possible from the incorporation of characters derived from races of *S. spontaneum* as yet unknown. The Indian Central Sugar Cane Committee propose, therefore, to equip a small expedition to collect all the wild forms of *S. spontaneum* occurring in northern India[2]. Meanwhile the breeding work at Coimbatore goes on and two lists, covering the years 1944 and 1945, are given of the recent additions to the Co series, eleven in number in each list.[3] There is evidence in these lists of a shift in the centre of gravity of the work. The early stage, when the objective was primarily the selection of general purposes canes adapted to the main cane growing tracts, has passed and greater attention is being given to the selection of a range of canes suited to the various local conditions with the object of extending the manufacturing season. Emphasis is, therefore, laid on the time of maturity while paying attention to the more general characters which control yield and quality of juice. The two series cover the numbers Co 612 to Co 622 and Co 623 to Co 633 respectively. Their main characters are :—Co 612 (Co 417 × POJ 2878) late and a good yielder; Co 613 (Co 419 × Co 285) vigorous growth of medium thickness; Co 614 (Badila × probably Co 419) class Co 419 but sparse flowering; Co 615 (Co 419 × B 3412) class Co 419 but sparse flowering; Co 616 (Co 440 × POJ 2727) rich juice and early; Co 617 (POJ 2878 × Co 285) fairly erect with better juice than Co 285; Co 618 (POJ 2878 × Co 285) thin to medium, fairly heavy yielder; Co 619 (POJ 2878 × Co 312) better habit than Co 312, very sparse flowerer; Co 620 (POJ 2878 × Co 313) fairly early and sparse flowerer, leaves strip easily; Co 621 (Co 421 × Co 393) thin to medium, fairly early; Co 622 (Co 421 × Co 331) erect with good qualities of both parents but better juice;

1 *Indian Farming*, 1944, **5**, p. 398. 2 *Indian Farming*, 1945, **6**, p. 153. 3 *Indian Farming*, 1944, **5**, p. 420 and 1945, **6**, p. 176.

Co 623 (Co 449 G.C. × probably Co 450) medium-thick mid-season, practically non-flowering; Co 624 (Co 419 × Co 453) good habit, mid-season; Co 625 (Co 419 × Co 453) good habit and satisfactory juice, mid-season; Co 626 (Co 443 × Co 313) good yield, early and satisfactory juice, promising; Co 627 (Co 421 × Co 440) × (Co 419 × Co 440) early with high sucrose; Co 628 [Co 603 × (Co 459 × POJ 2878)] early, thickish with satisfactory juice; Co 629 (POJ 2878 × Co 313) early, moderate yield; Co 630 (POJ 2878 × *Sorghum Durra*) early with satisfactory yield; Co 631 (Co 349 × Co 313) late, practically non-flowering, strips easily; Co 632 [Co 508 × (POJ 2878 × SG 63/32)] mid-season, fairly heavy yield, sparse flowerer; Co 633 [Co 349 × (Vellai × *S. robustum*) × Co 419)] mid-season, practically non-flowering and non-pithy. The last is the first seedling to be distributed which contains "blood" of *S. robustum*.

Losses from Top Borer.

The extension of cane cultivation in northern India following the introduction of the Coimbatore canes has raised a number of subsidiary problems, among which is disease caused by insect pests and fungi. The most important of these in the Punjab is the top-borer (*Scirpophaga nivella*). In all such cases it is difficult to measure the losses arising from the attack and, from the technical aspect, to measure its relative abundance both in time and locality. A detailed statistical study has been made by K. A. Rahman and D. Dastur in an effort to find a means of accurate determination of the extent of the attack.[1] For the purpose, a third acre field of Co 285 was divided into 40 sub-plots and all the canes, in groups of 50, examined for borer attack; the total number of groups being 400. The frequency curve has a slight negative skewness but without significant departure from normality to stultify the conclusions drawn from the analytical methods adopted. These groups of 50 canes were then aggregated in various combinations forming samples of 50, 100, 250, 400, 500, 800, 1,000, 1,250, 2,000, 2,500 and 5,000 canes and calculations made inclusive of the coefficient of variation and its standard error. From these calculations it is concluded that very little additional precision results from increasing the sample above 500 canes. Further analysis, taking areas of different shapes, indicates that increased precision is obtained from long, narrow strips with length to breadth ratio 1 : 10 or, at minimum, 1 : 2·5. Three to six replications of 500 canes each taken from strips of those dimensions should supply sufficiently accurate information.

Composting Schemes.

The above references deal with the sugar cane and problems directly bearing on it. But, in India, its cultivation is not a mono-culture; it forms an integral item in the peasants' rotation and cannot, therefore, be considered in isolation. In a certain sense, breeding new varieties capable of giving higher yields has outstripped progress in other directions. All too frequently, as was the case with wheat, the fertility of the land falls below the standard necessary for the production of which these new varieties are capable. The deficiency here is humus and the question is economic. Owing to the density of the population characteristic of the northern Indian plains, waste lands from which material for the making of compost could be made, are entirely insufficient; straw is eaten by the cattle and, through inability to purchase fuel on account of poverty, the droppings are largely used for that purpose. That applies to the country-side; there remains the large volume of city wastes which have hitherto been destroyed. In recent years a movement has arisen for the recovery of these and a note on the latest developments give the following facts[2].

Under a town refuse composting scheme, sponsored by the Imperial Council for Agricultural Research, 150 compost centres had been organized. At these centres compost to the extent of some 3·5 million cubic feet or some 70,000 tons had been made. The problem of manufacture, thus appears to be adequately solved. Present difficulties lie, rather, in the distribution. Facilities for cheap transport are lacking and Municipalities are being encouraged to purchase lorries; but the reverse process, the organization of distribution by agricultural and rural development departments could be more widely developed. There is, too, the prejudice of the peasant against handling compost derived from town refuse and nightsoil; that prejudice only time and propaganda can break down.

To stimulate the production and distribution of such compost, the Government of India have agreed to pay to local Governments a subsidy of 12 as. per ton minimum during the year 1944-45, the amount depending on the quantity distributed. Under this scheme it is established that some 120 to 150 thousand tons will be distributed. There can be little doubt that the available compost will give its maximum utility if applied to the sugar cane. Not only will the increased yields of cane mean a higher cash return to the cultivator, but the general standard of fertility will be raised with corresponding benefit to succeeding crops. Satisfactory as the development is, the supply of compost must be but a drop in the ocean and agricultural practice will only catch up with the higher potentialities of the new varieties for yield when an alternative fuel becomes available and releases the straw and cattle droppings to fertilize the land. At the present time too little use is made of the urine of cattle and a simple method for its conversion is described by C. N. Acharya[3]. Nor is the process limited to the plains and C. Maya Das and M. P. Bhatnagar[4] describe a method of composting left residues particularly suitable for hill fruit gardens, at a cost of 4 as. per md. in the hills and 2·5 as. in the plains.

H.M.L.

1 *Ind. J. Agric. Sci.*, 1944, **14**, p. 233. 2 *Indian Farming*, 1944, **5**, p. 571. 3 *Indian Farming*, 1945, **6**, p. 214.
4 *Indian Farming*, 1945, **6**, p. 219.

Vapour Melting.

A Method of Saving Steam in the Refinery.[1]

By F. M. CHAPMAN,
Process Manager, Tate & Lyle, Ltd, Plaistow Wharf, London, E. 16.

As its name implies, the vapour melter is a method of saving steam. At present we require melter liquor to be 65–67°C., and in most cases the source of heat for both heating liquor and imparting the heat of solution is low pressure steam. It is apparent that any refinery has available substantial quantities of heat in pan and evaporator vapours, and that part of the vapour can do useful work if it can be introduced into melter liquor. Dilution resulting from condensation is in this case, of no consequence as it can be offset by adding less water to the melter, the final Brix thus remaining unaltered at any desired figure.

Plant.—As the plant used was built up from existing equipment, the condenser and its entrainment trap are disproportionate in size, and the illustration attached is diagrammatic. Crude liquor containing grain, string and other debris at a temperature of about 35°C. is first passed through a bar screen into the pump suction section. A 5 in. Wallwin semi-unchokeable pump (which will pass anything up to 3 in. diam.) driven by 3 Vee-ropes and a 30 H.P. 1460 r.p.m. motor then pumps the liquor to the jet condenser, the tail pipe of which discharges into the intermediate section of the melter. Part of the liquor returns to the pump section and the balance overflows to the steam end of the melter.

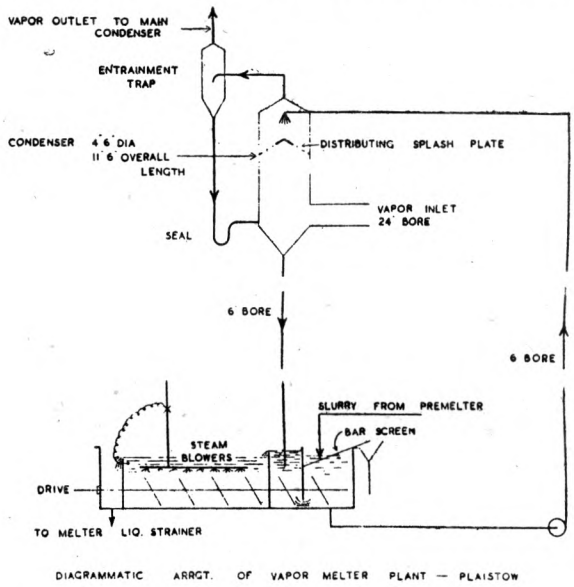
The distribution inside the condenser was the only real difficulty encountered. It had to be a compromise between sub-division of the liquor, which would promote efficiency, and reliability, i.e., freedom from blockage. It is impossible satisfactorily to strain the supply, as a screen which will intercept the debris, will also intercept much of the grain. The original arrangements of trays and bars all failed in the long run due to accumulations of string and bag fibre, which were cemented into a mat with grain.

The final arrangement consists of a whirling nozzle 5 in. diam. with 1 in. rifling. This rifles the edge of the stream, and the "core" is caused to splatter upon a splash plate about 2 ft. below the nozzle discharge. It has been found necessary to avoid thermometer bulbs in the tail pipe. A crushed syrup tin catching on a bulb caused the condenser to fill with liquor, but, as the head against the pump increased, the discharge reached zero and no harm was done. We have had no other mishaps.

Results.—The amount of recovery pan vapour available is inadequate to supply the melter requirements at all times, but some daily records in December 1943 show (with 2 recovery pans boiling and supplying vapour) :—

Average temp. of slurry entering melter,	35°C.
Temp. of liquor leaving vapour melter	52°C.
Temp. of vapour entering vapour melter	55°C.
Temp. of vapour leaving vapour melter	52·5°C.

Some samples of slurry into melter, and of liquor from the vapour melter showed on an average 37 per cent., and 13 per cent. of grain by weight respectively. With melter liquor of 68°Brix. there was



DIAGRAMMATIC ARRGT. OF VAPOR MELTER PLANT — PLAISTOW

originally 68 per cent. grain and 32 per cent. water, so that: (68–37)/68 = 46 per cent. of melting took place in the premelter (the heat of solution being recovered in the vapour melter) and (37–13)/ 68 = 35 per cent. of the melting took place in the vapour melter, leaving 19 per cent. of the melting to be done in the steam end. In a new plant, the excess of the liquor returned from the vapour melter could probably be shunted to the inlet end of the premelter, thus raising the temperature and increasing the amount of melting done prior to vapour heating. If melter liquor is 100/68 = 147 per cent. by weight on melt then the total savings become :

$$\text{Liquor heating} = \frac{(\text{Wt. liquor} \times \text{temp rise} \times \text{sp. heat})}{\text{Initial} - \text{Final heat in steam}}$$

$$= (147 \times 17 \times 0{\cdot}65)/\,(639 - 50) = 2{\cdot}76\%\ \text{steam on melt.}$$

[1] *Sugar Industry Engineers*, 1944 Meeting.

Heat of Solution.—The heat of solution, being negative, must be supplied by steam or vapour, and this heat (in the present case) =
Heat of soln. (CHU/LB) at 52°C. × % of melting done before the steam end of the melter (81%) converted to F/A steam[1]
= (9·7 CHU/LB. × 81)/ (639–50) = 1·34 per cent. steam on melt.

Total savings 4·10 per cent.

In terms of evaporation 4·10 per cent. steam saved is equivalent to raising the Brix of brown liquor from 67–69. However, the actual saving over a period is dependent entirely on the amount and temperature of the vapour available. When making high-test molasses, with the recovery plant idle, the saving is likely to be as little as 1 per cent. of steam, and when using refinery pan or evaporator vapour it can be as much as 6 per cent. of steam on melt.

Future Developments.—From experience gained on this plant it seems possible to say :—(a) the vapour melter condenser need not be large ; (b) the distribution need not be elaborate ; (c) the entrainment catcher can be small ; and (d) the vapour melter condenser should be in series with other surface or jet condensers so that it can abstract as much heat as is required, leaving the remainder to go to the balancing condenser.

A development of some importance might be the contact heating of raw sugar magma. If hot affination is shown to be advantageous, the question of the method of heating becomes important. The Americans do it at the expense of a vast amount of power for high speed mixing and high velocity pumping of heating water. Direct contact heating of raw magma would be rapid and effective, and the addition of 2 per cent. water in the form of condensate might not be very serious when one is going to add 5–10 per cent. of wash water in the machines. The scheme would of course be a compromise between the disadvantages of dilution and the advantages of saving power, and such a device was described some years ago by PITCAIRN for the reheating of third crop massecuite. Such an arrangement would have to be a single pass affair, magma being made at the top and gravitating down a jet condenser with its tail pipe sealed in the machine supply trough.

Temperature elevation (*T.E.*).—A point of peculiar interest, although of small practical value, is that vapour melting provides an example of heat " running uphill." Condensation in a contact condenser is a matter of equalization of vapour pressures ; the heat transfer being incidental. As a sugar solution at a given temperature has a vapour pressure lower than that of water vapour at the same temperature, if the solution be brought into contact with water vapour the equalization of pressures will result in the sugar solution assuming a temperature in excess of the vapour temperature. This phenomenon, shown as " Boiling Point Elevation," is of course commonplace in vacuum pans and evaporators. In the existing plant, the vapour supply is sometimes inadequate, and readings of T.E. have therefore to be taken under suitable conditions.

Some observations in December, 1943, showed an actual T.E. of 0·55°C. as compared with a possible 2·55°C. These figures could no doubt be improved by better distribution of the liquor, but the reliability of the plant would be compromised and as the gain would be small it has not been attempted. It has been demonstrated in the Research Laboratory that vapour at 50°C. will condense in KOH solution at a temperature of 70°C.

Boiling House Control.

New Formulæ Presented.[2]

By S. N. GUNDU RAO.

The procedure adopted by the author in developing the new formula is to keep the manufacturing losses per unit sugar entering the boiling house constant and only allow for such losses resulting from changes in juice purity. Let r = Actual Boiling House Recovery E. S. G. ; m = Final Molasses Gravity Purity ; J = Gravity Purity of Juice ; R = Reduced Boiling House Recovery E. S. G. at Juice Purity 85.

Now total losses per unit sugar entering the Boiling House = 1 — r. The losses can be split into (a) loss in molasses and (b) other manufacturing losses. The loss in molasses $= \left(\frac{1}{J} - 1\right) \frac{m}{1-m}$

Other manufacturing losses =

$$\left[(1-r) - \left(\frac{1}{J} - 1\right) \frac{m}{1-m}\right] .$$

While reducing the actual recovery to the Reduced Recovery at 85 purity of Juice (J′), all that we are

1 NOTE : All steam is expressed as F/A with a total heat of 639 CHU/LB.
2 *Proc. 13th Conv. Sugar Tech. Assoc. India*, Pt. 1, pp. 43-52 (here abridged).

required to do is to keep the manufacturing losses the same and alter the loss in Molasses resulting from the change in juice purity. R = 1—total loss.
= 1 — (Manufacturing loss + Molasses loss).

$$= 1 - \left[(1-r) - \left(\frac{1-J}{J}\right)\frac{m}{1-m} + \left(\frac{1-J'}{J'}\right)\frac{m}{1-m}\right]$$

$J' = \cdot 85$

$$R = 1 - \left[(1-r) - \left(\frac{1-J}{J}\right)\frac{m}{1-m} + \frac{0\cdot 15}{0\cdot 85}\left(\frac{m}{1-m}\right)\right]$$

Further simplification leads to—

$$R = r + \frac{m}{1-m}\left(\frac{17-20\,J}{17\,J}\right)$$

The formula overcomes the objections against Deerr's formula and is very simple. The Reduced Boiling House Recovery, E.S.G. can be calculated in one straight step and provides a really dependable basis for comparison under varying conditions of juice purity. Any juice purity can be selected as the standard with corresponding changes in the above formula.

Influence of clarification.—In the formula given above, the loss in molasses is calculated on assumption that non-sugar entering in mixed juice will quantitatively pass on to the final molasses. But this is incorrect in so far as non-sugars will be added or eliminated during clarification depending on the efficiency of clarification process and its control. The non-sugar causing the molasses loss is that which is actually present in clarified juice and therefore, introduces corresponding changes in the quantity of molasses.

Thus, if K = Non-sugar in Clarified Juice per unit Non-sugar in Mixed Juice, then, the molasses loss would be $K\left(\frac{1-J}{J}\right)\frac{m}{1-m}$ and when manufacturing conditions remain the same, K will also remain the same and at juice purity J′, the molasses loss will be : $K\left(\frac{1-J'}{J'}\right)\frac{m}{1-m}$. The new formula for Reduced Boiling House Recovery will then be :—

$$R = r + K\frac{m}{1-m}\left(\frac{17-20\,J}{17\,J}\right)$$

Where r = Recorded B. H. Recovery; m= Actual Molasses Gravity Purity; J=Gravity Purity of Juice; and K=Non-sugar in Clarified Juice per unit Non-sugar in Mixed Juice.

B. H. P. Figure—The ratio of actual Boiling House Recovery E. S. G. to the Basic Recovery (with S = 100 and m = 28·57) has been accepted as a measure of the Boiling House Performance. Copp, however, introduces v, the Virtual Purity of Molasses in his formula for B. H. E. N. These figures have objections to them as with the Winter Rendement in that they depend on the purity of juice. To overcome this variable factor in Boiling House Performance, and get a ratio in which the basic figure does not alter, the author suggests the adoption of the constant basic recovery at juice purity 85. The new Boiling House Performance figure would then be :—

$$\text{B. H. P. (Rao)} = \frac{\text{Reduced Boiling House Recovery E.S.G. by new formula}}{\text{Basic B. H. R. at 85 juice purity}} = \frac{\text{Reduced B.H.R., E.S.G. by new formula}}{92\cdot 95}$$

Reduced over-all Recovery, E.S.G.—The reduced overall recovery E.S.G. as adopted by the International Society of Sugar Cane Technologists cannot now be accepted. It is suggested that the formula may now be modified as follows :—Reduced Overall Recovery E. S. G. = Reduced Extraction (Deerr) × Reduced Boiling House Recovery (Gundu Rao) :

$$= \frac{7-v}{7} \times \left[r + K\left(\frac{m}{1-m}\right)\left(\frac{17-20\,J}{17\,J}\right)\right]$$

Where $v = \frac{(1-e)\ (1-f)}{f}$

The Reduced Overall Recovery E. S. G. as calculated by the above formula provides the best scale for comparing the Overall Performance of different factories or of the same factory under varying conditions of cane quality.

Table I. Table II.

J.	Calculated Virtual Purity	R.B.H.R. (Deerr) B.H.P. 94·44	R.B.H.R. (GunduRao) B.H.P. 94·44	R.B.H.R. from new formula using new B.H.P. 94·44
74	36·3	90·54	89·90	87·78
76	36·7	90·22	89·47	87·78
78	37·0	89·84	89·04	87·78
80	37·5	89·41	88·67	87·78
82	38·0	88·86	88·29	87·78
84	38·7	88·18	87·94	87·78
85	39·0	87·78	87·78	87·78
86	39·5	87·31	87·61	87·78
88	40·6	85·95	87·28	87·78
90	42·0	84·49	86·96	87·78
92	44·0	82·04	86·67	87·78
94	47·1	77·91	86·39	87·78

Table III.

		A	B
1	K=Non-sugar in Clarified Juice % Non-Sugar in Mixed juice	93·83	99·51
2	Purity of Mixed juice	88·24	82·31
3	Purity of Final Molasses	31·77	32·59
4	Loss in Press Cake % Pol in Mixed juice	0·39	0·45
5	Loss undetermined Mixed juice	2·36	2·45
6	Loss in Molasses	5·69	9·95
7	Loss (4) + (5)	2·75	2·90
8	Recorded Boiling House Recovery	91·56	87·15
9	Reduced Boiling House Recovery (Deerr)	88·80	89·47
10	Reduced Boiling House Recovery (Gunda Rao)	89·69	89·00

Actual Factory Data :—(Table III). After developing the formula, the author had the oppor-

tunity to examine the factory working data of a factory which was throughout handling high purity juices and suddenly in a week had handled juices whose purities were six units lower. Figures from two periods A and B have been copied from the actual records which confirm observations set forth in this paper and also the greater reliability of the new formula as an indicator of the boiling house working.

It will be seen that all the standards that go to determine the working of the boiling house such as (*a*) Non-sugar elimination (*b*) loss in press cake (*c*) unknown loss (*d*) purity of molasses etc. show superior working in A, whereas when the Reduced Boiling House Recovery is worked by Deerr's formula, B becomes more efficient. The new formula on the other hand depicts the correct state of affairs.

The author's thanks are due to Mr. H. G. KULKARNI, Laboratory-in-charge, for Calculations and graphs.

Sugar and its By-Products

In the Plastics Industry.[1]

By LOUIS LONG, Jr., Ph.D., Massachusetts Institute of Technology.

Sugar (*Sucrose*). Several moderately successful attempts have been noted in the literature to form a commercially useful plastic material from pure sugar. In 1929, a patent[2] was issued in Germany covering the preparation of hard, insoluble and infusible products by heating sugar with a persulphate, such as ammonium persulphate. It was stated that the physical properties of the products could be modified by including in the reaction mixture small quantities of oils, natural or synthetic resins, or inert salt solutions, and that fillers might also be added. It was claimed that the products could be used for making moulded articles. This appears to be the first mention of the use of sugar for plastic formation.

" Sakaloid," a new sugar plastic, was announced in the United States in 1931, and the inventor obtained three patents[3] to cover its manufacture. In the first, it was stated that a plastic substance could be made by reacting together a disaccharide, an aldehyde and urea; phthalic anhydride was substituted for urea in the second, and an aliphatic carboxylic acid in the third. It was said to be of an absolute water-white clarity. He stated that a block of " Sakaloid," ten or more inches thick, could be placed over the smallest type and that the latter could be read through the mass as well as if uncovered. The polymerization could be interrupted to produce a product called " Rubba-glas " which was claimed to have all of the properties implied in its name.

In the next stage, the hardened form, a brilliantly clear quartz-like product was said to be produced. It was reported to have a refractive index approaching quartz, a transparency to ultra-violet and infra-red rays, and in addition, it could be drawn machined or drilled. A moulding powder made from this material could be pressure moulded with heat in an irreversible manner. "Sak-a-tex " was the name given to the material when applied to paper or textiles ; " Sak-a-lac," when used for varnishes and lacquers ; and " Sak-a-tine " when extruded into filaments for spinning and weaving. A photograph of the new sugar plastics was displayed in which were included elastic, rubbery masses, completely hardened forms, some tinted and others water white, some moulded from powder and some cast. However, no further mention of the manufacture of " Sakaloid " could be found in the literature, and it is believed to have met with little success.

In a patent[4] issued during the following year, another inventor claimed to have prepared resins to serve as substitutes for shellac by heating together cane sugar, water and crystalline phenol in the presence of a small amount of hydrochloric acid. In this case, the final product was a dark-coloured hard resin. Also in 1932,[5] a patent disclosure was made describing the formation of a resin by the reaction of a carbohydrate such as sugar with a non-substituted ether-forming oxide, such as ethylene or propylene oxide, in the presence of aqueous alkali.

An interesting report of a plastic with the trade name of " Sucrolite " was published[6] in 1935. It is described as a cheaper form of " Bakelite " in which sucrose has been substituted for formaldehyde, the most expensive of the raw materials involved in the phenol-formaldehyde condensation process. An " A " resin is first produced by heating a mixture of phenol, suphuric acid and sucrose under suitable conditions. It is described as a black, brittle, shiny, lustrous, but not porous material. To increase its strength for moulding purposes, the "A" resin is mixed with a filler, such as wood pulp, and a hardening agent The composition of the finished product is about

1 Scientific Report Series No. 1, published by the Sugar Research Foundation, Inc., New York (here much condensed). A preliminary abstract has already been printed, see *I.S.J.*, 1945, p. 199.

25 per cent. sucrose, 50 per cent. filler and 25 per cent. phenol. Among the possible applications of the plastic are mentioned the varnish and lacquer industry, as a material for table tops, in the radio and electrical industries, and as floor and wall tiles in the building industry.

A plastic made from sucrose and aniline in a similar manner and with like properties is also described. However, due to the use of aniline, the manufacturing cost is higher. A third plastic is mentioned, made from sucrose, formaldehyde and urea. This plastic is said to have the same properties as glass, and to be convertible into any colour. To obtain a satisfactory finished product, however, great care is required in its manufacture. In a review of the progress made in this field, published in England in 1943,[7] it is stated that thus far these sugar plastics have been manufactured only on a laboratory or semi-industrial scale.

In 1937, a British patent[8] granted to the German I. G. Farbenindustrie described the reaction of acetylene with carbohydrates at an elevated temperature, in the presence of a strongly alkaline acting substance as a catalyst. Carbohydrate derivatives, which still contain at least one reactive hydroxyl group and are stable in the presence of basic substances above 100°, may also be used. As examples of such substances, are mentioned tetramethyl glucose or preferably carbohydrate derivatives that are acetalized to a considerable extent, such as *B*-diacetone fructose, mono-acetone glucose, or the mixture of these formed by treating sucrose with acetone and sulphuric acid. The products may be used as softening agents for lacquers and plastic masses, or may be polymerized. The polymerization products may be used, alone or mixed with other substances, for the preparation of lacquers, films or foils.

A patent[9] for the polymerization of a sugar, such as glucose or sucrose, was issued in 1937. The polymerization was effected by heating the sugar at about its boiling point in the presence of an aqueous solution of an inorganic acid, such as 20 per cent. hydrochloric acid. The resin so formed is soluble in acetone, and is compatible with cellulose acetate and nitrate. Insoluble resins suitable for use in the treatment of water by anion exchange are prepared by condensing m-phenylene diamine with a mono- or di-saccharide in the presence or absence of a non-sugar aldehyde. The diamine is used as its salt. As an example, the hydrochloride of m-phenylene diamine is condensed with sucrose, and then with formaldehyde. This disclosure was made in a British patent[10] issued in 1937.

Another recent, interesting series of patents[11] describes the production of a polysaccharide from sucrose, called dextran, by a microbiological process. Dextran is said to form plastic amorphous masses when caused to react with an alkyl or aralkyl halide and sodium hydroxide. These plastics are either water-soluble, or insoluble, depending upon the reaction conditions, and the particular halide involved.

Sucrose Octaacetate.—Although the esters of sucrose are not used to form plastics, they are of some importance in the plastics industry as plasticizers and solvents. Up to 1932, sucrose octaacetate[12] had been used as a gum constituent of lacquers, a plasticizer, in anhydrous adhesives, and in the treatment of paper.[13] In 1933, Dr. G. J. Cox of the Mellon Institute for Industrial Research described[14] the semi-plant preparation of the octaacetate, octapropionate and octabutyrate esters of sucrose. The work done under a Multiple Fellowship of the Sugar Institute, Inc. In 1943, British Celanese, Ltd., patented[15] a process to prepare sucrose octaacetate in a yield of 80 per cent. of the theoretical.

Glucose and Fructose—Several references to the use of glucose and fructose (dextrose and levulose) in the formation of plastic materials have already been made under the discussion of sucrose plastics. Fructose and glucose were included as compounds useful for the preparation of water-insoluble resins[10] suitable for use in the treatment of water by anion exchange. *B*-diacetone fructose and tetramethyl glucose were mentioned as two of the compounds available for reaction with acetylene,[8] to be followed by polymerization of the vinyl ether so-formed.

A number of additional processes for the polymerization of glucose have been recorded. J. V. MEIGS made numerous patent disclosures concerning synthetic resins from glucose during the period from 1931 to 1933 inclusive. The various methods included the use of mixtures with glucose of aniline and phenol[16]; aniline and hydrochloric acid[17]; phenol, furfural and hexamethylenetetramine[18]; phenol, china wood oil and hexamethylenetetramine[19]; hexamethylenetetramine and calcium hydroxide[20]; and glycerol and sulphuric acid[21]. Also in 1933, a patent[22] was assigned to WEISS and DOWNS, Inc., covering the use of a hexose with the anhydride of a dicarboxylic organic acid at a temperature not exceeding 170°C.

The firm of Holzhydrolyse A.-G. in 1934 and 1935 patented a number of processes[23] for polymerizing carbohydrates. Some of the methods included treating the solution of a monomeric aldohexose with a small amount of hydrochloric acid, evaporating to dryness, and then heating with a current of hot air. Another patent described treating finely powdered carbohydrates with a small excess of acetic anhydride in the presence of an acid condensing agent, and using the product as the starting material for a polymer.

In 1936, a patent[24] described melting a monose with about one-hundredth of its weight of sulphuric acid and heating to remove water at 120-180°C. The Celanese Corporation[9], in 1937, found that the resinous product formed by the polymerization of glucose in the presence of an aqueous mineral acid is compatible with cellulose acetate. An animal or vegetable

glue, water and the reaction product of glucose and an alkaline earth bisulphite was patented[25] in 1943 for use as an adhesive in laminating papers.

Glucose is among the substances described to form useful products when esterified with α-chloroacrylic acid and polymerized, in a patent[26] assigned to the Pittsburgh Plate Glass Co. in 1944. The esters may be polymerized to form either insoluble infusible insoluble fusible, or soluble fusible plastics. Numerous uses of the products include the preparation of lacquers and moulded materials, and the manufacture of safety glass.

Molasses.—Polymerized molasses has found application as a road-surfacing material as well as for the formation of plastic articles. As early as 1908, experiments[27] were undertaken at Newton, Massachusetts, by the United States Department of Agriculture utilizing molasses as a road binder. The practical tests were tried after successful laboratory experiments had been completed. Some thirty years later, several papers[28] were published by chemists in India describing the successful use of molasses, resinified by heat and acids, combined with coal tar and asphalt, to form an insoluble road material.

In the plastic field, a patent[29] was issued in 1934 for a process in which an acid liquor rich in organic acids and esters was extracted from molasses by the action of a mixture of sulphuric acid, alcohol, and an organic solvent such as ethyl acetate. The acid liquor is heated to about 100-120°C. in a concentrated solution to obtain a hard, non-inflammable, heat-resistant, insoluble, infusible resinoidal product which is suitable for use in making moulded articles.

Bagasse.—Bagasse is in a favourable position as a raw material in that the cost of initial collection and defibering has already been absorbed in the manufacture of sugar. Costs of baling, storing and transportation after receipt from the mill, however, must be borne by the using industry. Of the 423,000 tons of bagasse produced in continental U.S.A. and the 3,276,000 tons produced in insular U.S.A. per annum in the period 1931-1935[30], probably 250,000 tons per annum were used in the production of structural and insulating board.

In 1933, the U.S. Forest Products Laboratory at Madison, Wisconsin, proposed methods for the production of plastic materials from sawdust, and allied substances. These methods[31] consisted essentially of hydrolysing or digesting the raw material at elevated temperatures and pressures with dilute acid or with aniline, and mixing the hydrolysed residues with aniline. Subsequently, about 1938, the Agricultural By-Products Laboratory at Ames, Iowa, studied the effects of a number of variables on the above procedures applied to bagasse.[32, 33]

The aniline bagasse plastic seemed to show the greatest promise. A comparison of certain physical characteristics of the bagasse plastic with those of the phenol-formaldehyde type is presented in the following table:

	Flexural Strength lbs/sq. in.	Moisture Absorption %	Specific Gravity	Hardness	Moisture in Air-Dry Moulded Product %	Cost $/lb.
Bagasse Plastic	6,900	2·99	1·38	90	0·86	0·054*
Phenol-Formaldehyde Plastic	7,063	0·34	134·	98	0·25	0·14†

*Cost of labour, steam, etc., is not included.
†All costs are included.

The bagasse plastic compares favourably in all of the properties listed with the exception of its moisture content, and the latter has been improved in further experiments made in recent years.

A pilot plant for the production of moulding powders from bagasse, based on the procedures developed at the Agricultural By-Products Laboratory, was erected in 1939 at a sugar mill in Louisiana, with a capacity of about 200 lbs. of powder per day. The product offered for commercial use was an improvement over the laboratory product in-so-far as moulding characteristics were concerned, but it did not meet with any commercial success[34]. Chief among its shortcomings were the excessibly long curing time required, poor flow qualities and excessive gassing during moulding. In view of these difficulties, attempts at marketing the product were discontinued for over a year, and all efforts were devoted to improving the material.

A product was finally developed which was comparable in most respects with the general purpose thermosetting compounds previously on the market, and which had certain advantages over many of them in shortness of curing time, flow and finish. A few tons of this material were manufactured, sold, and successfully used for commercial articles.

In the devlopment work, the process was divided into two parts: the production of a resin from bagasse with complete destruction of the fibrous and non-reactive portions; and a parallel development of a satisfactory filler from bagasse. A resin was successfully developed, as well as a filler made from bagasse which, when used in combination with the bagasse resin, was superior to wood flour and other common types of filler.

It was reported early in 1944[35] that a steadily growing demand for the thermosetting moulding components based on bagasse had made in necessary to expand manufacturing facilities from the original pilot plant scale to a full-sized commercial unit. Research was directed toward the final development of two products—a general purpose and a semi-impact moulding compound.

In the course of a search for a molding compound which could be manufactured within the use of any critical raw materials, a new thermoplastic resin based upon bagasse was developed. The characteristics of this material suggested its use as a possible substitute for shellac in the manufacture of phonograph records, with the result that after a period of preliminary experimentation, commercial production was started in September 1942.

The development of an alcohol-soluble bagasse resin showing some promise for use in laminating paper was continued during 1943. A water-soluble thermosetting bonding resin, suitable for use with paper, cloth and veneers, has been carried to the point of undergoing commercial tests. Its favourable characteristics include its extreme solubility in water, its rapid cure, and the relatively low temperatures and pressures required for complete curing. The resin is reported to have an unusual degree of flexibility after curing and to be very resistant to water.

Co-operative work between the Agricultural By-Products Laboratory and the automotive and rubber industries developed the fact that these moulding powders can be compounded with both synthetic and natural rubbers. Steering wheels of moulding powder-synthetic rubber have passed all laboratory and service tests. Gasket material of the same mixture has superior oil resistance, if not subjected to heat. It can also be sustituted for part of the shellac used in the preparation of the hard, dense, lustrous materials used for fender guards. The automobile industry, in addition, in interested in its use for buttons knobs, dashboards, panels and other automobile parts.

Other possible applications of the moulded plastic include its use as electrical insulation material in the manufacture of radio and electrical equipment, and as tiles, table and desk tops, window frames, and numerous other articles of interest to the building and furniture industries.

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3 A. S. FORD (to Industrial Sugar Products Corp.), U.S. Patent 1,949,831,; 1,949,832,; 1,974,064,; A. S. FORD, *Plastics*, 1931, **7**, p. 448.

4 J. V. MEIGS (to Meigsoid Corporation), U.S. Patent 1,845,314.

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12 *I.S.J.*, 1935, p. 278.

13 G. J. COX and J. METSCHL, *Ind. Eng. Chem.* (News Ed.), 1932, **10**, p. 149.

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16 J. V. MEIGS (To Meigsoid Corporation), U.S. Patent 1,801,052.

17 J. V. MEIGS (to Meigsoid Corporation), U.S. Patent 1,801,053.

18 J. V. MEIGS (to Plastix Corp.), U.S. Patent 1,868,215, July 19th, 1932.

19 J. V. MEIGS, U.S. Patent, 1,868,216, July 19th, 1932.

20 J. V. MEIGS (to Plastix Corporation), U.S. Patent 1,877,417, September 13th, 1933.

21 J. V. MEIGS (to Sweets Laboratories, Inc, U.S. Patent 1,908,485, May 9th, 1933.

22 J. M. WEISS (to Weiss and Downs, Inc.), U.S. Patent 1,999,380, November, 17th, 1933.

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24 E. FARBER (to N. V. Internationale Suikeren Compagnie), U.S. Patent 2,027,904, Jan. 14th, 1936.

25 N. R. PIKE, P. H. KELM, and G. A. MCLAREN, Jr. (to Applied Sugar Laboratories, Inc.), U.S. Patent 2,322,736, June,22nd, 1943.

26 M. A. POLLACK (to Pittsburgh Plate Glass Co.), U.S. Patent 2,388,967, Jan. 11th, 1944.

27 *Rock Products* (1908) **8**, p. 26.

28 H. D. SEN, *I.S.J.*, 1937, p. 445; 1938, p. 405; 1939 p. 389; 1940; p. 260.

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32 T. R. MCELHINNEY, T. F. CLARK and D. J. F. LYNCH, *Mod. Plastics*, 1938, **16**, p. 42.

33 T. R. MCELHINNEY and S. I. ARONOVSKY, *Mod. Plastics*, 1940, **17**, p. 59.

34 T. R. MCELHINNEY, Plastics Catalogue, p. 214-216 Plastics Catalogue Corp., New York., 1943.

35 T. R. MCELHINNEY, Plastics Catalogue, p. 274-275, Plastics Catalogue Corp., New York (1944).

MR. ANDERSON ON SUGAR.—Mr. Clinton P. Anderson, the new Secretary of Agriculture, Washington, is reported in a press interview as having stated that he had never questioned the nutritional value of sugar, though the Department's experts had done so. He thought it far better to admit the serious shortage of sugar, and to take steps to remedy it, rather than attempt to discredit its value, and tell people not to use it. Of course, he concluded, it is a good food.

CANE AGRICULTURE IN T.H.—The Waimanalo Sugar Co. reported that their crop had dropped to 36 tons of cane, and 2·95 tons of sugar, last season. The cane averaged 19·8 months old, and demonstrated that the 1389 ratoons could not withstand drought. It is planned this year to plant largely with 8560 cane, using a new planting machine, thus almost entirely replacing the 1389 variety. The 8560 variety is being extended everywhere, being found to withstand drought conditions excellently, and to be ideally suited to mechanical harvesting. It has given average yields of 53·85 tons of cane and 6·43 tons of sugar, in spite of the unprecedented drought on Maui.

BROADBENT'S 4-MAN SUBMARINES.—Probably the most romantic of Huddersfield's war-time industrial achievements was the building in strict secrecy by Messrs. Thomas Broadbent & Sons, Ltd., in association with two other firms, of a number of "X" Craft, that is, miniature submarines for crews of four, these being designed to search out and destroy enemy ships in harbour. These small craft carried relatively large explosive-filled tanks attached to each side of the hull, capable of being released at will by the crew. These submarines were constructed and assembled completely at Broadbents' Central Ironworks, and all small parts and accessories were made by the firm, excepting only equipment such as electric batteries and scientific instruments. Completed, and disguised as large motor boats, they were conducted in the early hours of Sunday mornings along the deserted streets of Huddersfield, whence by special trains with their crews for the Clyde—and the sea. The officers and crews of these Four-Men Submarines have been awarded the following decorations: 2 Victoria Crosses; 7 Distinguished Service Orders; 10 Distinguished Service Crosses; 3 Conspicuous Gallantry Medals; 26 Mentioned-in-Despatches.

Precipitation of Magnesia as an Aid to Settling

and its Possible Application to the Sugar Industry.

By NOËL DEERR.

The mechanics of settling of aqueous coarse suspensions such as those afforded by the salts of the alkaline earths have been given by COE and CLEVENGER[1], by ROLLASON[2] and by DEERR[3]. If such a suspension, for example a 0·5 *N* suspension of calcium carbonate, be allowed to settle in a cylinder, tall in proportion to diameter, it will in a short time be found to have divided itself into three zones :— (1) An uppermost clear zone free of suspended matter. (2) A middle zone where the particles are falling freely at an even rate. (3) A nethermost zone made up of particles that have come to rest. Zones 1 and 3 are constantly increasing in depth and zone 2 is decreasing. Eventually zone 2 coalesces with zone 3, and the system is now reduced to two zones. Settling is now complete and this condition is referred to by COE and CLEVENGER as the critical position. The observations here made typify two essential points in cane juice defecation : rapidity of settling and sedimentation volume.

If within the body of such a suspension there be precipitated by the action of an alkali a small quantity of magnesium hydroxide, the rate of settling will be found to increase, and eventually with selected quantities of magnesium salt and of alkali the suspended material will pass to a precipitant condition and will settle with extreme rapidity. At the same time, dependent on the quantities of magnesium salt and of alkali, the sedimentation volume may present a notable increase.

This phenomenon is to be associated with the SCHULZE–HARDY[4] effect dealing with the coagulation of sols by electrolytes, which has been extended by WOSSNESSENSKY[5] to coarse suspensions. Reference may also be made to CLARK[6] and his colleagues, and to FLENTJE[7]. It is also known to and made use of by Messrs. ALFLOC Ltd. in their process of boiler water treatment[8]. As far as an intensive survey of the literature allows me to write, there has appeared no detailed study of this phemomenon ; and, if I have overlooked any, its author's indulgence is asked.

The extent and nature of this behaviour may be assessed from the experimental data detailed below.

A suspension of calcium carbonate was prepared by mixing equivalent quantities of the chloride and of sodium carbonate at a temperature of 90°C. After washing by decantation till free of chloride, a stock suspension containing 100 grms. calcium carbonate per 1000 c.c. (2 *N*) was prepared. Of this 10 c.c. were introduced into a measuring cylinder of 50 c.c. capacity, the graduation marks of which were closely 1 mm. apart. The cylinder was then filled nearly to the 50 c.c. mark with distilled water leaving space for the subsequent introduction of the predetermined quantities of magnesium salt, added as chloride in normal concentration, and of sodium hydrate in 0·2 *N* concentration. These materials were added as drops from burettes, the jets of which had been adjusted to deliver 1 c.c. in twenty drops. The magnesium salt was always added first as it was observed that variation in the order of addition made substantial differences in the rate of settling. Mixing was effected by rotation of the cylinder and its contents in a vertical plane. After the final mixing, the cylinder was set on one side to settle, the times being reckoned from this point. During settling the cylinder was kept in a 1,500 c.c. beaker filled with water, the temperature of which was controlled within the limits 24·8–25·2°C. The beaker itself was covered with paper except for two narrow and opposite vertical windows over against one of which was placed an electric bulb. This arrangement enabled the divisions between the three zones to be read with reasonable fidelity.

A large number of determinations was made embracing the rate of settling of calcium carbonate, sulphite, phosphate and oxalate, and also of barium sulphate. The observed results of the rate of settling and of the critical position (giving also the sedimentation volume) of a 0·04 *N* suspension of calcium carbonate in 0·008 *N* sodium hydrate, as affected by the presence of magnesium chloride in concentrations from 0·00001 *N* to 0·04 *N*, are given in Table I. Table II presents the same data for a 0·04 *N* suspension of calcium carbonate in 0·001 *N* magnesium chloride with concentrations of sodium hydrate from 0·0002 *N* to 0·0096 *N*.

In these tables the column on the extreme left gives the depth of the uppermost layer or of zone 1. The entries in the corresponding horizontal lines give the times in seconds for the system to assume this position. The entries in the horizontal line corresponding to C in the left hand column give the depths at which the critical position appeared, the entries

1 *Transactions of American Society of Mining Engineers*, 1916, p. 356. Most easily accessible in "Chemical Engineers' Handbook" edited by PERRY and CALCOTT (New York, 1934), p. 1346. 2 Student's Thesis, Massachussets Institute of Technology, quoted by WALKER, LEWIS and MCADAMS in "Principles of Chemical Engineering "(New York, 1927). Second Edition, p. 336. 3 *I.S.J.*, 1920, p. 618. 4 SCHULZE : *Journal für praktische Chemie*, 1882, **23**, p. 431. HARDY : *Proceedings of the Royal Society*, 1888, **60**, p. 110. LANDON and PICTON : *Journal of the Chemical Society*, 1896, **67**, p. 53. ODEN : *Kolloid Zeitschrift*, 1920, **26**, p. 100. 5 *Kolloid Zeitschrift*, 1922, **31**, p. 338 ; 1923, **33**, p. 32. 6 CLARK and PRICE : *Journal of the Society of Chemical Industry*, **52**, No. 6, pp. 35-44T. CLARK and HAMER, *loc. cit.*, **54**, No., pp.25–28T. CLARK and COUSINS : *loc cit.*, **54**, No. 21, pp. 143–49T. 7 *Journal of the American Waterworks Association*, 1927, **17**, p. 253. The title of this is "Calcium and Magnesium Hydrates as coagulating Agents." 8 "Sodium Aluminate in Water Treatment," p. 15.

in the bottom horizontal line affording the corresponding times in seconds.

It is suggested that this specific property of magnesium in promoting the coagulation of indifferent coarse suspensions has a bearing on sugar-house problems and practice..

(1) In defecation, using lime only, the rate of settling and the sedimentation volume may be influenced by the amount of magnesium normally present in the juice.

(2) That the conditions under which the settling of cane juices occur may possible be favourably modified by the introduction of magnesium salts.

(3) That in the process of sulphitation of cane juices, in preparation for white sugar manufacture, a coagulated condition obtained in the precipitated calcium sulphite may have some beneficial effect.

(4) Where a clarification of the juice as a final treatment before sending to the evaporator is practised, the coagulation of a material such as calcium carbonate following on the precipitation of magnesia by an alkali (which in this case would be lime) may have that final clarification effect upon which the quality of the sugar largely depends.

(5) The experiments, of which an account has been given above, were all made with precipitated material. Later trial was made to see if powdered limestone would behave in a similar way. This was found to be the case. In such a combination there were found the grosser particles and coagulated material. The former might possibly serve as a filter bed if a more positive separation than that obtained by settling were considered advantageous.

(6) Clarification by the use of this coagulation property would appear to be of general application outside of its use in the sugar-house. An immediate application would seem to lie in the treatment of factory effluents before discharge to a river or swamp.

The coagulation of coarse suspensions and their application to sugar-house practice may not be novel. Recently I was able to secure a treatise on sugar cane cultivation and the manufacture of sugar that was new to me[9]. On page 128 of this there appears the statement quoted in full below :—

" PREPARATION AND USE OF CLAY BATTER. In the previous direction the cream-of-lime is recommended to be used along with clay batter or gypsum or whiting batter. The beneficial effects have not been taken advantage of to the extent they might be. The clay is best prepared by digging a stiff adhesive clay, containing little sand, from such a depth as to

TABLE I.

Rate of settling in seconds of 0·4 *N* suspension of $CaCO_3$ in 0·008 *N* NaOH as determined by the precipitation of $Mg(OH)_2$

Depth of upper-most zone, mm.	0	0·00001 *N* $MgCl_2$	0·00002 *N*	0·00004 *N*	0·00008 *N*	0·00016 *N*	0·00020 *N*	0·00040 *N*	0·00060 *N*	0·00080 *N*	0·00100 *N*	0·00200 *N*	0·00300 *N*	0·00400 *N*	0·00600 *N*	0·00800 *N*	0·01200 *N*	0·01600 *N*	0·02400 *N*	0·03200 *N*	0·04000 *N*
40	119	90	78	71	63	50	44	28	25	20	20	22	26	31	35	37	34	43	43	53	55
50	134	105	96	87	81	57	50	34	30	27	25	27	33	38	44	45	4	55	52	69	68
60	148	123	117	102	93	64	56	40	35	31	30	32	39	45	53	53	56	68	65	88	87
70	173	142	131	120	111	73	65	46	41	38	36	37	47	54	63	63	77	100	91	187	187
80	193	162	150	137	123	80	73	52	47	43	41	47	58	63	84	98	151	180	175	240	237
90	217	183	169	160	136	100	89	65	118	130	153	171	178	177	227	339	643	949	1095	1603	—
C	93	92	92	92	92	90	90	86	86	86	85	80	80	84	80	76	70	68	70	66	66
	229	192	178	167	141	100	89	60	53	57	57	47	58	80	84	82	77	93	91	112	141

TABLE II.

Rate of settling in seconds of a 0·4 *N* suspension of $CaCO_3$ in 0·001 *N* $MgCl_2$ as determined by the precipitation of $Mg(OH)_2$

Depth of upper-most zone, mm.	0	0·00020 *N* NaOH	0·00040 *N*	0·00060 *N*	0·00080 *N*	0·00120 *N*	0·00160 *N*	0·00240 *N*	0·00320 *N*	0·00480 *N*	0·00640 *N*	0·00800 *N*	0·00960 *N*
40	119	102	92	80	57	52	47	51	30	30	22	20	26
50	134	113	113	102	78	67	61	63	36	39	26	25	32
60	148	122	131	117	91	79	71	75	42	48	30	30	38
70	173	160	156	141	112	95	82	84	49	56	35	36	41
80	193	195	177	162	127	107	94	99	56	64	43	41	48
90	217	215	195	178	148	120	114	123	114	121	136	153	144
C	93	93	93	93	91	91	90	90	88	88	85	85	85
	229	228	209	191	153	125	114	123	90	77	55	57	58

[9] ANGUS MACKAY " The Sugar Cane in Australia " (Sydney, 1883), p. 128.

be free from roots, and as free from organic matter as possible. This clay should be well dried in the sun, the dry masses crushed by an edgestone or otherwise, and screened through a wire gauze sieve of from ten to fourteen threads to the inch. Clean water is put into any appropriate vessel and the sifted clay poured into it gradually, mixing it well up, till the whole is of the consistency of cream or batter. From four to eight gallons of this batter, mixed with the ascertained quantity of cream-of-lime, would go to a clarifier of 500 gallons of cane juice. When gypsum or whiting is used in place of the clay, it must be in very fine powder."

I mentioned the subject matter of this communication to Mr. D. M. SEMPLE, the managing director of the Mirrlees Watson Co. Ltd. Shortly afterwards in the archives of this firm he came across a letter written in February 28th, 1889 by the late Mr. W. J. MIRRLEES who was then making a world tour of the sugar industry. He was describing a new diffusion process which was then being operated at Broadwater, Australia, and which I have his leave to quote.

"They are going to use carbonate of lime in the diffusers. This must be freshly made and not in the form of chalk as I had previously imagined. They make lime water, which must be dilute enough to quite dissolve the lime. Then carbonic acid is pumped through the lime water which precipitates the lime in the form of carbonate, precipitated chalk in fact. This is collected in filter-presses and mixed in the proportion of 1 lb. per diffuser with the slices. Sugar made by this process is particularly good and gives little trouble when taken direct from the diffusers to the triple effect."

Summary.—Attention is called in this article to a phenomenon following on the precipitation of magnesium hydroxide within the body of coarse suspensions of materials such as calcium carbonate, barium sulphate, etc. By this phenomenon is implied the assumption of a precipitant condition by the coarse suspension following on the coagulation of the particles. There does not appear to be any but scanty reference to this behaviour in the literature of colloid chemistry over the past twenty-five years. It is suggested that the coagulation of indifferent materials by this means may have application in industrial chemistry generally and in the sugar industry in particular. Evidence is brought forward that this precipitant condition may have been unconsciously used sixty years ago in Queensland.

Brevities.

J. L. HULETT AND SONS, LTD.—Net profit for the year to April 30th, 1945, amounted to £125,938, after providing for taxation, depreciation, and other charges (previous year net profit was £137,283). The difference is mainly accounted for owing to a larger reservation for taxation. The directors recommend a dividend on the Ordinary shares of 6 per cent. (same) plus a bonus of 2 per cent. (same) and that £5,000 (same) be placed to dividend equalization reserve. In the previous year £5,000 was placed to general reserve.

REHABILITATION OF THE PHILIPPINES.—Millard Tydings, Chairman of the U.S. Senate's Territories Committee, on returning from the Philippines, suggested a gift of $100 million for their rehabilitation. He advocated a continuation of the pre-war trade policy for four to five years, and stated that he considered two or three years would be required for the restoration of the sugar industry there. On the other hand, Lt-Col. J. L. Rauh, U.S. Civil Affairs Administration, stated that he thought at least five years would be required before the P.I. would be able to produce sugar in any great quantity.

PROBLEMS OF THE BRITISH WEST INDIES.—A Joint Deputation from the West India Committee and the British West Indies Sugar Association was received by the Secretary of State for the Colonies recently (13th September). Mr. Creech Jones the Under-Secretary of State was also present. A general exchange of views took place in regard to the problems of the sugar industry of the British West Indies. The deputation consisted of Mr. J. Gordon Miller, Chairman, and Mr. Robert Gavin, Secretary, of the West India Committee and from the British West Indies Sugar Association—Mr. G. Douglas Pile (Barbados) Chairman, Mr. R. L. M. Kirkwood (Jamaica), Mr. G. M. Eccles (British Guiana) and Mr. H. E. Robinson (Trinidad).

WAR TIME BEET SUGAR IN U.K.—Annual figures of acreage and tons of beet harvested are given by the British Sugar Corporation, Ltd., as follows : 1939, 345,000, 3,529,000 ; 1940, 329,000, 3,176,000 ; 1941, 351,000, 3,226,000 ; 1942, 425,000, 3,924,000 ; and 1943, 417,000, 3,760,000. It is seen that 1942 was the peak year of production, when 1,200,000 tons more beets grown than in any pre-war year.

THE LATE H. E. POTTS.—He was a chemist, who as partner in the firm of W. P. Thompson & Co., of Liverpool, one of the most eminent patent agents in the country. He became widely known for his skill in drafting specifications, especially those of a chemical nature, and was regarded as one of the most eloquent and resourceful advocates in the Patent Court. His book entitled "Patents and Chemical Research" is accepted as a standard work of reference on the subject.

THE PHILIPPINE SITUATION.—The recently-formed Philippine Sugar Rehabilitation Committee express the opinion that no considerable production of sugar can be expected for 1945-46 ; but a number of experts now believe that with proper organization it should be possible to produce at least one-half of the normal crop in the 1946-47 season, and a full crop in 1947-48. Others are less optimistic. On Luzon a good deal of looting of fields for cane for the production of *panocha* and rum is going on, giving rise to the fear that there may not be enough cane left for seedlings. Information from Negros remains conflicting, but it is generally agreed that the situation there is at least as bad as on Luzon. R. Renton Hind,[1] estimates that six years will be necessary for the restoration of the Philippines former position, and that in any case their future depends on a continuance of a favourable policy by the United States.

[1] *Sugar*, 1945, **40**, No. 7, pp. 24-25.

Chemical Reports and Laboratory Methods.

A Comparison of Sucrose and Polarization Balances.

H. B. SPRINGER. *J.A.S.T. Quarterly*, **8**, No. 1, pp. 6-9.

During the last crop in addition to the usual analyses, determinations were made of the sucrose, using the invertase method. In the case of the mixed juice, the average of seven weeks gave a polarization purity of 83·92, and a gravity purity of 85·44. Factory polarization and sucrose balances were as follows :

	Tons of Pol.	Pol Bal. % Pol in Juice.	Tons Sucrose	Suc. Bal. % Pol. in Juice.
Recovered in the sugars	1187·69	91·24	1195·80	90·24
Lost in the Final Molasses	83·66	6·43	98·68	7·45
Lost in the Filter Cake,	16·97	1·30	16·97	1·28
Lost in refining the Raws	9·57	0·74	10·94	0·82
Undetermined	3·79	0·29	2·79	0·21
Total in the Juice	1301·68	100·00	1325·18	100·00

Conclusions : It is seen, therefore, that the sucrose recovery is lower than the polarization recovery by 1 per cent., and the molasses loss increased by a like amount. The undermentioned loss was affected to the extent of 0·08 per cent. only, a small difference that might well be ascribed to experimental error. Actually, therefore, at Monymust, the sucrose balance does not appear to offer a material advantage over the pol figure under present conditions for comparative purposes. This becomes the more evident when it is considered that greater differences in recovery have been due to the nature of the impurities present in the juice at different times, as is shown by a 20 to 30 per cent. variation in molasses produced per ton of cane at similar final purities.

In the discussion following the reading of the paper, M. B. FLORO said that he had made a similar balance comparison for eight weeks running, and had also found the actual recovery by the sucrose balance to be lower than by the pol balance. But he had noticed that the undetermined losses were affected by the sugar/reducing sugars ratio of the molasses. J. G. DAVIES remarked on the difference returned above, between apparent and gravity purity figures of juice and syrup which were higher than he had experienced elsewhere, his experience showing a difference of 0·5 to 0·6, instead of 1·52. In Trinidad the College and a commercial factory had run a sucrose balance over a good many crops, and at both factories it was observed that in the early part of the crop the pol may at times be higher than the sucrose. J. R. MCFARLANE said that he had maintained a sucrose balance throughout the past crop at Caymanas, finding the indetermined loss was much lower on a sucrose basis than on a pol basis. There was no relationship on which one could base a factor for converting pol to sucrose determinations.

Industrial Control of (Thermophilic and Mesophilic) Micro-Organisms in Beet Granulated Sugar.

ROBERT S. GADDIE and WILLARD A. OLSON. *Proc. Amer. Soc. Sugar Beet Tech., Third Meeting*, pp. 475–488.

Most of the thermophiles in granulated beet sugar have their origin in the soil, being in fact introduced with the beet itself. Counts of several thousands were made in 10 grm. of raw juice from the diffusion battery. A considerable proportion of this count is eliminated in the carbonatation with its subsequent filtrations, but many go through to become centres of contamination in later stages of the process. Unfiltered syrups and accumulations of sugars and juices throughout the factory show extremely high counts.

Experiments were devised at Toppenish beet factory (Utah) to determine whether by using diatomaceous earth it was possible, in a single filtration of the standard liquor, to produce thermophile-free massecuite and sugar. By adopting a strict technique (here described) it was found possible to reduce the count of the white massecuite to as low as 5 per 10 grm., giving a granulated sugar quite free from thermophiles. This good result was aided by various hygenic measures, such as washing the standard liquor tanks on the pan floor by spraying them with hypochlorite solution (= 1 per cent. of av. Cl) ; and by taking similar measures around the filter-presses and at the centrifugals. In the season in which this bacteriological control had been established, the average count of thermophilic bacteria in the sugars made had dropped to 10, and was further reduced last campaign to an average of 3 per 10 grm. So much for the thermophilic bacteria.

But the presence of mesophilic bacteria in granulated sugars is hardly of less importance, seeing that in high concentration they may destroy both the flavour and the appearance of carbonated and uncarbonated drinks. Yeasts and moulds are also of great importance to the soft-drink bottler, as they may tolerate acidities as high as 2 *pH* (which would inhibit most bacteria), producing stringy sediments. It is self-evident that the same sanitary measures taken for the control of the thermophiles should also be used in the control of the mesophiles ; but

in addition various other sanitary measures were adopted such as the following :

All windows and doors allowing outside air currents to come into contact with exposed sugar or filtered syrup were equipped with air filters, and kept closed as much as possible. Covers were placed over the standard liquor tanks, and 2 ft. above, so as to allow the steam to escape without condensing, while preventing the entrance of dust-laden air. Water and sugar accumulated on the curb of the centrifugals were preventing from dripping into the basket during the purging of the strikes. Yet other minor measures were adopted. All of these means of exercizing a strict control over the centrifugals, the wet sugar conveying machinery, and the bagging room resulted in an average bacteria content of 97 per 10 grm.

Admittedly, the carrying out of these measures was difficult, and required careful supervision. Attempts were therefore made to destroy the offensive organisms in the finished sugar by means of ozone, and also ultra-violet radiation. But in no case did such treatment have any effect on the bacteria or mould spores. It is, however, known that a certain number of the mesophilic bacteria, contained in dry sugar, die off during long storage periods. Generally speaking, the bacteria able to survive the long dry storage periods, are undoubtedly spore formers, and the fewer these spore-forming types originally present the greater will be the decrease in the stored sugar. No noticeable decrease in mould count has occurred after storage.

Filtration in Chemical Analysis. H. YAGODA. *Booklet published by Carl Schleicher and Schüell Co., New York.*—This is a guide in quantitative analytical work to the selection of that quality of filter-paper best suited to the purpose in hand. Thus, precipitates of extreme fineness, such as calcium oxalate precipitated from cold solution, or zinc sulphide from ammoniacal media both having a tendency to form colloidal dispersions, require an extra dense paper, as 602 ED. Precipitates of medium fineness, as barium sulphate from cold solution are best handled by 589 blue ribbon. Coarser precipitates can be filtered off very well with 597. Gelatinous precipitates, on the other hand, as aluminium hydroxide, require a open-textured paper, as 604. It is to be noted that the diam. of the circle used is governed, not by the volume of liquid to be filtered, but rather by the size of the precipitate to be separated. A 9 or 11 cm. circle will usually prove ample for collecting 100–500 mgrm. of a crystalline precipitate, but for aluminium hydroxide or like voluminous precipitate, a paper having a diam. of about 12·5 or 15 cm., or even 18·5 cm., is necessary. Folding the paper in a quadrant as is usually done causes a triple layer of paper over one-half the filtering surface, which area requires more water for washing, but many chemists now trim off the greater part of the compound layer to reduce the area of the triple layer. Another modern device concerns the use of filter-pulp. It is added to a precipitate to induce it to settle down more quickly to the bottom of the beaker before beginning to filter. It is also mixed with intractable suspensions, as colloidal hydrated oxides, gelatinous silica, and various sulphides to render them more readily filtrable. Often in analytical work of great accuracy, it is neceesary to re-precipitate prior to ignition and weighing, and when doing so, use should be made of hardened filter-papers which are resistant to the action of hot water, and do not shed fibres. As for the ash of these filter papers, the "ash-free" qualities contain as little as 0·007 per cent., being only about 0·3 mgrm. for 11 cm. papers 597, 602 and 604.

Whole ("Integral") Sugar as a Food (containing, Vitamins). J. J. LIMA. *Proc. 17th Meeting Assoc. Tech. Azuc. Cuba,* pp. 65-67.—Whole sugar, or "integral" sugar, as it is also called, is acquiring importance in recent efforts to perfect the dietary balance. In this category can be included invert molasses when manufactured with invertase yeast from sugar cane juices, clarified at 7-8 *pH* and concentrated. In fact, Merck and Co., Inc. of Rahway, N.J. are said to be investigating the value of cane molasses as a source of thiamin and riboflavin (vitamin B_2), and also as a nucleus of positive combinations of mineral salts. It has been proved that next to fresh liver, cane molasses is the best material for renewing the red blood corpuscles, being rich in readily assimilable iron. In quantitative tests whole molasses has been found to contain 1·5 per cent. of cellulose and some 2 per cent. of pentosans and gums as well as proteins which carry nitrogen. The inclusion of yeast adds benefits to the molasses, thereby increasing the protein content by some 13 per cent., and adding at the same time about 7·5 per cent. of glycogen and some 2 per cent. of ash. In colonial times slave labour in sugar mills were given, as a stimulant for their work, a 50 per cent. solution of sugar cane molasses in water, which they called *Zambumbia,* while it is recognized that the labour around the sugar mill thrives remarkably well during the crop on the juice and the sugar they consume. The case of a coloured man suffering from pellagra disease, who was completely cured with the use of bread and sugar cane molasses is noted. Furthermore, in an epidemic of intestinal paralysis in cattle in Cuba, an effective remedy was found in drastic doses of a solution of molasses in water.

Value of an Air-Flow Recorder on a Bagasse-fired Boiler. F. H. C. KELLY. *Proc. Queensland Soc. Sugar Cane Tech.,* 1944, pp. 33-40.—There are several ways in which it is possible to obtain a measure of the correct quantity of air required for the best combustion conditions in a boiler unit. For many years it was usual practice to combine draught gauge readings with occasional or continuous flue gas

analysis and interpret the results of the latter in terms of the former for actual setting of dampers. It is now possible to obtain instruments which produce a record indicating the volume of combustion gases, and referred to as air-flow meters. The pressure drop is measured across a baffle in the gas stream after combustion has finished, and the mechanism of the instrument is designed to give direct flow readings on its chart. These instruments have been successfully used with coal, oil and gas-fired boilers for some years, but there is a factor which sets a limit on their universal adoption, viz., variations in the composition of the fuel. For a uniform type of fuel very good results can be obtained, but for a boiler using mixed fuels significant variations will be shown. The variations known to occur in the composition of bagasse have somewhat militated against general popularity of this record among sugar factory engineers. As the result of work described in this paper, the opinion is expressed that a continuous CO_2—unburnt gas recorder would be of greater value than a air-flow to steam-flow ratio indicator or recorder for the most efficient operation, but the continuous record of an air-flow meter used in conjunction with the steam-flow record is of greater value than an intermittent record of flue gas analysis. Experience has shown that regular flue gas analysis is essential for efficient operation and a continuous flue-gas analyser has been installed at Kalamia to record the CO_2 and unburnt gas for a regular period on each boiler unit in rotation.

Salvaging a Broken Thermometer. D. H. MATHESON. *The Chemist-Analyst*, **33**, No. 2, p. 44.—A broken 360°C. thermometer can often be converted into a satisfactory instrument, having a range up to a 100° or so by working on the following lines: Since the mercury thread is apt to be broken and part of the mercury lost, it is necessary to check the reading of the broken instrument against a standard thermometer. If the indication is incorrect or the thread is broken, it will be necessary to refill the capillary. Heat the bulb in a water bath until all of the broken thread is forced out of the open end of the capillary; the mercury will collect in a little globule to which an additional little droplet can be added. On cooling the bulb the mercury will contract and an intact thread of mercury will be drawn into the capillary. To adjust the length of the thread, note the scale indication where the stem is broken off. Attach the broken thermometer to the standard and place in a water bath heated to exactly this temperature. The excess mercury which is forced out can be wiped off, and on cooling the thread will be withdrawn and will indicate the correct temperature. It is not difficult to adjust the thread accurately to within ¼ mm. in this way. In sealing the thermometer, a small bulb must be provided at the top of the capillary to accommodate the gases forced out when the mercury thread rises in the tube. Place the bulb of the thermometer in a test-tube of freezing mixture to contract the mercury as far as possible. Heat not more than 4 mm. of the upper end of the stem in the flame and rotate it to allow a smooth round end to form. Then, while this end is still hot in the flame, remove the test-tube of freezing mixture and heat the bulb until the mercury rises about three-fourths of the way up the stem, causing a suitable bulb to be blown in the soft glass at the top. Finally, finish off the top of the thermometer to a plain rounded end, a ring top, or to a sphere."

Scaling of Boilers: Identification of Constituents. T. C. ALCOCK, L. M. CLARK, and E. F. THURSTON. *Jl. Soc. Chem. Ind.*, 1944, **63**, No. 10, pp. 292–298.—Data have been collected by the authors (of I.C.I., Ltd., Research Dept., Alkali Division, Northwich, Cheshire), on the composition of a number of boiler scales together with the conditions in which they have been formed. The following minerals have been identified for the first time as constituents of scales formed either in boilers or in pipe lines: crestmoreite, $2CaO.2SiO_2.3H_2O$; sulphatic cancrinite $4Na_2O.CaO.4Al_2O_3.9SiO_2.2(CO_2,SO_3).3H_2O$; periclase, MgO; barytes, $BaSO_4$; the new compound, magnesium hydroxyphosphate, $Mg_3(PO_4)_2.Mg(OH)_2$, is sometimes a constituent of boiler scales and its synthesis is described. In addition, a detailed description is given of the identification and conditions for deposition of chrysotile, $3MgO.2SiO_2.2H_2O$, sepiolite, $2MgO.3SiO_2.4H_2O$, sodalite $3(Na_2O.Al_2O_3.2SiO_2).2NaCl$ analcite, $Na_2O.Al_2O_3.4SiO_2 2H_2O$, and brucite, $Mg(OH)_2$. The X-ray powder patterns of some of these minerals are recorded, together with those of some magnesiumphosphates.

Colour Reactions for the Sugars. ADOLPH BOLLIGER. *J. Proc. Roy. Soc. N. S. Wales*, 1944, **77**, pp. 109–115. An 0·01 per cent. aq. solution of the sugar, 0·5 ml. of 5 per cent. alcoholic thymol and 5 ml. of conc. HCl containing 5 per cent. of ferric chloride, are heated in a test-tube in a boiling water-bath. When the colour change occurs, the time taken is noted. Then reference is made to a table, which enables one to identify certain of the monosaccharides. It is said that the method can be made quantitative.

Relative Sweetness of Sucrose, Glucose and Fructose. A. T. CAMERON. *Trans. Roy. Soc. Canada*, 1943, **37**, Sect. V, pp. 11–27.—By means of organo-leptic experiments it is shown that the relative sweetness of these three sugars varies with the concentration, and that the sweetness of one sugar is enhanced by the presence of a second. It would seem that alpha-dextro-glucose is sweeter than the corresponding beta-form. It is believed that people lack a delicate taste sensation for sweetness. A review of the literature of the subject is given.

New Books and Bulletins.

Mosquito Control: Practical Methods for Abatement of Disease Vectors and Pests. WILLIAM B. HERMS, Sc.D., and HAROLD F. GRAY, Gr. P. H. Second Edition; revised and enlarged. (The Commonwealth Fund, New York; Oxford University Press, London) 1944. Price: $3·50; 15s.

This is the second edition of a well-known American manual on Mosquito Control, written by two specialists, the first being Professor of Parasitology at the University of California, and the second Lecturer in Public Health at the same institution. It presents a very comprehensive discussion of the subject, dealing with the general priniciples of abatement methods; with the drainage and reclamation of fresh and salt water marshes; with oils and larvicides, and their application; with control by the use of fish; and lastly with species sanitation and naturalistic control.

This second edition comprises a thorough revision and enlargement of the first, which was published in 1940, this making it more applicable to the requirements of military forces now, and to the needs of occupational forces later. It now contains (in an appendix) data on species identification, and the use of entomological keys, designed to enable persons without training in systematic entomology to gain a fair understanding of the methods of identifiying mosquitoes. It also contains (in a second appendix) a list of vectors of mosquito-transmitted diseases other than malaria, such as yellow fever, dengue, filariasis, and epidemic encephalitis. A chart presenting the more important malaria vectors throughout the world, grouped geographically, and by typical breeding places, with appropriate control measures, has also been added to complete a very valuable and up-to-date treatise on the subject.

Experimental Electronics. RALPH H. MÜLLER, R. L. GARMAN and M. E. DROZ. (Prentice-Hall, Inc., 70, Fifth Avenue, New York.) 1945. Price: $4·65.

Professor MÜLLER and his assistants, of New York University Chemistry Department, have designed this book primarily for the use of students of electronics. It was first published in 1942 and is now in its fifth impression. In it the authors have drawn up a very complete set of experiments to be carried out in the gaining of knowledge which comes more easily by experimentation than by perusal.

Each chapter is devoted to a particular piece of equipment, such as triodes, photo-electric cells, power supplies, etc. They open with an introduction to the item to be dealt with, followed by a brief description of its operation and function. Experiments to be carried out are then enumerated with the particular purpose in view. Each chapter ends with supplementary literature and problems connected with the specific piece of apparatus under discussion.

The book is liberally illustrated with wiring diagrams and graphical results. It contains a host of very useful information on the application of electronics to non-commuication devices in industry. It is true that a much better working knowledge can be obtained by familiarity with equipment by experimentation, but this work should be read and re-read by all progressive sugar factory electrical staff. No technical library should be without this informative volume on Experimental Electronics.

Down among the Sugar Cane. (The South Coast Corporation, Houma, Louisiana, U.S.A.).

This is a colour-printed booklet containing general information on the activities of the South Coast Corporation for the benefit of its security holders. It tells something of the history of sugar in Louisiana, it outlines the practice of cane cultivation in the State, and has a little to say of the latest varieties in use. It sketches factory and refinery operations, and concludes with particulars of the properties of the S.C.C. Oil was discovered on the Corporation's land in 1937, and there are now 14 producing wells. Mr. BROR DAHLBERG, President of the Celotex Corporation, is Chairman of the Corporation.

Manual of Nutrition. MAGNUS PYKE. Ministry of Food: S.O. Code No. 70-466. (H.M. Stationery Office, London). 1945. Price: 1s.

This is an excellently written booklet by a former member of the Scientific Adviser's Division of the Ministry of Food, consisting of twelve lessons designed to give a grounding in the principles of the important science of nutrition. No attempt is made in it to teach chemistry, general physiology or other of the basic subjects upon which the subject depends. But the booklet can be relied upon to impart much valuable information on the role of carbohydrates, fats, proteins, mineral substances and vitamins in the metabolism of the human body. An excellent manual for use in schools and colleges.

Notes on Jacareuba and Cedro. Leaflet No. 27. Forest Products Research Laboratory, Princes Risborough, Aylesbury, Bucks. (Department of Scientific and Industrial Research).

The Tree; the Timber; Seasoning Properties; Mechanical Properties, Natural Durability; Insect Attack; Working Qualities; and Uses.

Report of the West Indies Committee of the Commission on Higher Education in the Colonies. Cmd., 6654. (H.M. Stationery Office, London). 1945. Price: 1s. 3d. net.

Contents: Agriculture and Agricultural Science; The University Department of Education; University Buildings; Finance.

Sugar-House Practice.

Keeping Qualities of Sugars and Sugar-containing Products during Storage. (Deterioration of Raw and Refined Sugars). C. A. BROWNE: *Proceedings of the Institute of Food Technologists*, 1944, pp. 174–185.

Dr. BROWNE last year presented to the Institute of Food Technologists a particularly complete survey of the subject of the keeping qualities of sugars and sugar-containing products during storage (comprising sugar deterioration), and those desiring to acquire an insight into this phase of technology could not do better than study this excellent review. He dealt with his material under the following headings: I. Physical Factors that affect Keeping Quality (Segregation; Atmospheric Humidity and Temperature). II Chemical Factors that affect Quality. III. Biochemical Factors that affect Keeping Quality. IV. Microbiological Factors that affect Keeping Quality (Microbial Infection of Raw Sugars; Deterioration of Raw and Refined Sugars). V. Spontaneous Combustion of Sugars and Sugar-containing Products. VI. Influences of War Conditions on the Keeping Qualities of Sugars.

Dr. BROWNE'S remarks under the last heading is of interest at the present time, and is here reproduced: "Many of the statements in the present paper are based upon observations on the storage of raw cane sugar imported into the United States during and immediately following the first World War. Industry profited, although very slowly, by some of these experiences, and the average polarization of imported raw cane sugars, as based upon the reports of Dr. F. W. ZERBAN[1] of the New York Sugar Trade Laboratory, increased gradually from 95·09 in 1920 to 97·23 in 1940, an increase of 2·14, with a corresponding loss in moisture and a gain in keeping quality.

"But after 1940, as a result of conditions resulting from the new World War, the average polarization of imported raw sugars has declined from the high average of 97·23 to 96·86 for 1943, a loss of 0·37, which is largely owing to the importation of stored deteriorated sugars. It is evident, as in the first World War, the disruption of manufacture and commerce are again causing a decline in the polarization and keeping quality of imported cane sugars, and that as the war progresses, a further continuance of this tendency is to be expected. Certain differencies, however, in the character of the changes produced during storage in the present and previous war, have been called to my attention by Dr. ZERBAN.

"Twenty and more years ago with the raw sugars of higher moisture content the predominating change in storage was destruction of sucrose by inverting micro-organisms. With the higher testing raw sugars of the present day, losses from inversion, although of less significance, still occur. The average decline of 0·37 in polarization gives a much too low estimate of the storage losses during the present war, as the actual loss of sucrose is concealed to a large extent by a counterbalancing increase in polarization owing to the greater destruction of levulose by the non-inverting torula class of micro-organisms.

"Under normal conditions the sucrose of raw cane sugars is about 0·3 higher than the polarization, but now with a growing increase in the destruction of levulose, this marginal benefit, formerly enjoyed by the purchaser, is so far reduced in some cases that the percentage of sucrose instead of being 0·3 higher is over 0·3 lower that the direct polarization. In other words the abnormal conditions described have become more common under present day practices.

"The changes, both normal and abnormal, which sugars and sugar-containing products undergo during storage are not only most fascinating subjects of research, but they constitute problems of immense practical importance to the food technologists. It has been possible in the present paper to give only a very general survey of the subject. There is much yet to learn about the nature of the complex chemical changes that our carbohydrate food products undergo during storage. It is hoped that more members of your Institute may be attracted by the very abundant opportunities for chemical, biochemical, and mycological research in this almost limitless field."

Economy of Sulphur (and of Lime) Indian Sugar Factories. D. R. PARASHAR. *Indian Sugar*, 1944, **7**, No. 10, pp. 311–316.

It is stated that the heaviest consumption of lime and sulphur before the introduction of wartime measures for its economy was in factories in North Behar, the figures there for Co 313 being about: 0·33–0·37 and 0·09–0·10 per cent. cane respectively. But by reducing the amount of lime used, and by omitting to sulphur the syrup, the sulphur consumption was reduced to 0·045–0·05 per cent. cane. In other parts of India, the figures for lime and sulphur varied between 0·15–0·2 for lime and 0·05–0·07 per cent. cane for sulphur. Fractional liming at high temperatures proved particularly helpful in lime and sulphur economy without adversely affecting the results, as the following figures indicate:

	Usual Method	Fractional Liming.
Lime	0·15—0·16 per cent.	0·11—0·12 per cent.
Sulphur..	0·035—0·04 ,,	0·02—0·022 ,,

some factories reducing their sulphur consumption to 0·011–0·015 per cent. cane by the use of an excessive amount of superphosphate (0·04–0·05 per cent. cane).

In factories in which the lime had been much reduced, difficulties were experienced, mainly the

[1] *I.S.J.*, 1942, p. 101.

slow filtration of the scums, but this was overcome partially by (it is said) diluting the scums with water in the scum blow-up tanks, or by increasing the imbibition water on the mills. Trouble was also had with the settling of the juices, but this was remedied by adding Fullers earth to the milk-of-lime used in clarification. Then, in the absence of syrup sulphitation, the appearance of the sugar suffered, which could not be remeded by the application of Blankit, as this product was no longer on the market[1].

Baluchistan sulphur, however, has been used to some extent,[2] either by burning it directly, or by refining it in some way or other previously. Of the several methods of refining it which have so far been tried, sublimation has not been found economical, on account of the high cost of fuel, and because of the wear-and-tear on the metal work of the plant. Steaming the crude ore at a pressure of 25–40 lbs., and separating the molten sulphur is said to be the cheapest and easiest way of working as by means of it one can obtain a product of 99·2–99·4 per cent. purity, which will burn readily in existing furnaces without any diffculty. However, the recovery by this method has not been high, only about 30–33 per cent., depending a good deal on the quality of the ore. In applying this method, however, the ore should be given a prelimina y wash, and the exposed ironwork of the plant should be protected against attack by a covering of suitable paint as Napier.

Carbo-sulphitation, a method of operating which was recently proposed,[3] has not yet been given a thorough trial. Some few factories have tried it, but have used such small quantities of charcoal for combustion in the existing furnaces that the CO_2 produced barely exceeded 0·5–1·5 per cent. and hardly exerted any appreciable economy in the consumption of the sulphur. These factories are said to have reported that larger quantities of charcoal could not be used owing to the danger of cracking the furnaces as the result of the high temperatures developed. It has, however, been observed that the clarified juice obtained by this process has been lighter in colour than that obtained by sulphitation alone, provided that the quantity of lime used in the operation is properly adjusted.

Length of Life of Multiple-Tube Char-Kiln Retorts. A. F. Blake and Major R. A. Ring[4]. *Presented at the Sugar Industry Engineers, New York, 1944 Meeting.*—Experiments were conducted using stainless steel tubes in kiln retorts, these being subjected to temperatures of the order of 1050°F. Due to scale formation on both sides of the tubes and the action of heat, rapid destruction of the tubes took place. In the long run they found that the use of stainless steel tubes was not a success.

Efficient Operation of Cooling Water. Anon. *South African Sugar Jl.*, 1944, **28,** No. 9, p. 389.—It is essential to have a continuous and uninterrupted flow of the cooling water through the jackets, coils, pipes and the other equipment. Ideal conditions are an inlet water of say 60°F. (15·5°C.) with an outlet temperature not over 90°F. (32°C.). A very large volume is concerned. Often, however, difficulties are caused by the jacket and at times the pipes being choked by algoid growths, which, besides reducing the rate of flow of the water, causes the formation of an internal heat-insulating layer. Another trouble is the growth of *Crenothrix*, a bacterium causing a deposit of iron hydroxide, which imparts a red coloration and turbidity to the water. This results in the interior of the jacket and of the pipes being coated with iron rust growths, which are irregular in size and shape. The remedy for all such irregularities is to prevent the growth of the algae and bacteria by the use of chlorine, using a suitable industrial equipment, such as is supplied by several London specialist firms. Normally the chlorine gas is admitted at the rate of 0·5 part per million of the water. This small amount serves to keep the cooling equipment absolutely free from algoid deposits, thus eliminating the time and expense which otherwise would be expended in cleaning it.

Continuous Aerobic Process for Producing Distiller's Yeast. E. D. Unger, W. H. Stark, R. E. Scalk, and P. J. Kolachov. *Ind and Eng. Chem.*, **34,** pp. 1402-1405.—Present yeasting practice in distilleries is undesirable, because the resultant yeast is not pure culture and lacks uniformity, besides requiring large equipment. The advantages of a completely aseptic, aerobic technique for yeast production, one which is continuous, are obvious. A pilot plant for such a process has been designed, the factors evolved in working it out being : Effect of media, filtration of mash, sterilization, air consumption, and rate of propagation.

Dredging Ideas : can they be used in the Sugar Industry. T. B. Barton. *Proc. Queensland Soc. Sugar Cane Tech.*, 1944, pp. 45-48.—Engineer to a tin dredging concern in the North of Queensland, the author describes the main features of his up-to-date machinery in the hope that they may suggest possibilities in the cane sugar mill. His main point is the great advantages of electric *vs.* steam drive. There is also much of interest in the pumping system of the dredger, which works with a great amount of sand and slime in suspension in the water, giving rise to excessive wear and tear. Automatic priming pumps as used in the dredger also call for some study. Fitting one so that it comes into operation only when the main pump becomes empty overcomes priming difficulties. They should prove a boon in the sugar industry in mills where the injection water pumps are situated some distance from the mill.

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[1] British-made hydrosulphite of soda is obtainable in London of quality equal to that of the German product.
[2] *I.S.J.*, 1943, p. 306 ; 1944, p. 136. [3] *I.S.J.*, 1944, p. 218. [4] Atlantic Sugar Refineries Ltd., Canada.

Review of Recent Patents.

Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom:* Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). *United States:* Commissioner of Patents, Washington, D.C. (price 10 cents each).

UNITED KINGDOM.

Production of Citric Acid by Fermentation (using Molasses). MERCK and CO., INC. 568,508. March 13th, 1943.

In specification No. 266,414 the use of strains of various *Aspergillus* especially *A. niger* is described, but to obtain citric acid by such a process it is necessary to follow the practice of surface or shallow fermentation which requires an extensive plant, and is generally less efficient on an industrial scale than deep or submerged processes. It has now, however, been unexpectedly found that if the fungus *Aspergillus wentii*[1], be employed that this difficulty does not arise, and citric acid may be produced by the deep or submerged technique. An agar medium which is especially favourable in the isolation and the identification of this organism, and in the production of abundant spore material, is one containing in grm. per litre : 5 of peptone, 10 of glucose, 1 of potassium dihydrophosphate, 0·5 of magnesium sulphate, and 15 to 25 of agar. Cultures in it are incubated at 25–35°C. for about 7 to 20 days.

This organism has distinct advantages over *A. niger*, as (1) growing rapidly under submerged as well as surface conditions ; (2) producing citric acid abundantly ; and (3) forming only slight amounts of oxalic and gluconic acids ; and (4) withstanding high acidities. Highly satisfactory results are obtained with the use of an aqueous solution which comprises per litre 150 grm. of sucrose or glucose, and contains the following nutrients in grm. per litre : Urea, 0·5–1·0 ; magnesium sulphate, 0·5 ; potassium dihydrophosphate, 0·05 to 0·08 ; potassium chloride, 0·15 ; manganese sulphate, 0·02 ; and zinc sulphate, 0·01. Agitation of the culture medium is necessary. An example given outlines the following procedure :

Aspergillus wentii is first grown on a suitable agar medium (such as that already indicated) for a period of 7 to 20 days, for the production of an abundance of spore material. One of the culture media already specificially described herein is then sterilized, adjusted to *pH* 2·0, and inoculated with a heavy suspension of spores in sterile water. The inoculated medium is placed in a suitable chamber ; as an alternative, the medium may be sterilized in the chamber and then inoculated. Next, the growth phase is initiated. The contents of the chamber are now continuously agitated, while either air under pressure, or oxygen at atmospheric pressure, or a mixture of oxygen and air under pressure, is simultaneously admitted into the chamber. The contents of the chamber are maintained at a temperature of about 25 to 35°C.

As soon as a substantial quantity of citric acid has been formed, a sterile suspension of calcium carbonate or hydroxide is added to neutralize such a quantity of the acid formed that the *pH* does not exceed 3·0. Agitation and aeration are continued for a period of 7 to 15 days. When the fungoid growth has attained an optimum stage of development, and most of the sugar has been converted to citric acid, the acid solution is withdrawn from the chamber and the replacement phase is begun. The fermentation is resumed for another 5 to 10 days, under similar conditions. Such replacements are made as long as the growth of the fungus continues to be adequately operative.

Yields of pure citric acid obtained by *A. wentii* under similar conditions are as follows :

Days of Fermentation	Citric Acid produced gm.	Sugar Consumed (Total sugar in medium 15 grm.) grm.	Conversion of sugar to acid per cent.
3	3·46	8·06	42·9
5	5·01	11·44	43·9
7	7·13	13·58	52·5

Anti-Foam Agents. IMPERIAL CHEMICAL INDUSTRIES, Ltd., of Millbank, London. 568,318. March 26th, 1943.—Claim is made for a process of treating water (or other liquids) which comprises adding thereto a small proportion, e.g., 0·01 to 1·0 grain per gal., of one or more substances of high molecular weight, containing at least 36 carbon atoms, having two N-substituted amide groups, the nitrogen atoms of which are separated by at least one CO-group. In an example, 10·5 grm. of palmytl chloride at 120°C. and 5 grm. epilon-amino-*n*-caproic acid, are added with stirring, which is continued at 150-160°C. for one hour, after which 10·2 grm. of *n*-octadecylamine is added and stirring continued for two hours, the product being a brown wax.

UNITED STATES.

Filter. HAROLD F. OSWALD, Elizabeth, N.J. (assignor to OLIVER UNITED FILTERS, INC., Oakland). 2,352,340. April 10th, 1944.—A rotary drum filter comprising a tank ; a filter drum arranged to rotate in the tank ; a plurality of peripherally spaced longitudinally extending division strips secured to said drum and defining a series of filtrate compartments ; conduits communicating with each of the filtrate compartments which can be successively subjected to a differential filtering pressure ; a plurality of spaced ribs secured to the drum within each compartment ; and a wire mesh screen disposed over the drum and soldered to the heads of rivets which are substantially flush with the outer surfaces, holding some of the ribs in position.

[1] See "The Aspergilli" (Williams and Wilkins Co., Baltimore Md., U.S.A.) 1926.

Brevities.

GUSTAVE T. REICH.—After having been chief research chemist since 1928 to the Pennsylvania Sugar Co. and its subsidiaries the Pennsylvania Alcohol and Chemical Corporation, and the Siboney Distilling Co., Dr. Reich, whose name is well-known among technologists as the author of valuable papers on fermentation and allied subjects[1] has taken up consulting work in Philadelphia at 1015 Packard Building.

MR. CLINTON P. ANDERSON.—Formerly Chairman of the Committee to investigate Food Shortages, appointed by the House of Representatives, and now Secretary of Agriculture, he was not one of the better known members of Congress. He was only serving his third term in the House, to which he was first elected in 1940. A native of South Dakota, of Swedish ancestry, he owns an 800-acre irrigated farm in New Mexico stocked with Hereford cattle, and other farm property in South Dakota. He is just on 50.

LABOUR SAVING IN THE T.H.—It would be difficult, if not impossible, to operate factories efficiently in Hawaii without provision for cleaning the cane ; and without the present drastic cane harvesting methods it would be impossible to take off the crop with the existing labour shortage. Several mills have greatly improved their cane cleaning plants, and others are following on the same lines. A number of mills have ordered machine dischargers on their low-grade centrifugals. These appliances also alleviate the man-power problem.

BLACKSTRAP AS LAMB FODDER.—A study made by H. M. Briggs and V. G. Heller, of the Oklahoma Agricultural Experiment Station, U.S.A. shows that blackstrap molasses can be used as fodder for lambs most effectively, as far as digestibility of the ration is concerned, when it constitutes not more than 5 per cent. of the ration. However, digestibility was not so greatly reduced at the 15 per cent. level but that it would often be economical to use the product at such a level in commercial lamb feeding.

ACTIVATED CARBON APPLICATIONS.—In addition to its uses as colour and vapour adsorbents, activated carbons have several miscellaneous applications, which are not so well-known, such as the following : As an addition to boiler feed water for the reduction of corrosion, the removal of oil, and the improvement of the coagulation. As a stripping agent for acetate colours in the wench dyeing machine. As an anti-corrosive medium in paints, being superior to red lead in protecting steel against corrosion. As an adjunct to fertilizers, being said to facilitate ammonification, nitrification and the fixation of nitrogen.

NEW VARIETY FOR LOUISIANA.—It is CP 36-105, which in co-operative field tests in recent years had compared favourably with CO 281 and CP 34-120 in yield of sugar per ton, but averaged somewhat below CP 34-120 in yield of sugar per acre. It is resistant to red rot and root rot, but has shown a trace of mosaic at ten of the test fields, and 2 per cent. infection in one, but control of mosaic in this variety is not expected to be a problem. Chlorotic streak infection ha sbeen negligible. Its stalk has about the same diam. as Co 290, and is slightly heavier than that of CP 34-120. It is believed that the new variety will lend itself readily to mechanical harvesting, because of its erect growth and resistance to lodging. It does not deteriorate at an excessively rapid rate when cut for milling, but apparently windrows poorly, so is not recommended for that purpose. Its fibre content is about the same as that of CP 29-320.

SOLAR HEAT BOILER.—A solar heat boiler is being built in Tashkent, Russia, and is expected to yield 120 kg. (264 lbs.) of steam per hour. This "helio-boiler" as it is called has a reflector of the parabolic type of about 33 ft. wide.

LIME IN BARBADOS.—In Barbados, due to the scarcity of fuel and the restriction of imports, the supply of lime for use in clarification in the sugar factories became critical during the war. Natural gas is, however, available in the Colony : a suitable kiln burning this fuel was erected. It is now producing a very high quality lime at the rate of 5-6 tons per day.

CANE VARIETIES IN BARBADOS.—The percentages of the total acreage of land in Barbados under the various varieties reaped in 1944 are as follows : B 37161, 48·69 ; B 35187, 11·28 ; B 3429, 9·49 ; BH 10(12), 8·00 ; B 726, 4·79 ; B 2935, 4·73 ; B 34104, 4·19 ; B 3013, 2·98 ; B 35245, 2·06 ; and other varieties, 3·79 per cent. The returns from plantations for the 1944 crop shows that there were 29,796 acres under cane made up of 14,144 acres of plant canes, 10,557 of first ratoons, and the balance of second and other ratoons. In addition the acreage reaped by small holders was 7000.

SUGAR BEET DELEGATION TO U.S.—Acting upon a suggestion made by Professor Bainer of the University of California, who recently visited this country to advise upon mechanization in beet cultviation and harvesting, the Ministry of Agriculture has arranged, to send a small mission to North America to study progress there in development work on this subject. The party consists of : J. Bradley, Principal Scientific Officer, National Institute of Agricultural Engineering ; F. E. Thornhill, Agricultural Officer from the British Sugar Corporation factory at Allscott, Salop ; and H. S. Taylor, Agricultural Officer from Brigg, Lincs.

SCIENTIFIC ALLIANCES.—Last year an informal "alliance" was arranged between the Imperial College of Science and Technology, London, and the Institute of Technology, Massachusetts, U.S.A. Now a similar arrangement has been arranged between the Imperial College, London, and the Indian Institute of Science, Bangalore. There has been no attempt to define the terms of this *concordia amicabilis*, which has perhaps, more promise of real benefit on that account, but it is expected that exchanges of staff and of students may be arranged. At any rate, it is the hope of both Institutes that their ties will be close and numerous in the years to come.

CANE CUTTERS' WORK IN JAMAICA.—At the 8th Annual Conference of the Jamaican Association of Sugar Technologists held recently, C. K. Clarke, gave some details of the work output by cane cutters on the Worthy Park Estate. In the discussion following the reading of papers[3], A. C. Barnes, remarked that a large percentage of the cutters employed at Frome Estate appeared to have done hardly any work for the crop, appearing almost to have eaten more than they have cut. On the Westmoreland Estates the total number of cutters employed in 1944 was 4460 to reap a crop of 163,797 tons, the average tons of cane per acre being 26·12 and the average tons cut by all workers per week being 8620, or an average of 2 tons per worker per week. In Florida the figure was 5, or 4 say when the cane was burnt. Comparison of figures of the 100 best and 100 worst cutters on his Company's estates showed the former cut 15,000 tons of cane for the crop, or an average of 150 tons of cane per head per crop ; and the latter 126 tons for the crop, or an average of 1¼ tons of cane per head per crop.

1 See *I.S.J.*, 1943, pp. 54, 220 ; 1945, p. 218. 2 *Jl. Agric. Rsearch*, 1945, **71**, No. 2, pp. 81-87.
3 *J.A.S.T. Quarterly*, 1945, **8**, No. 3, p, 14.

Stock Exchange Quotations.

LONDON STOCKS, at September 20th, 1945.

Anglo-Ceylon	39/0 — 40/0
Antigua Sugar Factory (£1)	17/6 — 20/0
Booker Bros. (£1)	$3\frac{1}{32}$ — $3\frac{11}{32}$
Caroni Ord. (2s.)	2/0 — 2/6
„ 6% Cum. Pref. (£1 shares)	20/6 — 21/6
Gledhow Chaka's Kraal (£1)	$1\frac{7}{8}$ — 2
Hulett & Sons (£1)	37/6 — 39/6
Incomati Estates (£1)	21/0 — 22/0
Leach's Argentine (10s. units)	8/3 — 9/3
Reynolds Bros (£1)	44/6 — 46/6
St. Kitts (London) (£1)	$3\frac{3}{16}$ — $3\frac{5}{16}$
Ste. Madeleine (Ord.)	16/6 — 17/6
Sena Sugar Estates (10s.)	15/0 — 16/0
Tate & Lyle (£1)	73/0 — 74/0
Trinidad Sugar (5s. Ord., 4s. stk. units)	5/0 — 5/6
United Molasses (6s. 8d. stock units)	41/3 — 41/9

NEW YORK STOCKS, at August 31st, 1945

	$
American Crystal	$23\frac{5}{8}$
Amer. Sugar Ref. Co. ($100)	$46\frac{1}{2}$
Central Aguirre	22
Cuban American ($10)	$18\frac{7}{8}$
Great Western Sugar	$32\frac{1}{8}$
South P.R. Sugar	$46\frac{3}{4}$

United States, All Ports.

(Willett & Gray)

	1945 Long Tons.	1944 Long Tons.
Total Receipts, Jan. 1 to Aug. 18	2,925,509	2,931,076
Meltings by Refiners „ „ „	2,941,737	2,865,911
Importers' Stock, Aug. 18 ..	—	—
Refiners' Stock „ ..	186,552	361,870
Total Stock „ ..	186,552	361,870
	1944	1943
Total Consumption for 12 months	5,725,249	5,263,624

Cuba.

(Willett & Gray)

	1945 Sp. Tons.	1944 Sp. Tons.
Carry-over from previous crops	680,176	559,119
Production to date	3,453,746	4,182,771
	4,133,922	4,741,890
Exports, Jan. 1st to Aug. 18	2,937,835	2,293,075
Stock (entire Island) Aug. 18 ..	1,196,087	2,448,815

Brevities.

British West Indies.—Following is the estimated production of sugar in tons for the quota year ending August 31st, 1945, summarizing the latest information received by the West India Committee: Barbados, 120,000 (including 20,000 of fancy molasses); Jamaica, 150,980; Leeward Islands, 48,600; Trinidad, 76,884; Windward Islands, 6,111; and British Guiana, 144,471 a total of 547,046 tons.

Sugar Exports from Peru.—The exports of sugar from Peru reported by A. N. Crosby, of Lima, to different countries for 1944 (and in brackets for 1943) were as follows: Chile, 173,622 (119,909); U.S.A., none (3,595); Panama & Canal Zone, 2,029 (2,225); Uruguay, 29,647 (28,776); Bolivia, 38,870 (18,563); Ecuador, 12,721 (2); Mexico, 27,848 (2,166); Colombia, 8,018 (none); Paraguay, 6,420 (460); Argentina, 18,484 (8,221); totals, 317,653 (183,917), all in metric tons.

Graver Tank & Mfg. Co., Inc.—This firm announces the appointment of Mr. Earle M. Copp, a specialist in the continuous clarification of cane juices, as Executive Sugar Engineer in their sugar factory equipment division. Mr. Copp is a highly experienced sugar technologist of international reputation, who has been a frequent contributor to this Journal.[1] He will be located in New York City, whence he will direct the design, manufacture and sale of Graver sugar factory equipment, especially of the well-known Graver cane juice clarifiers.

Fungicide Tests with Cane Setts.—In Natal it has been shown that by dipping the ends of the cane setts in a dilute solution of a suitable fungicide the proportion of successful germinations can be increased enormously. Generally speaking mercurial preparations give the best results, such as "Abavit," "Ceresan," and "Agrosan," all of which were found to be better than the untreated cane at 99 : 1 odds. Plots treated with "Abavit" were the best looking, the cane being taller than the rest, due to the earlier start.

Potato Drying in Beet Factories.—In a number of factories of the American Crystal Sugar Co., of Minnesota, U.S.A., surplus potatoes were dehydrated during the inter-campaign[2], being passed successively through the trash and stone catchers, the washer, the Chronos scale, the pulp catcher, the press, the Büttner dryer, and thence to the store. But, though the object in view was accomplished, viz., the preservation of the surplus tubers, it was by no means an easy task, many difficulties arising, such as: stoppage of the equipment by stems, sprouts, etc. low capacity of the dryers; the gelatinization and "case-hardening" of the slices, and low recovery. The dried product was distributed among distillers and commercial live-stock processors.

Mosaic in Natal.—It is reported from Natal that mosaic disease has been found on Co 281 in three localities in the sugar belt; and that, although the number of diseased plants discovered so far has been small, and the effect negligible, growers are warned that they should exercise great care with the material they are using for the propagation of this variety. In the cases examined, the symptoms consist of a slight pallor of the green colour of the leaf with small scattered, definite stripes of normal green tissues, mostly noticeable on the youngest leaves. This state is not to be confused with a chlorotic condition of the young leaves, which is common on Co281, consisting of a general lack of chlorophyll, particularly towards the tips. It is advised that suspicious leaves should be sent in to the Experiment Station for examination.

1 *I.S.J.*, 1942, p. 125; 1943, pp. 182, 207, 303; and 1944, 93, 127, 212.
2 *Sugar*, 1945, **40**, No. 7, pp. 32-34.

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☞ *The Journal is published about the 7th of the month.*

Telephone : MANSN. HO. 6822. *Cables :* SUGAPHILOS, LONDON.

Annual Subscription, 21s. Post Free.
Single Copies, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "THE INTERNATIONAL SUGAR JOURNAL," and not to individuals.

☞ All communications to be addressed to "The International Sugar Journal," 7 & 8, Idol Lane, London, E.C.3.
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