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PRICE OF RAW SUGAR IN 1902,

The following table shows the highest and lowest price of centrifugal (96 degrees test) and muscovado (89 degrees test), and the average yearly cost as compared with previous years:

	—Muscovado—		—Centrifugal—	
	Highest.	Lowest.	Highest.	Lowest.
January	3 3-16	2⅞	3 11-16	3⅜
February	3 3-16	3⅛	3 11-16	3⅝
March	3⅛	2 7-16	3⅝	3⅜
April	3⅛	2⅞	3⅝	3⅜
May	3	2⅞	3½	3 7-16
June	3	2¾	3½	3¼
July	2⅞	2 13-16	3 7-16	3 5-16
August	2 15-16	2⅞	3 7-16	3⅜
September	3	2⅞	3½	3⅜
October	3 5-16	3	3½	3½
November	3 5-16	3 3-16	3⅞	3 11-16
December	3 7-16	3 5-16	3 15-16	3⅞

HAWAIIAN SUGAR CHEMISTS' ASSOCIATION.

The following is a list of officers and members:—

President, C. F. Eckart, Honolulu; vice-president, J. C. Penny, Ewa, Oahu; secretary and treasurer, E. C. Shorey, Honolulu.

EXECUTIVE COMMITTEE.

C. F. Eckart, Honolulu; J. C. Penny, Ewa, Oahu; E. C. Shorey, Honolulu; P. A. G. Messchaert, Waipahu, Oahu; W. McQuaid, Olaa, Hawaii; G. H. Baldwin, Hamakuapoko, Maui; A. Fries, Makaweli, Kauai.

OLD TREE STUMPS.—To remove old stumps, a correspondent to the *Country Gentleman* gives the following:—'Get a 2-inch iron pipe, 8 ft. long; have a steel point welded into one end of it. With a sledge hammer drive this under the stump as far as may be necessary. Drop half a stick of dynamite into the hole thus made, and tramp earth upon it until the hole is filled, then light the fuse. The stump will be lifted entirely out of the ground with no earth adhering to it, so that it may be burned the next day.'

IMITATION CANE SUGAR.—A country grocer in England was recently prosecuted for selling sugar alleged by a public analyst to be colored with aniline dye so as to imitate Demerara crystals. On being consulted, another analyst of the highest standing declared that if even a ton of sugar were submitted to examination it would be impossible to discover whether an aniline dye had been used or not, the total quantity of coloring matter in the whole mass being so minute. The question then arises as to who shall decide, and how, whether aniline has been introduced. It is an important matter for aniline is injurious, and if the impression should gain ground among consumers that West Indian sugars were colored by such means, our produce would be seriously prejudiced. This has been clearly recognized in Demerara, and the planters in that Colony have one and all signed a statement on oath that aniline has never been, and is not now, used by them. Our planters have enough competition to face without unfair methods of this kind, and the sooner they rub it into the buyers in Mincing Lane and elsewhere that aniline has never been used in the process of the manufacture of sugar in Trinidad, the bett .r. Statements on oath forwarded to the leading London journals should quickly dispel any misapprehension aroused by parties interested in beet.—*Vaughn's*

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THE WESTON CENTRIFUGAL MACHINES.

We notice by our exchanges that recent improvements has been made in applying the motive power to these machines, in connection with electricity, by which better work is done, and the machinery will be adapted to other work than has heretofore been performed. In the manufacture of sugar particularly, it has superceded every other power, and the same remark may apply to other branches of manufacture.

It must be a matter of pride to Hawaiians that this great labor-saving implement originated here, and that they have the name of the inventor—David M. Weston, the founder of the Iron Works of this city. The improvement consists in the application of electricity as the motive power, which has proved to be superior to any other, though probably there are more of them at present driven by water than by any other power. In England this improvement has been awarded a patent, which indicates its value. The number of Weston machines now in operation can hardly be computed, and the application of this power to them direct, from any source, will vastly increase their number and usefulness.

Thrum's Hawaiian Almanac for 1903 is issued, and we are indebted to the publisher for a copy. Like previous issues, it is full of statistical and other information, valuable for reference. Among them we note articles on ancient Hawaiian Farming, Birds, Penal Settlement, Annual Retrospect, and local incidents during the past year. One's library is not complete without this valuable serial, which dates back for nearly thirty years.

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In answer to inquiries from abroad, it may be stated that our volcano on Hawaii is not in action now, nor has it been for some months or years past. It is not dead, but it is simply slumbering, the dense smoke continually rising from the deep pit, while the sky above it is brilliantly illuminated at night. It does not seem to have any connection with any other volcano, and when ready for action makes its own plans. It is well worth visiting at any time, and no stranger should fail to witness it, in connection with a visit to Hilo.

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A CAUTION TO MILLMEN.

The European correspondent of the Louisiana Planter writes the following; which all Sugar men should know:

"In one of our sugar factories an accident has happened to which it may be useful to call the attention of your readers. Work being finished, one of the officers of the factory wanted to see whether there was any water in the last steam evaporator and he opened, accompanied by a workingman, the so-called manhole, but before he was able to find out whether there was still any water in it or no, an explosion took place with fearful detonation. The officer and the workingman were thrown a long way off and the latter killed, while the former was dangerously wounded. Investigations as to how the accident could come to pass led to the discovery that a a lamp had been burning in the condensator, by which the gases in the apparatus had been set on fire, causing the explosion. The apparatus, however, is not damaged in any way. This event reminded the managers of factories to take care that their workingmen should not be allowed to come with burning lights to any vessel wherein explosive gases could be gathered, but to use electric glow lamps or any lantern of a safe construction. Besides it should be arranged that all vessels before approached by men are left open for a sufficient period to let any gases stream out."

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RUSSIAN SUGARS.

U. S. Supreme Court Decision.—The United States Supreme Court, at Washington, D. C., decided the Russian sugar case on fifth instant, in effect that Russia indirectly

pays a bounty on sugar exported, and, therefore, that sugar imported into the United States from Russia is subject to the assessment of countervailing duty equal to the bounty, according to the Tariff Law in force. This decision supports the position taken by Great Britain and will probably have an influence on Germany, Austria and France in completing the ratification of the Brussels Convention. The quantity of Russian sugars imported into the United States has been small since the countervailing duty has been assessed.

The following statements were agreed upon by the attorneys in the case when it was before the Board of U. S. General appraisers:—

"I. The Russian Government estimates the total production and the total consumption of sugar, and the total amount which may be put upon the market at the normal excise of R. 1.75 per pood is definitely fixed at the total amount required for consumption. This is known as free sugar.

"II. The first 60,000 poods produced by each factory is free sugar. The balance of the production is divided into free sugar, obligatory reserve and free surplus or free reserve.

"III. The amount of free sugar in each factory is proportioned to its total production, as the estimated consumption is to the total production of the country. This percentage is fixed by the Government according to the estimates of production and consumption.

"IV. Under the Russian law, therefore, all sugar is divided in the three following classes:—

(a) "Free sugar which consists of a certain quantity of sugar which the Russian Government permits a factory or refinery to sell for home consumption under an excise tax of 1.75 rubles per pood.

(b) "An Obligatory or Indivertible Reserve" of sugar, which consists of a certain quantity kept at each factory or refinery by order of the Government, and which may not be sold or removed without the special permission of the Government.

(c) "Free Reserve or Free Surplus," which consists of such sugar as is manufactured over and above the quantity of "free sugar" and "obligatory or indivertible reserve." This sugar cannot be sold for home consumption, except upon payment of the regular tax of 1.75 rubles and an additional tax of 1.75 rubles, or 3.50 rubles in all.

"And the Russian Government fixes and determines the following:—

(a) The total quantity of sugar required for home consumption.

(b) The quantity of "free sugar" allowed to each factory and this "obligatory reserve" which each factory or refinery shall keep on hand.

(c) "The maximum price at which sugar may be sold for domestic consumption.

"V. That the sugar which was imported in this case, and which is covered by this protest, consists of 'free sugar.' as above defined, and would have been subject to an excise tax of 1.75 rubles per pood if sold in Russia.

"VI. That, upon the exportation of said sugar from Russia, the Russian Government under its laws and regulations, released said sugar from said tax of 1.75 rubles, either by a refund of the tax or a cancellation of indebtedness, or otherwise.

"VII. That in addition to remitting said excise tax the Government issued to the exporter a certificate certifying that he had exported such a quantity of so called free sugar.

"That the said certificates have a substantial market value and are transferable, and that the price thereof is usually determined by the difference existing at the time between the price obtainable for the sugar on the home market and the price obtainable abroad.

"VIII. That said certificates are sold to and used by sugar manufacturers or refiners who are thereby enabled to transfer from their 'free reserve' or 'free surplus' to their 'free sugar' an amount of sugar equal to the amount shown by said certificates to have been exported, which amount may then be sold for domestic consumption on paying the ordinary tax of 1.75 rubles per pood (to which free sugar is regularly subject), instead of a tax of 3.50 per pood.

"IX. That the import duty of sugar into Russia is 3 rubles per pood."

Justice Brown handed down the opinion of the Supreme Court, and in discussing the effect of the certificates, he said: "In practice the market value of these certificates must vary according to the demand and supply, but the theory underlying the transactions is always this, that the exporter shall suffer no loss because he has exported his free sugar instead of selling it in the home market. It is practically admitted in this case that a bounty equal to the value of these certificates is paid by the Russian Government, and the main argument of the petitioner is addressed to the proposition that this bounty is paid, not upon exportation, but upon production. The answer to this is that every bounty upon exportation must to a certain extent operate as a bounty upon production, since nothing can be exported which is not produced, and hence a bounty upon exportation by creating a foreign demand stimulates an increased production to the extent of such demand. Consequently, a bounty upon production operates to a certain extent as a bounty upon exportation, since it opens to the manufacturer a foreign market for his merchandise produced in excess of the demand at home. Where regulations exempt sugar exported from excise

taxation altogether we think they clearly fall within the definition of an indirect bounty upon exportation."—*Willett & Gray.*

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CHEMICAL CONTROL IN SUGAR WORKS.

Chemical control in sugar factories is a question of the utmost importance, and is one of the things to which the greatest attention should be paid. On the continent of Europe the fact was recognized long ago, but it is to be regretted that in this country and in our colonies proper importance is not often attached to the subject. It is the old conservative rule of thumb which governs most factories. Our factories in the colonies are very often reproached with using antiquated methods and antiquated machinery, but very seldom is it pointed out that what is most wanting is technical and scientific skill. It is not only the sugar industry which suffers in this direction; it may be said that nearly all the industries need improvement from the standpoint of chemical education.

Why is there such need of scientific chemical control? For no other reason than to ascertain and maintain the regular and profitable working of the factory. I have had occasion to speak with planters and sugar manufacturers from various parts of the world, and have been very much astonished at the way in which their business is conducted. They either do not employ chemists at all, or employ what they call very clever, handy men. They said their (so-called) chemist was very handy indeed, he could be employed anywhere, from loading the cane onto the wagons to store-keeping and book-keeping, in fact, almost everywhere. When they were asked in what way chemical control is secured, some only shrugged their shoulders and said: "Oh, we never have any, we know all these things by experience without chemical or analytical aid." Sometimes they complain that they cannot get chemists. In one case I heard they had had a chemist, but he was a nuisance, always quarreling with the manager and foremen. For people who consider a chemist in a sugar works a nuisance there is no help, and any discussion with them is useless. Planters and sugar manufacturers from the colonies frequently come to England and consult practical and scientific men. I suppose they get proper advice and go home enriched in knowledge and enlightened with regard to new methods and principles. The good planter on his return tells his manager all that he has learned in Europe; the latter laughs and says, "I know all this and have forgotten it long ago." The trouble the planter has taken and all his expenses go for nothing, and the work is carried on as it was done in his father's and grandfather's time. Of course, I do not intend this to apply to all factories, because I know there are many

which are conducted in a proper, scientific way, but the above has been my experience with many planters and manufacturers.

A chemist employed in a sugar works should have a scientific training, and, if possible, practical knowledge. He should not only be acquainted with analytical chemistry, but have some knowledge of agriculture, engineering and commerce. A chemist in a sugar factory should be appinted by the proprietor or by the board of directors, to whom he has to send his weekly report and whom he must consult on every important occasion. Such reports should be handed to the manager, the latter may take note of them and be guided by them. The chemist should be properly paid and treated, and his engagement should be for a term of years. He should be able to take pleasure in his work, should have a chance of promotion, and be informed about everything going on in the factory. He should be required to visit the factory regularly each day and night, see the whole process of working, and should be the scientific adviser of the manager and the foremen. The more he knows about the ins and outs of the factory, in every department, the more useful will he be in the laboratory for a certain number of hours, and only pleased when the evening hour comes and he can leave his sanctum. It is necessary he should be on the best terms with the manager and the engineer. I have known cases where the manager and the engineer considered the chemist as a spy, a detective, an enemy, a creature whose presence was not required, and whose life was to be made miserable from day to day; and I have also known cases where the chemist was more disliked the more diligently he labored for the good of the place.

What is the duty of a chemist in a sugar factory? He must analyze and investigate all raw material, cane, beet root, limestone, sulphur, etc., in short all the products which are employed in the factory, and all the materials used in the processes. He must be required to analyze them regularly, and to enter his observations or reports in a book, which should be initialed by the manager or proprietor. In factories where a process is employed in which poisonous materials are used, these must be examined frequently and at short intervals. He must further analyze the finished product, and also the products during the various processes. It is absolutely necessary that from time to time a full analysis of the sugars should be made and properly recorded in the books. Every lot of sugar which is sold or bought must be analyzed and the analysis recorded. How useful such a record is in cases of dispute I can say from my own experience. Disputes with customers and too exacting buyers are the frequent lot of every sugar manufacturer and merchant, and in these cases

such a record is indispensable and forms the only reliable testimony.

In factories where poisons are employed in any of the processes every lot of sugar which goes to the consumer must be analyzed in full before it leaves the premises. Samples of such sugars must not be taken at random from a big bulk, but from a small quantity, and if the quantity is large several samples must be taken and analyzed. In such processes, for greater security, I would advise also the regular sending of samples of sugar to a public analyst to check the analysis of the chemist.

In cases where poisonous processes are used, the importance of regular analyzing the sugar cannot be too strongly emphasized.

As a matter of course the chemist has to analyze the juice and syrups in all the different stages; also the bagasse in the case of the cane, the press cakes from the filter presses, the wash water from the filter bags, and all the by-products of the manufacture.

The chemist should have the opportunity of improving his knowledge of the agriculture, as carried on in the field. Samples of cane and beet should be taken during vegetation and analyzed. He should be allowed some insight into the trade of the factory, as very often his advice may be useful in the changing of processes. The boiler house should be visited regularly and the chimney gases anlyzed.

Specially important is the animal charcoal or bone black plant, which should be under the constant control of the chemist. This is of the greatest importance in connection with sugar refineries and glucose factories.

In many continental factories a chemist or so-called chemist is employed only for the season, and of course he is only paid for the season, and when that is over he is no longer required or retained. Is this a tolerable situation for a competent man? With what pleasure can such a man work during the campaign, when he knows that when the latter is finished he has to turn out? He can only work perfunctorily and mechanically, just to finish his engagement. His employer and the interests of his employer, are considered by him in so far as they give him bread. Such a chemist employs half his time in thinking when and how he will find employment after the season is over, and where he will be the next season. Let us hope that this foolish system, too common on the continent, will soon cease, and that the sugar industry will no longer be despised by clever chemists with scientific knowledge who are thereby compelled to earn their livelihood in other industries. —*Sigmund Stein in the International Sugar Journal.*

A NEW MODE FOR HEATING AND EVAPORATING BEET JUICES.

A new mode for heating and evaporating beet juices has of late attracted some attention. Hitherto the accepted theory has been that for reheating it is necessary that the temperature used shall be at least superior to the maximum temperature of the liquid being heated. In most beet-sugar factories it is customary to draw from the first compartment of a multiple effect the vapor liberated from the juice being concentrated, and subsequently to utilize it for reheating, etc. These vapors from the last compartment could not answer the same purpose for various reasons; but they may render an important service by utilizing them in receptacles having considerable heating surface, in which the beet juice circulates. Do what one may, there are important caloric losses. The new mode consists in using the juice vapors at a low pressure for general heating purposes injectors being used. The appliance works on the same plan as a Giffard. Live steam is run through, drawing low pressure beet juices with it, and forcing them into a compartment communicating with the first compartment of a multiple effect. M. Saillard discussing the question calls attention to Dr. Classen's investigations regarding the possible economy of steam to be realized during evaporation, by the use of injectors of the Korting type. One kilogram of direct steam at a pressure of 6 atmospheres can draw by suction 0.55 kilos of juice vapor at 0.3 atmospheres vacuo, to force it into a receptacle at a pressure of 0.5 atmospheres. When the steam has a pressure of 4.5 atmospheres, the suction under the same conditions will be 0.4 kilos. In plain words there are needed 2 kilos of direct steam having a pressure exceeding by 5 to 6 atmospheres the pressure of the juice vapor, in order to draw by suction one kilo of the latter into a receptacle where the pressure is 0.8 atmospheres. If in a beet-sugar factory most of the machines are working at full pressure, the economy with injectors means for a quadruple effect 3.8 kilos direct steam for 100 kilos of beets, provided the vapor is taken from the second compartment. If the factory has only expansion engines, the volume of exhaust steam then being less, it becomes necessary to send more direct steam into the first compartment of the multiple effect, and the economy to be realized through the use of injectors under these conditions would be greater.—*Beet Sugar.*

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SUCCESSFUL CANE LOADER.

Having been informed of the successful operation of the Howard cane loader on the Waubun plantation, in Terrebonne parish, its work was viewed during the week by a representative of the Sugar Planters' Journal, and we are glad

to state that it was found admirably performing its labor-saving function.

The Messrs. Moore, proprietors of Waubun, began using the cane loader on the ninth instant, it being operated under the direction of the inventor, T. J. Howard, and so pleased were the purchasers that they bought another, which is now also in use.

The machine, as seen working, is practically the same in construction as the one exhibited last summer at the Sugar Experiment Station. The only difference lies in the grapple, which has been changed materially for the better. Each grapple is equal to raising 500 pounds cane to the lift, and consists of a fork with a trip hook, the load released by pulling on a cord. It is opened by a spring when laid on the ground and is in a position to clasp down on the cane when drawn along the furrow between the heap rows. As the grapple is drawn up to the top of the inclined boom that swings it around and over the wagons to be loaded, it is tightened, and securely binds the canes, which are released by a trip and drop into any desired part of the wagon awaiting loading.

The weight of the loader is reported as being 2,000 pounds and it is drawn along by four mules without any great difficulty, even when the roads are heavy. As noted on Waubun, when the loader had both the grapples working at once, one to either side, loading cane onto carts on both sides simultaneously, the following number of laborers were being used: One boy to drive the mules that pull the machine along; two men to direct the grapples; two men to attend to the swinging around of the two booms, from which hang the bunches of lifted canes which they also trip; one man sitting at the back of the loader, attending to the brake that controls the rope fastened to the grapple, which rope is drawn by a mule driven away from the machine and tripped loose by the two boy riders when their mules have raised the separate loads, the brakeman letting the ropes slip when the loads are in a position to be dropped by tripping. A boy was also employed in picking up the few loose canes that had slipped through the grapples. It is very likely that two of the men used on the sides of the loader will be displaced by the two teamsters of the wagons undergoing the loading process. In this event, the loader will be operated entirely by six men and boys.

Ever since the cane loader has been in operation on Waubun, it has had to overcome the drawbacks incident to heavy roads. Notwithstanding, it was seen that two wagons were repeatedly loaded in from five to seven minutes, approximating one and three-quarter tons cane to the wagon. The wagons have had their sides made two feet higher by the nailing on of wood racks, in this manner avoiding stacking the sides

with canes, as is common with hand loaded wagons. The canes that the machine was lifting at the time of our representative's visit were exceedingly heavy in stand, large and crooked. Manager Chapron, of Waubun, vouches for the statement that under his direction, on a recent occasion when the wagons were ready and waiting for the loader to supply them cane, and not vice versa, as is most always the rule on account of scarcity of wagons, eight wagons were loaded in twenty-five minutes, one and a half tons to the wagon. He also stated that a single wagon had been loaded in two and a half minutes.

Records kept on Waubun show that on the sixteenth instant loading of cane by hand was accomplished at a cost of fourteen cents per ton, while the cost of loading with the force as stated above was 6.62 cents per ton.

The economic importance of the mechanical cane loader in use on Louisiana sugar plantations is certainly manifest.

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INSURANCE ON LOUISIANA SUGAR HOUSES.

A sugar house recently burned down and at once became the text for several insurance writers, they arguing, we suppose, that sugar houses were a very dangerous risk, because they might happen to burn down; that one had just burned down and that therefore rates must be entirely too low.

We find now that even the *New York Journal of Commerce* in its issue of January 5, has in its insurance columns some comments concerning Louisiana sugar houses that are certainly not very satisfactory to those in the sugar interest here. It adverts to the fact that the 700 sugar houses in operation some ten years ago having now been reduced to about one-half that number, is an evidence of the languishing of the industry, forgetting as they do that is simply means that concentration in manufacture that leads to greater economy, and in the end, to a greater profit.

Referring to the character of these risks the *Journal of Commerce* says that some companies have put them on their prohibitive lists, while others write only selected plants and even on these demand increasing rates. It claims that the physical hazard never justified the low rates at one time approved by the New Orleans compact and that the unreasonable attitude of two or three local companies prevented adequate schedules being strictly applied. In other words, the insurance editor of the *Journal of Commerce* seems to refer to the New Orleans compact as a proper organization and believes that all these rates are too low.

We have had considerable conversation with prominent insurance men in New Orleans who have assured us that they never lost money on their sugar house business. They be-

lieved that well chosen sugar house risks were as good as could be had when fair rates were got.

There can be no doubt but that during recent years the insurance companies in New Orleans have nearly killed the goose that laid the golden eggs. They have asked such high rates for the sugar house insurance that a very large portion of the sugar house property of this state is not insured at all. At the same time, the owners of the sugar houses would be very glad to have them insured at fair rates and the companies would make money by doing the business, but they see fit to discriminate against this, the leading manufacturing industry of our state.—*Louisiana Planter.*

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EFFECT OF FUEL OIL.

(How the Substitute For Coal Has Cheapened Freights.)

Sir Marcus Samuel has called the attention of the British public to the possibilities of the future in connection with the substitution of oil for coal as a fuel for steam vessels. Mr. Melrose, of the U. S. Navy Department, predicts the use of oil in the near future as fuel for war vessels. They might have gone farther and told of the remarkable conditions now existing on the Pacific coast of the United States. There fuel oil has long passed the experimental stage. Over fifty steamers now sail from the port of San Francisco with oil for fuel. The steamer Mariposa returned from Tahiti, a return trip of 7,200 miles, under steam generated exclusively by oil. Pressure and speed were easily maintained, and she reached port one day ahead of her schedule. Her fuel cost just half as much as coal; there was no expense for painting ship such as is necessary when coal is used. Particularly interesting is the opinion of Lieutenant Winchell, who has reported on the voyage for the United States Government, as to the character of men that should be employed in the fire rooms where there is an oil-fuel installation. It neither requires physical endurance nor previous training with coal fire. The men placed in charge of the contrivance, however, should have mechanical aptitude, and possess readiness of resource and nerve. The senses of sight, hearing, and touch must be exercised at all times, since it is essential to keep a good look out on the furnace to note by the sound of the working of the blowers, and the completeness of combustion, and to check by the sense of touch the workings of mechanical contrivances. If fewer men are needed in the fire rooms it is requisite to secure men of high intelligence, who can judge quickly as to the tendency towards impairment.

THE MONEY SAVED.—Less space was occupied, the fixed charges for labor were greatly reduced, the feeding of the fuel took less time and cost less. In fact, no disadvantages

were discovered, and the advantages were manifold. It is estimated that on one troop-ship making the trip from San Francisco to Manilla and return the saving on fuel through the use of oil has been at least £5,000 for every such voyage. The result of the lack of demand for coal is remarkable. In San Francisco harbor alone £600,000 worth of capital in ships has been forced into idleness. Shipowners and skippers no longer find it profitable to voyage to Japan and Australia and return to San Francisco, awaiting cargoes of grain to Europe. The competition in carrying the small imports of coal has been so keen and the freight rates are now so low that the shipowners prefer to have their vessels idly ride the becalmed waters of the bay rather than take the chance of obtaining valuable cargoes in foreign ports. One of the benefits is that grain importers of California can obtain low rates to Europe. The vessels engaged in carrying coal are usually designed also for the grain trade to Europe. As this coal trade is gone, there is only one source of revenue left, and that is the grain trade. Here, again, keen competition has entered, and as a result there are low rates on grain to European ports.

Colliers Out of Work. — Twenty-three shillings is the present low price for a grain charter from San Francisco to Great Britain or the Continent. The use of fuel oil has put the colliers out of business, and in turn they have sought operations in other channels. The rapid increase in the shipping facilities of the world, due in great part to the artificial demands for transportation growing out of the South African and Spanish wars, has induced a reduction in ocean freight rates for cargoes in bulk, and to that extent favored the farmers and producers, if not the manufacturers. This favorable situation is accidental. When Mr. Morgan and his associates shall have completed their transportation arrangements, an oil-burning equipment for every vessel being a projected part of the plan, the tramp steamer will be out of the running. In connection with this oil question the Standard Oil Company has a great fight on its hands in California. The trouble lies between the Standard people and a big oil and transportation company. The Standard Oil people are building a pipe line 200 miles long from the great oil fields in Kern County to tide water in San Francisco Bay. The Standard Oil Company will use this pipe line for the transportation of oil from wells acquired by the corporation. It will also carry oil for producers. The rate of transportation to producers will conform to that of the railway companies connecting with the oil field, as the Standard Oil and the Southern Pacific and Santa Fe Railway Companies are working under a tariff agreement.

Cheap Oil. — A big California corporation, which owns

some of the best wells in the oil district and owns a coast line of steamers engaged in the oil-carrying trade , has surveyed a direct route from the oil field to ocean, and has agreed that if pledged freight to the extent of 10,000 barrels of oil daily it will build a railway, and thus furnish relief to the owners of wells having no connection with the Standard Oil Company or the railway companies. Thus far freight to the extent of 9,000 barrels of oil daily has been guaranteed. This fight is a very pretty one because the Californians in it are worth, in the aggregate, £20,000,000, and have already had several successful skirmishes with the railway companies. The outcome of the fight will be that oil will be the cheapest thing on the Pacific coast or the two companies will combine. The latter is the outcome to be expected. The issue of this shipping congestion is in doubt, but it will make American competition keener than ever, for the ocean freights will be so slow that they will be but a small matter in figuring prices in any part of the world. This will include the transportation of fuel oil for sale, and with the present situation along the Pacific coast in view it is but reasonable to suppose that a great majority of steam-going vessels will within a few years have substituted oil for coal. There is plenty of oil in the United States, and much in other countries. Its price is merely a question of transportation, and that again is merely a question of the construction of pipe lines to tide water. The last naval Appropriation Bill passed by the Congress of the United States carried an item of £4,000 for experiments to be made with oil on naval vessels and these experiments are now in progress. The same plant which has been used for years to test the efficiency of different grades of coals is now being used to test oil, a fact which speaks well for itself. It may soon become a question with the various peoples of the earth not as to the future coal supply, but what of the oil supply? The balance of trade may hinge on this in the future, for the cheapest transportation, governs the market.—*Exchange.*

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IMPROVING SUGAR CANES.

(Interesting Experiments.)

"Amongst the causes responsible for the present agricultural depression in the West Indies, particularly in the sugar-producing islands, must be placed the high profits formerly obtained from sugar cultivation. In the days before the beet became an important factor in the sugar trade of the world the sugar-cane yielded relatively enormous returns, and planters made every effort to extend the area under sugar-cane cultivation. To this end valuable fruit and other trees were cut down, poor lands prepared at great cost, and, in fact,

scarcely any sacrifice was thought too heavy so long as it led to an increase of the output of the staple crop." This was the view expressed a fortnight ago in one of the official publications of the Imperial Department of Agriculture for the West Indies. Instead of providing against contingencies by having several strings to their bow the colonists were attacked by a feverish desire to make fortunes rapidly, and could give no thought to the future. Cotton-growing, once the mainstay of some localities, was completely wiped out, so that, instead of the Mother Country receiving about three-fourths of her cotton supply from the West Indies, the commodity soon disappeared altogether from our list of imports. So with other articles; everything had to give way to sugar. But in making the change the planters acted without discrimination, and they adopted the policy of being content with growing the varieties of sugar-canes with which they were familiar and sticking to old-fashioned methods of producing the marketable commodity. When beet growers threatened competition the conservative cane growers ridiculed the step, and they never stirred in the direction of changing their methods. During more than half a century the beet growers have shown what it is possible to accomplish in improving the quality of a vegetable and the quantity of its yield, for the beet now produces about four times as much sugar as it did originally. Still the West Indian planters did nothing but fold their arms, grumble about foreign bounties, and trust to their exhausted canes to ward off collapse.

Modern Methods Necessary.—But since the institution of the Agricultural Department by Mr. Chamberlain in the autumn of 1897 things have begun to look more hopeful for the sugar-growing islands provided the planters are prepared to shake off their apathy and substitute modern methods for the obsolete ways of their fathers and grandfathers. These ways were excellent no doubt when there was no opposition, but they are wholly inadequate for modern days and keen rivalry when success can be attained only by incessant exertion on right lines. Adopting a practice well known to florists, horticulturists, and others, but to beet growers in particular, the department has in the past three seasons devoted much time to the study of improving the quality and productive capacity of canes suitable for cultivation in the islands, and the results, which are published annually, show the most encouraging success to have attended the work. Experiments have been systematically carried out in Trinidad, Barbados, Antigua, and St. Kitts with canes produced from seed, and not, as in former times, from slips of old canes. The seedlings prove to be far superior to the ordinary canes, as is clear from the voluminous statistical results relating to this year's investigation. When the experiments were first

undertaken the Barbados seedling known as B 147 was thought to be the most satisfactory, but further experience has brought out its defective qualities, and the best all-round cane is now declared to be B 208, which has been awarded the first place in each locality where it has been tried, all observers agreeing that its juice is remarkable for its great richness and purity. It should be noted that the experiments have been carried out on the ordinary sugar estates, plots being selected in the fields where the planters obtain their crops. As the treatment is in all cases the same the results are strictly comparable.

VARIETIES CULTIVATED.—A dozen varieties were under cultivation in the Barbados experiments. Without entering into details it may be stated that, taking the average yield of the plants in all soils, B 208 was first on the list with a yield of 7,595lb. of sucrose (cane sugar) per acre, the purity of the juice being very high. B 147 was in the second place, with 7,363lb. of sucrose but with juice of doubtful purity. On the other hand the planter's favorite cane, known as white transparent took the eighth place with 6,550lb. of sucrose and juice of high purity. At Antigua there were twenty-three varieties grown, and it is evident that the soil there is congenial ,for the results are all high. B 208 yielded 13,293lb. of sucrose per acre in juice, and nine other canes produced each over 10,000lb. White transparent was near the bottom of the list, however, being awarded the twentieth place, with 8,566lb., B 147 being the twenty-first with 8,327lb. Twenty varieties competed in St. Kitts, B 208 standing first with 10,378lb. of sucrose per acre to its credit, five others exceeding 9,000lb., but white transparent occupied a middre position, being tenth on the list with 8,677lb., B 147 coming next with 8,597lb. These are all very remarkable results, proving incontestably that by the introduction of more scientific methods it is possible to evolve a cane which will yield considerably more and purer sugar than has hitherto been found obtainable; we shall not say four times as much, as in the case of beet, but an increase sufficient to convert a bankrupt business into a paying one. For the present the authorities do not urge the planters to go in wholesale for the cultivation of B 208, but to begin cautiously with small areas of the best varieties, according to the nature of the soil, the rainfall, and the exposure of each locality, while the department continues its experiments with the best now discovered and new ones that may be found as the investigation proceeds.—*London Times.*

FREE TRADE IN SUGAR IN ENGLAND.

The full development of the policy of free trade, to which this country has long since committed itself, involves some very difficult questions in our relations with those foreign Powers who still adhere to the policy of protection, and among these questions is one which for some time past has engaged and still occupies the attention of our Government in connection with the non-observance by France of a treaty entered into by that country with this and two others as far back as 1864. Our Ministers, bound by the obligations of free trade, and fearful of the cry of "no protection," are perplexed to discover in what way this country, without resorting to countervailing import duties, can defend its home and colonial industries from deliberate attacks by protected foreigners. The case at once arises when a foreign Government chooses to subsidize a particular industry of its own in order to oust from our home as well as from the foreign markets an important competing industry of this country which otherwise would hold its own. Under such circumstances what course is our Government to adopt? Are we to look on and see British capital, labor, and skill forced out of a natural and advantageous channel of employment at great loss, which ultimately falls on the consumer, because free trade forbids interference, and political economy demonstrates that in some indefinite period of time the country which so props up an industry will find out its mistake? I can find no authority among the leading economists and greatest advocates of free trade which goes so far as to maintain that no opposition must be offered by one nation adopting free trade in the event of its national industries being attacked by another nation using the State weapons of protection, not for the purpose of compensating natural disadvantages but with a view of crushing rivals, and thus dominating the market, and so ultimately recouping itself at the expense of the consumers.

This suppositious case has actually risen, and France at this time subsidizes her refiners in an indirect but most effectual way, in order that they may undersell and eventually drive the British refiner from his own, as they already have done from the continental market; and what is worse, in doing this, France is acting in direct contravention of a specific reciprocal treaty entered into ten years ago, the stipulations of which, although originated by her, she has never observed.

That such is the fact will be evident to any one who reads the despatches and correspondence relative to the Sugar Convention of 1864, contained in a paper presented to the House of Commons shortly before the recess. By that convention treaty France, England, Belgium, and Holland reciprocally engaged to make certain agreed fiscal regulations, in order

to put an end to all bounties on exportation of refined sugar. We have fulfilled our engagement in its entirety, but France has not yet done so, and consequently a treaty which on paper is what the jurists term an equal one, has in its operation, through default of France, become an unequal one, such as might have been imposed upon us by a superior Power, and the result is that the great refining industry of this country is being ruined, and the West Indian and other British colonies whence that industry drew its chief supplies of raw sugar are having their staple trade arrested and their produce artificially injured in value. This presses with great severity upon our West Indian possessions, especially Demerara and Jamaica, inasmuch as these colonies, with their free and well-paid, but scarce, supply of labor can barely maintain their ground against competition of the slave labor of Cuba, which, in spite of Spanish Abolition Acts, is more flourishing than ever. Even the wealthy and prosperous island of Barbadoes, with her good supply of labor, is so hard pushed by Cuban slavery, that she has no resources to spare for a contest in the British market with the highly-protected sugar of France. Ever since 1846, when Earl Russell, in opposition to the views of Sir Robert Peel, abandoned British Colonial sugar to an unequal struggle with the slave-grown sugar of Cuba and Brazil by equalizing the import duties on free and slave-grown produce, the West Indian colonies have ceased to expect any fiscal protection whatsoever, but they have relied upon our Government being able to give its free trade policy full play in negotiating and carrying into effect commercial treaties.

The very essence of free trade is to leave capital and labor to flow without let or stimulus into those channels of production which the natural advantages of each country may render most reproductive. By this means international trade is carried on with the greatest benefit to both producers and consumers of the several countries, but this harmony of interests is at once destroyed if one country subsidizes its own produce, which, so far as free trade is concerned, has exactly the same effect as placing a more or less prohibitive impost on the product of its neghbor. The conduct, therefore, of France, in not giving effect to this treaty has hampered our colonies in developing their natural advantages, has arrested the flow of capital and labor in this country into a reproductive channel of industry, and to whatever extent this has been done, by every maxim of free trade, the general interests of the mass of consumers must now or eventually suffer.

The parliamentary paper before referred to, contains some very vigorous remonstrances on the part of the late, as well as of our present Government, but the very feeble pleas put forward by the French Government betray either disinclination or inability to fulfil their engagements, and at the last

moment some fresh pretext for delayieng refining in bond, authorized by the House of Assembly early this year, and consented to by us as a solution of the difficulty, has been found. I am afraid that unless our Foreign Minister is very firm and watchful some indirect means will be taken to continue a bounty which, considering the large interests fostered by its influences, French statesmen now find great difficulty in dealing with. At all events, it will be a triumph of diplomacy if we succeed in securing the reciprocity which was the object of the treaty without having recourse to the surtax, which under clause 19 of the treaty we have power to impose upon imports of refined sugar if exported under a bounty by any one of the contracting nations.

I have endeavored to present the case in its full bearing upon our public policy of free trade and, without entering into the numerous details and trade statistics contained in the official correspondence, also to point out the serious injury which is being inflicted upon important home and colonial interests; and I am sanguine enough to believe that the influence of the press will materially help our Ministers in their endeavors to secure for our trade and commerce the fair and legitimate reciprocal advantages of "free trade and no protection," and in this expectation I submit the whole question for your consideration.—*Wallwyn Poyer B. Shepheard in The Int. Sugar Jour.*

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THE AMERICAN SUGAR REFINING CO.

The annual meeting of the stockholders of this company was held January 14, at Jersey City. There was represented the holders of 629,466 shares of stock, either in person or by proxy. The President, Mr. Havemeyer, reported a satisfactory business last year and an expectation of an improvement this year. Mr. H. O. Havemeyer, Mr. John Meyer and Mr. Arthur Donner, the directors whose term of office expired today, were unanimously re-elected. The acts of the officers and directors up to this time were approved. It was voted that the surplus in the treasury of the company, after the payment of the dividends which have been declared, shall be transferred to the working capital.

President Havemeyer in his annual report says: "The president is able to report to the stockholders that during the past year business conditions relating both to purchase of raw and the sale of refined have been reasonably satisfactory. The average price at which refined has been sold is 4.45c. a pound. This includes 1.81 cents a pound which goes to the Government. It thus appears that the net price has been reduced to 2.64c. a lb., as against a net price which, in 1887, at the time of the formation of the Sugar Refineries Co., was 3.50c. I refer to the matter particularly

at this time because of proposed legislation, the professed object of which is to regulate business done by corporations as against that which is done by individuals. Any such legislation overlooks the fact that a corporation is an aggregation of individuals. We have 11,274 stockholders, every one of whom is interested in the conduct of the business, and the business is done at an economy impossible in individual efforts. The low price leads to increased consumption, and enables the business to be done at the lowest possible margin. The natural increase of consumption, year by year, may be stated to be 4.75 per cent. During the last year the increase was 8.17 per cent; this is attributed to the reduction in price brought about by combination.

"It is only by keeping the price down that competition can be met; and if legislators would inform themselves of the situation they would learn that in the sugar industry there is no such thing as preventing competition and the building of new refineries. The above makes it impossible to understand what reasonable motive there can be for much of the so-called anti-trust legislation. Apparently it is solicitude for stockholders to which is due the proposed legislation. Our stockholders have heretofore shown confidence in the management in a way which cannot but afford gratification. They continue to do so. There is no law which compels them—and the same is true of all corporations to buy or to retain stock. It would seem that it would be time enough to interfere in the interest of stockholders when stockholders make the request. The company has heretofore given such information to stockholders as they, as a body, have asked for, but has conformed to its rule that special information shall not be given to individual stockholders. This recognizes that business which is to be done by corporations in competition with individuals cannot satisfactorily be done if the individual may withhold all information about his business and the corporation shall be compelled to make public information about its business. Unless instructed otherwise, the company will adhere to the policy heretofore pursued of doing business at a minimum of margin, relying for its profits upon enlarged consumption. It is a curious commentary upon much of the proposed legislation that while its avowed object is to relieve, its effect is to put restraints upon trade, this being directly the reverse of the action of our great commercial rival. England, which in recent years has been forced, both in the interest of producer and consumer, to wipe from its statute books legislation which for centuries it had been the policy of England to encourage upon the idea that it prevented restraint of trade. It is not my purpose to criticise or to comment upon the various plans which are under consideration to hurt corporate business. What I say is intended for our own stockholders. It is due to them that the business of the company shall be

carried on, so far as it fairly and reasonably can be, in their interest; and this course the directors propose to pursue, conforming always, of course, to whatever shall become the law of the land. The dividends for the last year have been continued at the 7 per cent rate, any surplus of earnings being reserved as working capital for the needs of the business. The stockholders have heretofore approved this, and they are asked at this time to confirm the action to that effect which has been taken by the directors." President Havemeyer made a statement commending to the attention of stockholders the observations of Governor Murphy of New Jersey on the subject of corporations contained in his message, contrasting them and the relations to the community with the efforts of public officials high in authority at Washington, who, he claims, pander to the erroneous public views on the same.

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A MODERN DEMERARA SUGAR FACTORY.

A visit to Pln. Diamond is a most instructive experience to those who take an interest in the processes of sugar manufacture. The estate by the amalgamation of Pln. Providence has become the largest in British Guiana, whilst in the factory a plant has just been erected which is certainly unsurpassed in the West Indies and the whole of South America. It was the good fortune for a representative of the *Daily Chronicle* to see the new machinery in full operation a few days ago, when the grinding season was about drawing to a close. The manager, Mr. John M. Fleming, himself acted as cicerone, and through his courtesy our representative learnt much regarding the new appliances that have lately been introduced.

INCREASING THE ESTATE'S AREA.

The factory seems to the unitiated a perfect maze of machinery, and without the direction of a competent guide it would be impossible to evolve anything approaching order out of the apparent chaos. Mr. Fleming conducted the *Chronicle* representative through the various departments in their natural order, commencing with the arrival of the canes in punts at the factory. As is generally known, the amalgamation of Pln. Providence with Diamond estate has led to the dismantling of the former factory, the canes grown on the plantation being now ground at Diamond. For this purpose the authorities of the estate had to construct at considerable cost a navigation canal connecting the two plantations. The scheme required that the canal should cross several of the ordinary draining trenches, and this was successfully accomplished through the agency of cast iron aqueducts which carry the water of the canal without interfering with the

course of the draining trenches. To maintain the supply of canes an excellent fleet of punts has been provided, but on account of the improved crushing plant of the factory an increased service of punts will be needed when the mill is worked to its full grinding capacity.

THE NEW CANE UNLOADER.

As the punts laden with canes arrive at the factory one sees in operation the most striking innovation that has been introduced in connection with the local sugar industry for many years. The Bodley cane unloader is an invention which has been applied to Diamond estate in the course of the last season. It is the first of its kind established in the colony and in its practical use it has proved entirely successful. An unloader of somewhat different construction was erected last season at Pln. Albion, Berbice, but the experiment was a failure. The installation of the unloader at Diamond was the result of the visit of Mr. Fleming and the estate's chemist, Mr. Wm. Douglas, to Louisiana and the Hawaiian Islands during the early part of 1901. They there saw the unloader at work, and after a number of experiments made at their instance by the makers, the Bodley Wagon Company, Tenn., U.S.A., a modified appliance was constructed which Messrs. Fleming and Douglas believed would suit the conditions in Demerara. The event has proved that they were right in their calculations. Some months ago Colonel Mallon of New Orleans, the inventor, who is responsible for the invention and introduction of nearly all the successful agricultural implements which in recent years have revolutionized sugar-cane culture in Louisiana and is the pioneer in cane-handling appliances, came to Demerara, and under his supervision the unloader was erected at Pln. Diamond in time to be put to practical use during the last grinding season. Its successful installation solves one of the problems that have been under discussion by the sugar planters of this colony during the past quarter of a century, and it represents perhaps the most effective labor-saving appliance at work in the factory.

UNLOADING INVENTIONS THAT WERE FAILURES.

Many efforts have been made to discover a process by which the punts could be unloaded at the factories by some means more expeditious and cheaper than by hand. The inventors, apparently, all proceeded on a wrong principle. Several decades ago, for example, the model of an unloading invention was shown in Georgetown but it does not seem to have commended itself to the planters. Its essential principle consisted in the complete raising of the punts and their contents out of the water—a somewhat superflous expenditure of energy to very little purpose, inasmuch as once raised the punts had still to be unloaded,—a problem which was never satis-

factorily solved. The punt could be got into mid-air and turned over, but the emptying of its contents on the cane-carrier was an important part of the process which baffled the ingenuity of the inventors.

THE UNLOADER AT WORK.

The Bodley-Mallon cane unloader is constructed on a more intelligible principle. The punts before being loaded in the cane-fields have a chain arrangement inside which completely envelopes the canes. Arrived at the factory, a hoisting gear is attached to the arrangement at either side; the weight of the canes pulls the gear taut, and the load is rolled bodily out of the punt and deposited on a platform adjoining the cane-carrier which conveys the canes to the mill. As the canes are deposited on the platform the youth in charge of the unloader pulls a lever; a flexible rake, which had been hoisted clear of the platform prior to the unloading of the punt, descends and is set in motion; it drags the canes from the platform on to the cane-carrier in such a manner that they are fairly evenly distributed, requiring no readjustment before being crushed. The machinery, which is driven by a small steam engine, works with remarkable smoothness and perfection. Hardly a cane is left behind in the punt; there is no delay in depositing the load on the platform; the net-chain arrangement in the punt by means of which the canes are lifted is placed in position without delay, and in less time than it takes to describe, the punt is emptied of its freight and has given place to another. The unloader works from both sides, so that two punts can be in process of unloading simultaneously. Thus, while on one side the rake is dragging the canes to the carrier, on the other a load of canes is being elevated from the punt.

THE UNLOADER AS A LABOR-SAVER.

The value of the unloader as a labor-saving agent was well illustrated at the time the *Daily Chronicle* representative was being shown over the factory. Some distance off about forty-eight hands were engaged in unloading punts to feed the older mills, whose crushing capacity is not at all equal to that of the mill recently introduced, in connection with which the unloader has been erected. With a gang of eight, mostly boys, the new apparatus was doing exactly the same amount of work as those 48 hands continuously employed. The unloader, which is erected under a shed outside the factory building, is very compact, occupying but little space, and is easily manipulated. A youth who takes up his position on a central frame has at his command a number of pull-levers and thus can regulate the motive power as it is required. The unloader undoubtedly represents the practical solution of a question which has engaged the attention of local planting

circles for many years. The cost of the apparatus erected, with chain equipment for the punts, was $10,000.

THE FULTON NINE-ROLLER MILL.

The canes, having been placed on the carrier, an endless apron, are conveyed to the crushing-mill. This, too, is an innovation in the colony and is perhaps the most perfect and powerful of its kind. It is known as the Fulton nine-roller mill and crusher (eleven rollers in all), and is made by the Fulton Ironworks, St. Louis, Missouri. The crusher is 32 in. in diameter by 78 in. in length, and the mill rolls are 34 in. by 78 in. In Louisiana it is frequently styled the Cora mill, that being the name of the plantation upon which it was first installed some years ago. It gives quadruple crushing, occupies a remarkably small floor area, and yields a higher percentage of extraction than any other mill manufactured. The authorities of Pln. Diamond had to work at high pressure to get the plant erected in time to participate in the grinding campaign just closed, and the installation of the machinery was an exceedingly expeditious piece of work, what practically amounts to the doubling of the factory having been completed in four months. An untoward incident happened at the outset which caused considerable delay. The ill-fated steamer *Roraima*, which perished in St. Pierre harbor on the occasion of the first violent eruption of Mont Pelee in May last, went down with a cargo of the new machinery on board, the disaster necessitating a repetition of the order. The ensuing delay deprived the estate of the full advantage of the new mill, which has not been working throughout the grinding season; but the excellent results given during the period it has been working justify to the fullest degree the belief of the manager in its suitability for local conditions.

THE MILL'S POWER OF EXTRACTION.

The acquisition of this improved mill, which like the unloader is an American invention, is also a consequence of the visit paid to the United States by Messrs. Fleming and Douglas. It was objected that the mill, which has for some years been at work in Hawaii and Louisiana, was not adapted to the grinding of the strong, coarse canes grown in Demerara and that the crushing would not be as perfect as that given by the prevailing processes in the colony; but after witnessing the mills in operation Mr. Fleming and his coadjutor had every confidence in recommending them, and their confidence has not been misplaced. As worked on Diamond estate during the past few months the mill leaves but 42 to 44 per cent. of moisture in the megass. There are no mills in the colony which produce megass approaching this in quality. In Hawaii it is claimed for the Fulton mills that they leave but 42 per cent of moisture.

THE NEW MILL AT WORK.

As the canes descend to the mill they first pass through a powerful "crusher" which also sends an even "feed" into the mill. This is a matter of some importance, in view of the fact that the unloader does not supply a feed of canes as even and regular as when the unloading of the punts is done by hand. The crusher, however, compensates for that defect, its essential feature being the regular supply it is able to provide for the rolls. After having received this partial crushing the megass, passes on to undergo a triple crushing in the mill, and having left the grinding rolls it is then conveyed direct to the furnace by the megass-carrier. A single man suffices to regulate the firing; the megass that the mill turns out is readily combustible and is fed direct to the furnace. In ordinary circumstances the megass is sufficient to generate the necessary steam without the aid of any other fuel, but on the occasion when the *Daily Chronicle* representative visited the factory a little wood was required, and it was then near the end of the grinding season and the machinery was in need of a general clean up.

THE "CLIMAX" WATER TUBE BOILERS.

The one furnace serves to supply the heat to two powerful "Climax" water tube boilers each of about a thousand horsepower. These boilers, also of American pattern, were erected some years ago, that just concluded being their forth crop. They are much safer and more economical in operation than the ordinary multitubular boilers. From them is supplied the steam for the new Corliss engine (30 in. by 60 in.: also erected within the past few months), which drives the Fulton mill. The engine is of the most modern make and is of the most efficient type working in connection with the colony's sugar industry. For the work being done it indicates 420 to 450 i.h.p. Misgivings were expressed by some experts as to its capacity to work such an elaborate plant, but in this respect no difficulty whatever has arisen, an ample margin of power being available.

Attached to the mill are many improvements which are new to the colony and make its working more efficient and satisfactory. An ingenious contrivance strains the cane juice as it emerges from the rolls and automatically carries the "cuss-cuss," as the fibrous matter remaining behind in the strainer is termed, back again to the rolls. Then the automatic pressure regulating appliances known as hydraulic accumulators, by whose action more perfect extraction is secured, are applied in a manner far more effective and with greater pressure than in the case of the general type of mills in the colony.

A CONTRAST.

The saving in space and power and efficiency which the new mill affords is well illustrated by the adjacent working of two single three-roller mills of the common pattern in use in Dem-

erara. They are each driven by an engine whose cost of working is approximately equal to that of running the Corliss engine, and the megass-fired multitubular boilers which generate the steam number no fewer than ten. These two mills give the canes a double crushing; until recently a third crushing was provided for, but to make room for the new Fulton plant, the third mill, which had been taken from the Farm factory was removed and transferred to the buildings at Pln. Wales across the river—an estate which is also the property of the Demerara Company, Ltd.

RESULTS COMPARED.

Needless to say, these two mills working together give very inferior results by comparison with the Fulton nine-roller mill. The latter is estimated to have extracted about 90 per cent. of the sugar from the cane, without maceration, during its working on Diamond; but the two other mills combined do not at present give a higher percentage of extraction than 84 per cent. of the sugar from the cane. It is not difficult to calculate what this difference means for a single grinding season in the handling of a large crop like that of Pln. Diamond. The double crushing plant will be improved and rearranged, with the addition of a crusher, during next season. The planters of Hawaii claim that with the Fulton plant they can get the percentage of extraction as high as 93 with maceration. Compare this with the results which satisfied the Demerara planters about ten years ago, when they were satisfied with a 75 to 80 per cent. extraction of sugar from the cane at the mill. The crop for the season just closed is 10,200 tons, which represents an average yield of 2½ tons of sugar to the acre. The new Fulton mill, it may be stated, is capable of turning out between three and four tons of sugar per hour. The average at Diamond has been 3½ tons, and the sugar output for the whole milling plant has been close upon 7 tons per hour.

THE TREATMENT OF THE CANE JUICE.

A detailed reference to the various processes through which the cane juice passes before crystallization is unnecessary. After leaving the mill the juice is treated with lime to precipitate impurities. It then passes through the heater and thence to the settling tanks. After a time the clear liquid is drawn off for further treatment and the scums and other impure matter go on to be treated in the filter presses, by which means a large quantity of the juice is recovered and there is left behind the nearly dry cake. In this department a new triple-effect, by Messrs. McOnie, Harvey & Co., Glasgow, has been installed, and a new vacuum pan, by Messrs. Fawcett, Preston & Co., Liverpool, has also been erected of 34 tons' capacity, with additional clarifiers, filter-presses, and centrifugals. The equipment is generally excellent, mechanical

contrivances being everywhere in evidence to save the cost of hand labor. Indeed this is the most striking characteristic of the factory of Pln. Diamond. With a large motive power always at hand the aim of the manager in every branch of sugar manufacture has been to supercede hand labor by the introduction of mechanical methods. When the syrup has been boiled at a low temperature *in vacuo* to the requisite crystallizing density it is passed on to the centrifugals, where the molasses is separated and the Demerara sugar of commerce emerges from the "grasshopper," to be immediately elevated by carriers working on the endless chain principle to the store-loft above. The molasses is taken and treated for the manufacture of second sugar, after which it is run off into tanks situated in a large annex recently erected to the west of the buildings, where it is allowed to remain for several weeks. When crystallization is completed the massecuite is transferred to the centrifugals by means of a special Magma pump recently installed for this purpose and replacing the hand labor formerly employed.

THE SUCCESS OF SEEDLING CANES.

Having left the factory attention was turned to the conditions in the fields. Our representative learnt the interesting fact that there were about two thousand acres of the estate planted in seedling canes. "As a rule," said the manager, "we have found them rather better all round than the Bourbon." The latter is an excellent cane under good weather conditions, but when these are unfavorable, the seedlings are usually better. Mr. Fleming endorsed the prevailing view that most of the seedlings did not mill so well as the Bourbon. The experience of the authorities of Diamond regarding the seedling 625 is hardly confirmatory of the reputation this variety has established on some of the East Coast estates. It grows well and has an excellent appearance, but it shows up very badly in the milling and its results are disappointing. Mr. Fleming, however, does not condemn this seedling unreservedly; it may be, he suggests, that it never had a proper opportunity of showing its redeeming virtues on Pln. Diamond.

IS STEAM CULTIVATION PRACTICABLE?

Conversation next turned to the methods of cultivation in the cane-fields. On this subject Mr. Fleming made an important statement which will be of much interest to the planting community. A former Government chemist of this colony declared the system of tillage to be "only adapted to a state of society such as that which existed prior to emancipation, when manual labor for every field operation was abundant, effective, and cheap." That was fifty years ago, and the conditions are little improved since. There are many obstacles in the way here to the supersession of manual by mechanical

labor in the tilling of the soil, but Mr. Fleming after his visit to Louisiana has come back strongly impressed by the possibility of introducing more up-to-date methods of cultivation. "I am convinced," he said to the *Chronicle* representative, "that implemental cultivation is practicable here. Experiments cost money and we may have failures, but I believe it can be done. We never can do much without trying." Indeed, since his return to the colony Mr. Fleming has tried how far it is feasible to plow with mules, but he finds that the animals are too light for the heavy class of soils that have to be cultivated. Steam or oil engines, he believes, will be the motive power necessary, and it is along these lines that his experiments will in future be directed. When questioned as to the difficulty of dealing with the drainage problem, Mr. Fleming expressed the belief that it can be overcome. "The difficulties are there," he said, "but they are not insurmountable." It would certainly be in accordance with the fitness of things that the authorities of Pln. Diamond should discover the solution to a problem of cane cultivation in this colony which has been before the public at intervals extending over sixty years.

SUGAR PLANTING IN HAWAII.

Mr. Fleming was deeply impressed by his visit to Hawaii, which he describes as a phenomenal sugar-producing island. A yield of eleven tons of sugar to the acre is nothing unusual there, and the planters are perhaps the most progressive in the world. As Mr. Fleming stated, they can well afford to be, since their sugar goes into the United States duty-free, a matter of $35 per ton or thereabouts over and above the prices obtained for Demerara sugar in the same market. The profits are proportionately large, but considerable sums are spent periodically in acquiring the very latest appliances. The Hawaiian planters are also exceptionally situated in this—that they have virtually absolute control over the weather conditions. The rain, it appears, falls for the most part in the hills of the interior. It collects in natural subterranean reservoirs and is pumped on to the fields as required. This circumstance, taken in conjunction with the remarkable fertility of the soil, accounts for the immense cane crops that can be raised in Hawaii every season.

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CANE EXPERIMENTS.

The report of the agricultural work in Barbados for the season between 1900-1902, carried on by Professor D'Albuquerque and Mr. J. R. Bovell under the direction of the Imperial Department of Agriculture, is an elaborate work, consisting largely of tables of a valuable character. Minute details are given of manurial experiments with sugar cane which

were carried on on four estates, and the results, although the compilers of the report refrain from making any definite pronouncement, should be of great assistance to the planters of the island in preparing their land for next season's canes. The seedling cane experiments are of more general interest. According to the reporters, the selected varieties were cultivated at eleven estates situated in different typical localities, nine being black soil estates and two red soil estates. At two red soil estates and at two black soil estates ratoons were included amongst the plots, so that altogether there were fifteen fields under experimental cultivation. In nearly every field, the seedlings grown upon it were arranged in duplicate plots. Each plot consisted of 100 stools of canes arranged in 4 rows of 25 canes. With but few exceptions, 30 stools were cut from the inner two rows, weighed and sampled. By recording the result of the inner rows only the effects of one variety upon the growth of another and less vigorous variety were eliminated. From the 30 stools mentioned, a sample of about 105 pounds weight was taken by a mechanical method. Of this sample 100 pounds were crushed in the laboratory mill, the juice and megass weighed and the juice analysed, from which data the results were calculated to the acre. With the high quotient of purity and low glucose ratio common in the juice of best varieties of West Indian sugar-cane it is possible on well-worked muscovado estates with steam pan and filter press to recover 80 per cent. of the weight of the saccharose as marketable muscovado. The recovery is less if the purity is lower and the glucose ratio higher, as they are in immature canes or in mature canes of some varieties. According to Hon. F. Watts, "if the glucose ratio reaches 6 per cent. the sugar produced is soft and generally indifferent in quality. Under these circumstances it is difficult in the muscovado process to obtain a formation of crystals of sufficient size to enable the sugar to part with its molasses: the result is a sugar of low polariscope test." The conclusions come to were that B seedling 208 was for the second time the best all round cane, taking into account its ready germination, the yield of sugar, the richness and purity of its juice and the satisfactory results obtained in black and red soils, plants and ratoons. The White Transparent cane maintained its reputation as a good all-round cane. Its juice was rich and pure. B seedling 147 broke down on the average quality of its juice and in the red soils, especially rattoons. The Sealy seedling also broke down in the quality of its juice, and the milling properties were unfavorable. From a table giving the selected varieties arranged in order of yield showing the relative position and purity of juice of certain canes in different soils, and also when grown as plants and first ratoons, we find that B 147 ranks second as regard yield of saccharose in lb. per acre in all soils as plant canes, fourth as ratoons;

fourth as plant canes, and third as ratoons in black soils; sixth as plant canes and seventh as ratoons in red soils. Arranged in order of freedom from rotten canes, B 147 comes out at the head of the list with 3.20 per cent. less than the average number; while the White Transparent, brings up the rear with 16.39 per cent. more than the average number. B 208, which has proved the best all-round cane, heads the lists in saccharose yield both as plant canes and ratoons in all soils, but had 8.40 per cent. more than the average number of rotten canes.—*Demerara Chron.*

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THE OLIVE.

(One of the Oldest Known Fruits, Its Culture is Increasing.)

The olive is one of the oldest known fruits. It is noted by Pliny and is frequently mentioned in the Bible, where it forms the basis of many parables and figures of speech. In Grecian mythology the olive tree occupies an important place, and to-day the "olive branch" is the world symbol for peace. The olive tree itself is rather melancholy in appearance, but the eye soon becomes accustomed to the tone which the olive trees give to the landscape, and in nearly all of the Mediterranean countries they are found almost everywhere. In general, the olive will flourish wherever the vine can be cultivated for wine-growing purposes. It will not bear a temperature below 21 degrees or 22 degrees F., and in Europe it cannot be grown above 46 degrees latitude. The young plants and fruit are very delicate, but the tree itself is quite tough. Naturally, in Italy, where the olive forms one of the principal agricultural products and contributes so largely to the wealth of the country, the trees are cultivated with the greatest care. The kernel of the olive requires about two years to germinate naturally, but it is found by mixing clay and goat manure nature's processes can be hastened so that it will germinate the same year. The trees attain great age, and a large olive tree near Nice is believed to be 1000 years old and is said to have yielded 500 pounds of oil in a single year.

The culture of the olive in the United States is increasing rapidly, and in California the industry has attained such proportions that already $500,000 is invested in it. Olives were first introduced into the state by the Franciscan Missions almost a century ago. The oldest olive trees in California date from the last century. They are six in number and are stationed at the San Gabriel Mission and are still bearing fruit and are a living monument to the wisdom of the Franciscan Brothers. According to some authorities, the oldest tree is at the Capistrano Mission, 30 miles south of Los Angeles. The seed from which this tree was grown came from Corsica in 1769. It is now 50 feet high and the trunk is at least five feet

in diameter. The old trees at the Missions are as robust and thrifty as when they first commenced bearing fruit. The Franciscans raised most of their trees from cuttings which they brought from Spain. They found the soil and surroundings most congenial for olive raising, and that the trees flourished even better than on their native soil. The oil enabled the exile of the Fathers to be more supportable by supplying one of the accustomed luxuries of their far-away homes in distant Castile.

The modern history of the California olive culture began about 20 years ago, when the Hon. Ellwood Cooper of Santa Barbara, who is regarded as the father of the industry began his investigations on raising the olive as a commercial possibility. He first secured cuttings from the trees of the old Mission and set out a number of olive orchards in Santa Barbara and other places. The result has amply justified his venture. Now there is hardly a part of the state that has not its olive orchard. The olive seems to thrive best under the influence of sea breezes. It takes to almost any character of soil where the drainage is good and flourishes in the localities beyond the range of very heavy frosts. The tree does not require a great deal of attention, and does not resent neglect. The care of an olive orchard is less than for almost any other kind of fruit. The trees are highly symmetrical when grown, and on some ranges are planted along the roadside for the shade and the added beauty which they afford to the landscape. Olives are almost never raised from the seed, as this requires a long time. They are usually raised from cuttings, and have been produced by Mr. Cooper in the fourth year, and a good crop in seven years; 122 pounds is the average per tree. The method of propagation requires constant attention and great experience, but the plants are grown on such an enormous scale the cost of them is very small. In the spring after the cuttings are rooted, they are transferred to olive-growing nurseries, where they become trees of from three to five feet high in from 12 to 18 months.

In California opinions are much at variance regarding the variety of olive to grow. Formerly the Mission was the only olive planted. In recent years many different varieties have been brought from Europe. Different locations may require different varieties, but above all other considerations is the quality of the oil produced. The varieties that make the best oil should be selected in all cases, provided that quantity is a fair average to a given acreage planted. This rule is also applicable as well for pickling unless the fruit is too small for economic handling.

Mr. Cooper has trees 12 to 15 years old which yield 250 pounds of olives, but they do not bear every year. It is estimated that there are now no less than 24,223 acres of olive trees in California, with 1,162,739 trees, of which half are now

bearing. The soil must be occasionally cultivated and the trees must be pruned and sprayed to exterminate numerous insects. The greatest drawback to the successful cultivation of the olive is the black scale.

Olive oil making is a simple process; the quality depends on the care exercised from the picking of the fruit through every stage of manufacture until it is put into bottles and corked. About 8½ pounds of olives are required to a large bottle of oil. The fruit is gathered later in the season than other crops, and in the best orchards the olives are plucked one by one from the branches and not shaken from the trees or allowed to drop. Special ladders mounted on wheels are run among the branches of the trees, and the pickers ascend the ladders and pluck the olives, which they drop into a specially made device, usually of tin, strapped about the waist, and which is adapted to hold a considerable amount of fruit.

The olives must not be allowed to stand in heaps in sacks or any sort of package long enough to heat through, otherwise the oil will become musty and rancid. Absolute cleanliness is required in every step of the process. The olives are first dried, during which process they lose about half of their weight; they are then crushed by a heavy stone rolling over them, and are next pressed the same as in cider making. The first expression is what is known as the "virgin" oil; the lower grades follow in succession. There are at least a dozen oil mills in the state of California.

A considerable part of the olive oil imported is adulterated by cotton seed and other oils, but now with the splendid olive oil made in California there should be no difficulty in getting the pure article in any part of the United States. It is a mistake to believe, however, that absolutely pure olive oil made in southern Europe cannot be purchased here. It is expensive, but it can be bought; but the ordinary olive oil bought of grocers is apt to be adulterated, if it is not entirely fictitious. Large quantities of olives are pickled in California and are shipped in bottles or small barrels.

The olive industry is an example of what may be accomplished in the way of introducing a new agricultural pursuit in the splendid Southwest.—*Scientific American.*

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THE SUGAR INDUSTRY IN DEMERARA.

The average cost of production per ton of sugar during 1902 was about $45, or, deducting value of rum made, about $41 net per ton, not including any interest on capital or cost of special outlay on improvements. On estates where good returns were obtained, cost of production was as low as $40 per ton, but in some cases where crops were poor, cost per ton was not less than $55. The satisfactory and unexpected rise

in prices toward the end of the year enabled the majority of estates to make both ends meet.

The area under cane cultivation during 1902 was 73,800 acres, exclusive of 2,271 acres of farmers' canes. The largest area under cane cultivation on any one estate is 4,958 acres.

SEEDLING CANES.—There are about 7,500 acres under seedling cane cultivation on the different estates throughout the colony, and so far it cannot be said that any seedling cane has been grown which in all round good qualities is equal to the Bourbon. The majority of the seedlings, however, are hardier, and most of them ratoon better than the Bourbon, and on poor soils they have given returns in excess of those obtained from the Bourbon grown under similar conditions. The seedlings unfortunately, almost without exception, possess one or more undesirable characteristics such as difficulty in connection with milling, poor quality of juice, and low value of megass as fuel. Careful experiments on a manufacturing scale are being conducted on nearly every sugar estate in the colony, and a large amount of useful information is being collected and tabulated by the Experimental Cane Cultivation Committee nominated by the Agricultural Board. The most promising varieties of canes other than Bourbon so far cultivated are D 109, White Transparent, D 625, D 145, B 147, D 95, and D 74. The D 74 which has given such excellent results in the Hawaiian Islands and Louisiana requires a rich, porous soil, and it does not thrive well in the stiff clay soils of this colony. In Barbados B 208 continues to hold the leading place as the most promising cane, since the much vaunted B 147 was more or less discarded, and in this colony B 208 is now under trial to ascertain whether it suits the conditions prevailing as regards soil and climate. The supply of creole labor available is totally inadequate to meet the requirements of the sugar estates, and that in some districts it is practically non-existent. When the creole laborer thinks he is master of the situation he demands an impossible rate of wages, and experience has shown that a higher rate of wages generally results in his working fewer days per week. The creole laborer if he applies himself steadily to work six days per week can earn on the sugar estate at such work as cane cutting, &c., from $3 to $4. The planter was not desirous of reducing wages, but necessity knows no law, and to compete with bounty-fed Continental sugar he had to produce cheaply or go under. There are certain classes of work which creole laborers will not perform, and only the presence of the immigrant saves the situation. Remove from our midst to-morrow the 130,000 East Indian immigrants, and the whole business of the colony would be paralyzed. The sugar industry would cease within a year, and the circulation of money would fail.

SCREW-PINE OR PANDANUS.

These plants are characteristic of the Old World Tropics, a large number of them being only found in the islands of the Indian Archipelago. They usually occur on the sea-coast or in marshes, sometimes covering large tracts of country with a mass of vegetation which is almost impenetrable.

The leaves are narrow and tough and leathery, and are armed along the midrib and edges with sharp recurved prickles. They are arranged in dense tufts or crowns at the ends of branches, and it is this resemblance to pine-apple leaves that gives the plants their name of screw-pines.

The leaves of some screw pines found in Hawaii and other Polynesian Islands, are used for making bags or sacks, in which sugar is exported. Baskets, fans, and mats are also made from the leaves in various parts of the world, and the rough fibrous fruits are employed as scrubbing brushes.

A very remarkable feature about these plants is their aerial roots. They grow out from the stem protected by a well-marked root cap, and down into the soil. They are sometimes called 'flying buttress' roots, their function being to give times called 'flying buttress' roots, their function being to give an additional support to the tall, branched stem with its mass of foliage.

INSECT EPIDEMICS.

In the study of insect life, few things are of greater interest than the abnormal increase of a particular species, far beyond its usual limits. When this occurs in the case of an insect pest, the question becomes of greater importance owing to its bearing on agriculture, and it is then more easy to make observations as to the causes of this increase and the conditions that accompany it.

In closely studying the fauna of any locality, one observes constant changes in the relative numbers of the different species: an insect may be scarce for a long period, and then become abundant; and, equally, a species usually plentiful may decrease almost to extinction. There is constant variation in this respect, and it is seldom possible to obtain any glimpse of the causes of these variations. With regard to insects that are confined to crops, the matter may be very different. The regular variation in the number of such a pest as moth-borer in sugar-cane soon becomes apparent, and the causes of this appear to be so simple that one is tempted to ascribe it almost wholly to the work of the egg parasites (see *West Indian Bulletin*, Vol. I, p. 346.) Probably many other cases, if studied sufficiently carefully, could be shown to be due to similar causes, and in many cases of pests in various parts of the world the causes of sudden increase and decrease are well established and familiar.

During the past years, there have been some interesting cases of rapid insect increase in the West Indies. Some are very sudden, the insect appearing in great numbers almost at once, only later to increase equally suddenly. A familiar instance can be found in the sweet potato worm. (*Protoparce singulata*, Fabr.) Planters of Barbados and Antigua will remember the hordes of worms which appeared, ate the potato vines, and soon disappeared; in some cases these worms re-appeared once and perhaps twice, but presently they vanished to re-appear no more that season. How do these things happen? The answer to this might have been found had we been able to observe very closely. It is possible to hazard an explanation if we suppose that as the young sweet potatoes come up, there were a few moths ready to lay eggs. Each lays some hundred or more eggs, dotted about the potato fields, and since the worms that hatch are not many and are scattered, they escape the observation not only of the planters, but of the blackbirds and other enemies. There will then soon be some hundreds of moths from these worms. Suppose the majority of the females escape their enemies and lay eggs all in one locality. The eggs are not seen: the planter does not connect the 'Harry booby' moths he sees at night with an approaching attack of the potato worm, but in a few days these eggs hatch and vast numbers

of worms are now see... Not only does the planter see them, but also the birds, toads and insect enemies, chiefly parasites of the worms. Many of the worms doubtless die, but there are so many that large numbers survive, are able to become moths, and if they remain in that locality they will give rise to a second horde of worms. In the case of the second horde, there are probably fewer chances of any surviving; their enemies have been attracted by the previous attack; their parasites are probably enormously abundant from their increase in the previous horde, and we can understand how the second horde is possibly exterminated. Should it survive in part, we get a third horde of worms, and this is usually the last. Their enemies and parasites are too strong. Few caterpillars escape, and the few that do turn to moths are barely sufficient to propagate the species. This is probably a very approximate idea of what actually takes place. Enemies and parasites are here the factor that puts an end to the sudden increase.

In other cases, another factor may be lack of food. Possibly this has a great bearing in the case of the St. Vincent arrowroot worm. (*Calpodes ethlius*, Cram.) Obviously, if the swarms of worms absolutely eat all of the arrowroot leaves, the butterflies will have nowhere to lay their eggs and the pest is bound to decrease.

In both the above cases, the suddenness of the attack is a striking feature, and this is so in many of the cases where an insect increases far beyond the normal limit. A similar case was found in 1901 in the attacks of the Guinea-grass moth (*Remigia Repanda*, Fabr.) in San Fernando, Trinidad, where a considerable area of grass is reported to have been eaten by hordes of caterpillars. This attack was also seen in Grenada later in that year, and has this year been observed in Barbados. It would appear as if a *single* cause might underlie these three attacks, similar conditions or change of conditions producing similar effects in three separate localities. Mr. Hart was of opinion the cause of the San Fernando outbreak might be drought, but this would not apply to Grenada in 1901, or to Barbados in the middle of 1902. Probably where an outbreak cannot be studied very carefully for a considerable period of time, it is useless to speculate as to its origin, though we might frequently avert such outbreaks could we ascertain the causes that lead to them.

Some insect attacks, instead of being irregular and sudden, recur with something approaching regularity. Such a case is found in the caterpillar of the fiddle wood moth (*Purausta mellinalis*, Hubn.); though perhaps not entirely regular and periodic in its occurrence, this insect denudes the fiddle wood trees twice a year in Barbados, disappearing again after each outbreak for some months. The moth whose caterpillar eats lilies (*Euthisanolia amaryllidis*, Sepp.) is another fairly regular

visitor and there are other common but unimportant cases of a like nature.

In other instances, the increase of the insect is slow and gradual. The occurrence of thrips in Grenada on cacao is probably a case of a native insect slowly becoming more and more abundant from natural causes. Had the thrips not attacked cacao, its increase would not have been observed, for we are seldom conscious of the increase of insects other than those that attack our crops. Since the thrips was found on cacao, its increase was presently noticed and the accounts given point clearly to the steady spread and multiplication of these insects. As has been pointed out, (*West Indian Bulletin*, Vol. II., p. 183) this may have been due solely to the destruction of its native food plants with corresponding abundance of a plant to which it easily adapted itself. Cases somewhat similar to this appear to be found in the screw worm of St. Lucia, and the grasshoppers of St. Kitt's, though it is not possible to estimate the causes to which they are due.

From these cases, it can readily be seen that every outbreak of any insect pest is of peculiar interest from the light it throws on the conditions of insect life generally. Unfortunately, they can only be studied on the spot. Planters and others who have opportunities of observing can do much in this way, and all observations of this nature are of interest and value.

The West Indies have not experienced any outbreaks similar to those which have occurred elsewhere, and this is possibly due to the fact that these Colonies do not form part of a large continental area, but are isolated islands. As an instance of the damage done elsewhere by insect plagues, we may cite one, that of Massachusetts where from 1893 to 1898 $800,000 were spend in fighting the Gipsy moth, an insect introduced by chance from Europe. It is to be hoped that the West Indies may never be visited by such a pest, there being a sufficient variety and number here already.—*West Indian Bulletin.*

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INTRODUCTION OF NEW PROCESSES IN THE AMERICAN BEET SUGAR FACTORIES DURING THE 1902-3 CAMPAIGN.

By A. Musy, Sugar Expert.

It looks as if the present campaign would show a decisive departure in the way of improving the work in the American factories.

In addition to Naudet's diffusion and continuous carbonation, already successfully tested at Oxnard, Cal., the Manoury and Delafond processes will be used this month in several other factories. The columns of the *Beet Sugar Gazette* will

be open, of course, in proper time, to the examination of the practical results obtained. A full description of the processes would be out of order at present, but a few remarks about them will probably be read with some interest by the sugar men.

The Naudet diffusion system, as succinctly described in the last (September) issue of the *Sugar Beet*, has for its object the establishment of a forced circulation of the juice, heated to 80 degrees C., or over, through the last filled diffusor, the juice returning several times in the same direction through the same cossettes, until they all have the same maximum temperature which has been adopted for the battery. The extraction of the juice is accomplished more regularly in the diffusor through which the heated juices have successively circulated, and it begins to work with full force as soon as it is brought into connection with the cycle of the work of the battery. On account of the high temperature of the circulating juices, the action of dialysis is more rapid, and the purity of the juice drawn is largely increased.

It necessarily follows that Naudet mode of working in reality means an extension of the efficiency of the battery without the necessity of an additional number of diffusors. The advantages claimed are the following:—

Extraction of juices of a higher density and purity, reduction of the volume of juices for a given limit of exhaustion, and, consequently, large saving in fuel, the volume of water to be evaporated afterward being reduced by 20 or 30 per cent.

Elimination, almost complete, of the albuminoid matters, which, on account of the high temperature, are coagulated on the cossettes and sent away with the pulp, which results in a better and easier work at all the following stations in the factory.

The machinery required for the Naudet system includes:—

One special pump for circulating the juices.

Two circulating pipes, with two valves for each diffusor.

Two pulp separators.

A set of modern, rapid circulation heaters.

There is no special difficulty in the operation, and the men become promptly acquainted with it. The only difficulty is in the selection of proper apparatus in each factory, which selection ought to be made either by the inventor or by a competent engineer, as the slightest mistake in the installation would certainly result in a failure.

As a practical example of the effect of the Naudet system, the *Sugar Beet* quotes the French factory of Nassandres (Eure), where the daily capacity has been increased from 85 to 110 tons per day, or about 30 per cent., the purity of the diffusion juices being 87.5. The total losses, including the sugar left in the molasses, did not amount to 2 per cent. of the beets, with-

out osmose, which is rather satisfactory, considering that the beets contained more than 15½ per cent. of sugar.

The Naudet continuous carbonation process has been described in the April issue, 1901, of the *Beet Sugar Gazette*. It has been a success in six European factories in 1901, and will be used during the 1902 campaign in 18 other factories. When in Oxnard, Cal., Mr. Naudet offered to make a test of it, for one day, without any special machinery, simply in order to give an idea of its operation. All the juice produced in the Oxnard factory was carbonated, in a continuous way, in one of the old carbonation tanks selected for this purpose, the other tanks remaining empty, and the results were absolutely satisfactory as to the purification of the juices and the regularity of the alkalinity. No doubt the continuous system will be used next year in many American factories instead of the obsolete and defective system of interrupted carbonation.

In regard to the first Manoury process, patented in the United States in 1898 (Letters Patent No. 599,148), I would recall only that its principle is the crystallization of the sugar in the vacuum pan, not in the crystallizer, and that the Manoury system is now in use in hundreds of factories, giving everywhere the following results:—

A maximum yield in refined sugar.

A minimum percentage of well exhausted molasses.

The exhaustion of the low grade masse-cuites, including the osmosed products, is being made in one operation of boiling, and the second sugar is obtained in less than forty-eight hours at a high degree of purity.

No special apparatus is required for the Manoury process. which can be installed in almost every factory at a nominal cost.

The secondary Manoury process (Letters Patent No. 601,305) is based on the introduction of a certain percentage of low-grade syrup in the first carbonation, in order to combine a part of their potassium and sodium with the albuminoid matters left in the juices after the diffusion. The result, as verified in many European factories, is a reduction in the percentage of final molasses, and an increase of about one-half per cent. of the weight of the beets in refined sugar.

In fact, the use of both of the Manoury processes has given everywhere an additional yield in refined sugar, representing from one-half to one per cent. of the weight of the beets, or from 10 to 20 pounds of sugar to the ton of beets, with a corresponding reduction in the percentage of molasses.

The Delafond process deserves special attention. If the results claimed by the inventor and obtained in the previous tests in France by Mr. Horsin-Deon, an authority on the beet sugar industry, and in the tests made on a large scale in an American cane sugar factory, are verified in the practical

work of the beet sugar factories, there would be somewhat of a revolution in the working of the masse-cuites.

The use of carbonic acid gas or of any other gas under pressure as a factor in the crystallization of sugar has never been suggested before, and the success of M. Delafond in that way would open a large field to the imagination of our inventors. It is true that he proposes only, in his Patent No. 675,938, to subject the sugar solution or masse-cuites to the action of the carbonic gas under pressure in order to obtain a more rapid and complete crystallization, thus exhausting the final molasses to a much lower degree of purity, but there is no reason why the process, if successful in the treatment of low-grade masse-cuites, would not be just as good in many other stations of the beet and cane sugar factories, and of the sugar refineries. It would do away, for instance, in a short time with the low yield in "granulated" now obtained from the very pure first jet masse-cuites in the refineries.

The American sugar factories with their large number of crystallizers, are peculiarly adapted to the use of this process. The crystallizers are mostly of the Bock system; their manhole at the top can be easily and hermetically closed after the filling with second jet masse-cuite. The ordinary process of crystallization in motion can be used, the only addition to it being the introduction of carbonic gas under pressure through a small pipe at the top of the cylinder during all the time of crystallization.

No ordinary carbonic gas from the lime kiln could be used on account of the emulsion, which is the fatal result of the introduction of an insoluble gas in such conditions. It has been found that the cheapest way of securing pure carbonic gas is to order liquid carbonic acid in iron bottles. One iron bottle which costs about $2.50, will do for the crystallization of about 36 tons of masse-cuite in a crystallizer of 900 cubic feet. This is the only working expense of the process.

As it would not cost $10 per crystallizer to make the necessary alteration, it is evident that the test of the process in an American factory would not be an expensive affair.

Now, should it be proved that the purity of the molasses issued from the second jet masse-cuite thus treated is reduced to 50 degrees, for instance, instead of 60 or 61 degrees, as usual, the advantage of the process would be worth considering.

Taking a factory with 50,000 tons of beets, at 14.25 to 14.50 per cent. of sugar, and assuming that, after deducting all the losses, including the undetermined losses, there remains in the first masse-cuite alone, without any addition of wash syrups or of melted sugar, 13.50 per cent. of sugar, with a purity of 88 degrees, the yield in granulated sugar, if the molasses is exhausted at 60 degrees purity, would be given by the well-known formula:—

$$\frac{13.50}{0.88} \times \frac{88-60}{100-60} = 10.73\%$$

With molasses exhausted to 50 degrees purity, instead of 60, the yield would be:—

$$\frac{13.50}{0.88} \times \frac{88-50}{100-50} = 11.65\%$$

Difference in favor of the processes, 0.92 per cent., or more than 18 pounds of sugar per ton of beets.

At the price of 4½ cents per pound of sugar in a 50,000-ton campaign, the difference would amount to $40,625, and this practically without expense.

Of course, the benefit would be much smaller in the factories provided with an osmose plant. In such factories the molasses is osmosed only one time, as a rule, and the product of the first osmose amounts to something less than 0.90 per cent. of the beets, so that the use of the Delafond process would yield some more sugar, at the same time saving all the trouble and expense of the osmose. And there is no reason why the molasses, reduced to 50 degrees purity, could not be osmosed and furnish an additional profit.

While the three processes above are used in different stations of the factories, yet it is evident that they are tending to the same final result—the reduction of the percentage of final molasses.

Naudet eliminates the albuminoids, thus reducing the non-sugar, and consequently the quantity of molasses. Manoury, in his first process, prevents the destruction of sugar in the pans, crystallizers, &c. In his second process he eliminates a part of the albuminoids of the juices and also a part of the mineral and organic matters of the syrups. Delafond, by a more complete exhaustion of the low-grade products, lessens the quantity of molasses.

Let us therefore hope that their combined efforts will be successful, and that in the near future it will be impossible to find an American factory selling from 6 to 7 per cent. of the weight of the beets in molasses to the distiller, which is too frequently the case at present.—*Beet Sugar Gazette.*

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THE SUGAR CANE BORER.

(DIATRAEA SACCHARALIS.

(Condensed from a Report by William C. Stuggs.)

In 1890, the cane of the Sugar Experiment Station was badly injured by the borer. A partial study of the habits and life history of this insect was then made and the results published in Bulletin No. 9. It was then intended to continue these studies and obtain accurate data as to its hibernation and

the ways and methods by which it renews infection in the spring, but the heroic measures adopted by the station for its eradication so successfully accomplished the purpose that these studies were necessarily postponed. Prior to 1890, no general alarm had awakened the planters of the State to the necessity of taking precautions against the spread of this insect, notwithstanding it had occasionally produced serious injury in various localities of the cane belt.

The visitation of 1890, and the subsequent publication of Bulletin No. 9, failed, however, to attract universal attention, since little or no injury was done to the splendid crop of 1891. Only when the crop of 1900 was being passed through the mill was it discovered in certain sections of the State, that the borer was present in damaging quantities. In Ascension, Assumption and portions of Iberville parishes, the injury was revealed in the decreased yield, both in the field and in the sugar house. So great, in many instances, were these losses that a general alarm was given and everybody began to inspect closely his cane. Hon. Henry McCall, of Evan Hall Plantation, thus expresses his losses:—

"We had a good stand of cane, both plant and rattoons. Stalks were fairly long, but owing to a wet summer and want of cultivation, they were unusually slim, and consequently tonnage proved disappointingly light (from twenty to twenty-five per cent. short). Light tonnage was almost universal over the whole sugar belt, but where the borer was not present, it did not fall off more than ten to fifteen per cent., and therefore, we can safely conclude that the loss was from ten to fifteen per cent. by virtue of the presence of the borer. It was difficult to find a cane that had been more or less bored, sometimes in as many as a dozen places, rendering it pretty hollow and dry.

How Was the Borer Introduced?—The question how and when it was introduced is not definitely settled.

Mr. Robert Maurin, of Ville du Bois, plantation Belle Alliance Postoffice, Assumption parish, states that "in 1856, after the destruction of the cane in mats and stubbles by cold, Hon. Miles Taylor, congressman of the district, got the government to import cane from South America. I received one box, and on opening found the borer in it, and burnt the box and cane. Others planted them, and then it (the borer) began to spread slowly."

It may be in order to give a brief account of this importation, which had so disastrous a termination. In 1856 Congress appropriated $10,000 for the purpose of obtaining cuttings of sugar cane of such varieties best suited to the climate of the Southern States. The Commissioner of Patents was authorized to superintend the expedition, and the Secretary

of the Navy was directed to furnish the ships. One expedition was sent to the Straits Settlement, and brought back the Salangore variety, which was so badly rotted on arrival that no results were obtained. The other expedition went to South America on U. S. Brig Release, under Captain Sims, with Mr. Thomas Glover, the entomologist, to make proper selection of the canes. He was instructed to secure cuttings near the River Demerara, in British Guiana, and from the high lands, near Caracas, in Venezuela. He was specially enjoined to bring back the special variety of cane, known as Labba, in Demerara, and the Japanese purple canes from Caracas. Specific instructions were given Mr. Glover as to the selection and packing of the canes. The expedition returned to New Orleans early in 1857. Mr. J. Holt, Commissioner of Patents, in his official report, alludes to these canes as "growing nicely," and "if they should prove sufficiently hardy to withstand the climate of the regions where they are intended to grow, it is believed that they will amply compensate in the end for the trouble of introducing them."

Per contra, a writer in De Bow's review, May 1857, arraigns severely the parties engaged in the introduction of these canes, while in the New Orleans Delta the condemnation of the management of the expedition was wholesome and sweeping. "The boxes were filled with miserable chaffy stuff, completely spoiled." "Why make planters pay freight for West India pebbles?" "A plain, unpretending overseer from the State would have saved the Government much expense and have done something more profitable for the planters than help extract the few dimes from their pockets (in the shape of freight on trash, which they saved from the wreck of the last crop, to say nothing of the preceding ones.

De Bow's Review, in another place, has a letter from one of the largest planters, in which "he handles the officials without gloves." The letter says: "There was never such a failure. What a misfortune that Uncle Sam did not send a practical planter." "Not a sound bud from the stalks either in the hold or on deck."

The evidence here given is contradictory, but I have yet to meet the first planter that has any recollection of any canes grown from the imported cuttings.

Can it be possible that this importation brought the borer for the first time into this State? The evidence of our old friend seems to be direct and positive. Our friend says the Hon. Miles Taylor was instrumental in getting this appropriation for the importation of new canes. In a speech in Congress, delivered in 1857, Mr. Taylor says: "This appropriation in consequence of which some of the declared enemies of the sugar culture have taken advantage to decry that culture as a forced one and altogether precarious in its results was, I will

not say a Buncombe affair, but it was one which was occasioned by newspaper representation coming from the inexperienced; grew out of a desire to conciliate public sentiment, and was in my view, of doubtful expediency, and was more than doubtful in principle. I say it was of doubtful expediency, because the cane which has been cultivated for many years in Louisiana, in my opinion, is better fitted for the production of certain and large crops of sugar than any which will be likely to be introduced."

The reports of some of the correspondents are rather at variance with Mr. Maurin's. Mr. A. T. Bird, of Stella plantation, West Baton Rouge Parish, says: "I have known of the existence of the cane borer in Louisiana for sixty odd years." Mr. D. Himel says: "In 1857 they destroyed, with the late freeze, which occurred in April, one-half of the best crop I ever planted. The worms came after the freeze."

Nearly all correspondents are disposed to think a wet season propitious for rapid multiplication of the borer, though a few point to 1870 as a very dry year, no fertilizer used, and an excessive quantity of borers.

A large number of correspondents do not believe that succession cane is more liable to attacks of borer than cane following corn and peas. In fact, many assert that on account of increased vigor of the latter cane, it is preferred by the borer to all others. A few believe that the chief reason for the borer abiding in Louisiana, "is found in the atrocious practice of growing cane after cane for a number of years, getting the land infected with it, from which it can be eradicated only by a rotation of crops."

Remedies.—Remedies are numerous, particularly from those not now troubled by the borer.

One correspondent dissents from the otherwise unanimous opinion of the necessity of burning the trash for the destruction of the borers left therein. This dissenting planter condemns burning, and says: "It is God's manure, bury all of it. It is the best manure, that and rotation."

To emphasize the necessity of burning, Major C. Lagarde, of Lafourche, relates his experience, as follows: "I was once troubled with borers on my Leighton place for six or eight years, previous to 1889. I buried as much cane tops as I could, pulling them in the middles with hoes and covering them with four-horse plows. The crop of 1889 was one-third short, almost every cane was affected by the borer. In 1891 the bricklayer went under the shed to eat a cane. He cut seventy-five and every one was affected by the borer. My neighbors who had not buried, but burned their cane tops, were not affected at all. Since then I have burned the tops in December or January, in very dry weather, if possible, and I find very few canes now affected by the borer."

The time for burning is given all the way from "as soon

after harvest as they will burn," up to "March," and all advise "as complete as possible."

Several correspondents assert that the continued use of acid phosphate will eradicate the borer (?) Others think that keeping one's ditch and headlands clean, with a late lay by, to prevent the growth of grass in the cane will also stop the borer, as the weeds and grass are the receptacles of the eggs of the moth (??) Good cultivation is recommended by a few. Deep plowing during cultivation is given by one as a panacea for this trouble. (?)

Avoid the use of cotton seed meal, say some; others commercial fertilizers; others succession cane if you would be free from the borer.

"Land kept clear of grass, weeds and stalks, plowed early and twice before planting will not be bothered with borers," says a planter from Iberia.

A veteran planter "has found in dry years a plenty of ants that go into the borer holes and eat up the worms and leave only the skeletons." This observation is fully confirmed by other planters.

Another old and experienced planter has found that an immersion of canes in water one foot deep will completely kill them. "I have irrigated canes that had any quantity in it and they were all killed. You can put water at any time until March without danger to cane. Have had cane ten days in water that did very well, and no borers left in it."

REVIEW.—In reviewing the numerous replies received, it is evident that nearly every correspondent was familiar with the borer, and at some time had suffered from its attacks. It is probably true that there are few plantations where the borer does not exist at all, and why it should be kept in subjection, yea, almost obliterated, in some localities, while existing in destructive numbers elsewhere, is not clearly understood. Everybody (with but few exceptions) burns the trash, an acknowledged aid in depreciating their numbers, yet with this only known effort practiced alike in every community, the borer multiplies to a destructive extent in one section and is practically subdued in another. Again, a plantation practically exempt from its ravages for years may suddenly become a theater for its most destructive efforts, and then, as quickly as it came, the borer may disappear and be seen only in very limited quantities for years to come.

It is known that the cold of our winters is a great ally, not in the severity of the cold so much as in the fact that it gives us a long period when there is nothing above the ground for the borer to feed on, and therefore no opportunity for rapid multiplication, as in late summer. But the winters and the burning of the trash are common to all and hence like conditions should everywhere exist if these were the only forces of destruction at work.

It is, therefore, reasonable to suppose that there are other agents of destruction at work, more abundant and powerful in some sections than others, which check the multiplication of this pest. In foreign countries the eggs, soon after being laid, are sometimes filled with parasites, which destroy them. There are parasites which prey upon the worm and chrysalis. Observations have found several of the latter, and closer investigation may reveal the existence of the former. The larva of the beetle and the ants are known to be parasites of the larva here. Hence every effort should be made to drain well our lands, so as to make them habitable by ants and beetles, even during our wettest seasons. These little creatures may explain the facts reported that borers were worse in new ground than in old lands in wet seasons than in dry seasons, etc. Dry land is essential for the rapid multiplication of ants, and rainy weather, in alluvial lands, quite destructive. There may be other parasites of the egg or larva that are dominated by the weather.

Why not have an outbreak all over the State when a wet season occurs, some one may ask. I reply that worms in a given quantity are necessary at the start, to produce the large numbers required for the material injury of the cane in a favorable season. Only those localities already possessing the borer in certain quantities will therefore suffer. The other sections may suffer an increase, but the damage will be imperceptible. This is apparent in the different reports from the parishes of Ascension, Assumption and Iberville, reporting all degrees of damage from zero to thirty per cent.

(Continued in our next.)

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LINKED TO THE MAINLAND.

(Continued from our last number.)

Perhaps there is no country in the world that offers greater promise to the husbandman and grazier, at the present time, than the Sandwich Islands. The lands are now thrown open to all classes, the native and the foreigner, the subject and alien. We have a climate unparalleled in its salubrity, and affording every variety from the perpetual snows of Mauna Kea to the burning plains of Waikiki. Our soil though not deep, is warm, quick and fertile. We have no great extent of arable land, but I suppose out of the four millions of acres, at which the area of the islands has been computed, in round numbers, it would be a fair estimate to say that one-eighth, or 500,000 acres, are fit for the plow, and 2,000,000 of acres will afford good pasturage. What a fund of wealth lies hid in the slumbering energies of those 2,500,000 acres! Enough to feed five millions of inhabitants, and load a hundred first class ships annually with our surplus produce. Besides a fine climate and good soil, we are free from taxation

on our land, and in California and Oregon we have an unlimited market. A market too, which, owing to our proximity to those countries, will enable us to take advantage of every favorable turn it presents, and obtain larger prices for our great staples of sugar and coffee than traders from any part of the world. Let us be awake to these advantages.

There is one agent, however, that we require, who holds the key to success,—the great brawny-armed, huge-fisted giant called Labor. We must not only secure him, but direct, aid, and economise his efforts; for though with his strong arm and heavy hand he is mighty to accomplish, yet unguided by the art of man he strikes like the blinded Cyclops of old, destroying with one blow what he effects with another.

We may not have sufficient labor, we have not, but do we improve what we have? Do we economize it as we ought, by studying the nature of our soils and plants, and the amount of labor necessary for them? Are we making such improvements as we ought in our modes and implements of culture? Let us look back upon the history of our agriculture and see what advance we have made. What more do we know of sugar cane and coffee, their growth and manufacture, than we knew at the opening of the first sugar plantation at Koloa, or the first coffee plantation in Manoa? Doubtless we have made some advance, but far less than we ought. Depend upon it, until we bestow more study upon our soil, plants, and modes of culture, and seeks to economize labor more than we do, we shall never meet with success.

It is an old adage that, "the man who causes two ears of corn or two blades of grass to grow, where only one grew before, is a public benefactor;" and if ever a field was open for acquiring such a reputation, it is here in the Sandwich Islands. If what I have said be true,—if agriculture does lie at the bottom of all other interests of this kingdom,—if it is the source of life and wealth to a nation, and the only sure foundation of its prosperity, then it is our duty to spare no effort for its promotion. And not only is this the great duty incumbent upon us as individuals, but upon the government, as the chief guardian of the nation's welfare. I know much has been done by the last Legislature towards encouraging agriculture, by granting the natives the lands in fee simple,—by throwing open our waste acres to the skill, industry and capital of foreigners, and by the abolition of all duties on agricultural implements, garden seeds, and cattle introduced to improve our stock; but much yet remains to be undone. Government could, and I believe will, afford an important aid:

First—By making good public roads and bridges, both of which are so essential to the agricultural prosperity of a country. By a judicious system of internal improvement, cultivation would be extended to thousands of acres now waste,

and the productive territory of the kingdom be constantly increased.

Secondly—By improving our harbors, and facilitating communication between the islands by the introduction of small steamers.

Thirdly—By the importation of new seeds and plants adapted to the climate of these islands, and improved agricultural implements.

Fourthly—By the annual appropriation of a small sum to be distributed in premiums for the improvement of our cattle and crops; and also for the discovery of some means for destroying the cut worm and other insects so fatal to many of our best plants.

Fifthly—By collecting and diffusing practical knowledge adapted to the agriculture of these islands.

It is contended by some that the best way of encouraging agriculture is to let it alone. But this let alone system, I fear, has been practiced in these islands too long. We have seen its evil effects, and the general condemnation it receives calls for a speedy change. I am fully convinced, that the encouragement of agriculture is the last ray of hope left for the Hawaiian nation. Agriculture has been let alone, and the people's rights so long withheld, that now when the dark cloud which has lowered upon them for ages is lifting, there is hardly a nation to save. Alas, and must this people possessed of so many kind and generous traits perish from the face of the earth! Perish too, not by famine, nor pestilence, nor the sword, but by the rust of indolence—the canker of sloth. Must they die! Will we let them die, without making one struggle to save them from the grave to which they are hastening! No my friends, justice and humanity forbid! Let us not forget that the soil whose treasures we would unlock, was once the undisputed heritage of the poor Hawaiian, and let us remember too, that though the white man bore the glad tidings of salvation to his wondering ear, he planted in his veins the seeds of disease from which the great reaper Death has gathered full many a harvest. Though but a lone remnant remains, let us strive to gird it with strength to wrestle with its approaching destiny—to arm it with the healthy body and vigorous frame, the only weapons that can stay the hand of the Destroyer. Then, if our efforts to send a quickening life pulse through the heart of the wasting nation avail not, we can but commend it to Him in whose hand are the issues of life and death,—to Him who "counteth the nations as the small dust of the balance, and who taketh up the Isles as a very little thing."