THE

PLANTERS' MONTHLY,

PUBLISHED BY THE

Planters' Labor and Supply Company.

VOL. I. JULY, 1882. NO. 4.

It is superfluous to present before our readers, and it is impossible to exaggerate the importance of securing a supply of laborers before the end of of the present year. They are greatly needed now. It was mainly in order Planters' Company was organized. This at the least was its main present to use concentrated, harmonious and united effort to obtain labor that the object. Upon inquiry of the Trustees, we do not think they have lost sight of this subject for one moment, or have neglected any available means ts accomplish it.

After careful consideration they are led to believe that by sending to Japan a man thoroughly alive to the necessity of the case, familiar with the details, and with the proper credentials, a large number of Japanese could be introduced here. It was believed that this scheme would meet the strong approval of the United States and British Governments as well as the Japanese Government, and for reasons which can easily be conceived Mr. Armstrong at first expressed his willingness to undertake this business, and to leave for Japan by the first steamer. The public is generally aware of the Cabinet changes which then occurred, resulting in Mr. Armstrong returning to the States instead of going to Japan. Mr. S. T. Alexander, President of the Company, was finally prevailed upon to go, and all the arrangements with him were concluded by the parties. Much to their regret they learned, after Mr. Alexander's departure for San Francisco, where he was to await the proper credentials, that the Government was not willing to accredit him, and was not then prepared to appoint any one else for the Japanese affair. This result was wholly unexpected and is likely to cause strong comment on the part of those whose interests are affected.

AFTER the present Ministry took office, it was believed by most persons that the Portuguese immigration had fairly set in, with promise of continuing for a considerable time, would be kept up. If there was any difficulty about the funds or want of legislative action, the Planters' Company was fully prepared to advance all money required for introducing males. It was also ascertained that they could hereafter be brought here for much less expense than attended the first arrivals. The first intimation, however, which was receiveed by the Planters' Company or by any planter, as far as we can learn on the subject, was that the Government had telegraphed on to stop sending Portuguese immigrants. As editors of this journal we do not wish to make any partizan statements, nor to indulge in any unnecessary criticism upon the Government. The above recital will however speak for itself. It remains to be seen whether the Government can be depended upon to do anything in the direction of assisting the planter in his efforts to obtain laborers.

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PORTUGUESE IMMIGRANTS.

By the courtesy of the Secretary of the Board of Immigration, we have obtained the following statement of the last list of immigrants who arrived by the steamship *Monarch*.

The steamship *Monarch*, Capt. Mathew Thompson, arrived at Honolulu June 7th, 1882, from St. Michaels, and landed 830 Portuguese Immigrants. There were 203 adult males, 198 adult females and 429 minors (including infants). This was the first direct communication by steamer, and found very satisfactory: the voyage being made in 56½ days. There were 13 deaths (infants), and 6 births during the voyage. The immigrants found employment as follows:

	Men.	*Women.*	*Children.*
On the Koloa Plantation	10	10	29
Hutchinson's	29	26	70
Hitchcock & Co	12	11	29
Costa	13	8	15
East Maui Plantation	13	12	20
Brewer & Crowingberg	8	7	7
Halstead's Plantation	7	6	11
Buck, Honoapu Plantation		1	4
Eleele Plantation	7	6	21
Haiku Sugar Co	34	33	94
Honokaa Sugar Co	5	5	17
Kealia Plantation, Z. S. Spalding	26	27	51
Lidgate & Co	21	22	29
Alexander & Baldwin	14	14	31
W. H. Rice	3	3	2
Private Individuals, as domestic servants	1	5	3
Queen's Hospital, sick		1	1
	203	198	434

EFFICIENT CRUSHING.

While most mill-men agree that large rolls do the most efficient work in cane crushing, yet so few have made careful tests in the matter that it is by no means well known just in what proportion the efficiency of crushing is increased by enlarging the mill. To make a complete test the cane must be weighed before crushing, and the juice from the same, as well as the trash, weighed after crushing. This will give the percentage of juice obtained from a given amount of cane, but this is not all that is necessary for a fair comparison of one mill with another, because some cane is hard, other soft, some juicy, other dry. The amount of moisture remaining in the trash after crushing must be determined in order to complete the test. This really seems the most important part of the test where a comparison of crushing power is sought, and this can be made without delaying or interfering with the regular work of the mill. Take say a sugar bag full of trash as it comes from the mill, with care that the bagfull represents the average product of the mill and is not a selection of the dryest, weigh it carefully, then hang it in a warm, dry place and leave it till thoroughly dry, and weigh again. The loss in weight will represent practically the moisture remaining in the trash as it comes from the rolls.

At the Spreckels mills on Maui the test has been made repeatedly. The time usually allowed for drying a sample of trash is about eight days. The bag is filled with trash, sewed up and laid on top of the boilers, which are covered with "Ruch's Sectional Covering.' It is a warm place, and if the trash is not packed too tightly in the bag it is as "dry as chips" in eight days. An average of seven samples, which included in the aggregate 179¾ lbs. of net trash, showed a loss of 47½ per cent., or 85¼ lbs. These samples were taken at different times, one engineer making it a rule to test a sample every week.

If others who have made the same test, or will make it, will send the results to the PLANTERS' MONTHLY, a comparison can be made which will be interesting to all. It will be instructive to see how the efficiency of some of the smaller mills will compare with that of the five roll mills at Spreckelsville.

I would suggest that if possible it would be better to hang the bag of trash in a warm place, where there is also a current of air, than merely to lay it on a hot boiler. R.

TREATY BENEFITS.

One of the benefits to this country of the Treaty of Reciprocity with the United States, is the results produced on the revenues of the Government. The following figures, showing the amounts of certain revenues received,

are taken from the Reports of the Minister of Finance to the Legislature. The Legislature meets biennially, and each Report covers the period of two years, ending March 31st of the year in which it sits.

Internal Commerce (Licenses)—	
Two years ending March 31, 1870	$104,767 68
Two years ending March 31, 1876	89,711 97
Two years ending March 31, 1882	141,744 38
Internal Taxes (property and personal taxes)—	
Two years ending March 31, 1870	166,506 76
Two years ending March 31, 1876	213,929 99
Two years ending March 34, 1882	596,615 01
Fees and Perquisites (stamps, passports, hospital fees, &c.),	
Two years ending March 31, 1870	23,389 70
Two years ending March 31, 1876	19,285 97
Two yoars ending March 31, 1882	119,982 40
These figures show the following totals for two years ending March 31, 1870—	
From Internal Commerce	104,767 68
From Internal Taxes	166,506 79
From Fees and Perquisites	23,389 70
Total	$294,664 14
For two years ending March 31, 1876—	
From Internal Commerce	89,711 97
From Internal Taxes	213,929 99
From Fees and Perquisites	19,285 97
Total	$322,927 93
For two years ending March 31, 1882—	
From Internal Commerce	141,744 38
From Internal Taxes	596,615 01
From Fees and Perquisites	119,982 40
Total	$858,341 79

The treaty was ratified in 1876, and the foregoing figures are taken from three biennial periods at intervals of six years. The period ending March 31, 1876, being that immediately preceding the passage of the treaty.

POLARIZATION.

Scientific research is ever confering new benefits on humanity, its numberless discoveries made practically available are day by day opening up new manufacturing interests, introducing new systems of woking in all branches of trade, or devising new and ingenious apparatus for determining the actual commercial values on the different commodities for sale in the world's markets.

A prominent illustration of this fact is afforded by the use of the instrument known as the Polariscope, now almost universally employed by all engaged in the sugar industry to determine the true value of their products, giving results that possess an accuracy hardly to be attained by any other apparatus, approaching in fact, when properly manipulated, to the most subtle analysis. This instrument, in its present degree of perfection, is the result partly of accidental discoveries, as also of numerous scientific investigations in the domain of optics.

The fundamental law underlying its construction is vested in the property possessed by rock crystal, Iceland spar, or other mediums of a certain order, of splitting up or dividing a ray of light, causing it to undergo remarkable change. Light which has suffered this phenomenon is said to be polarized. But as before mentioned light may be polarized through other mediums, such as solutions of organic substances, a solution of cane sugar for instance exhibits this property, the degree of polarization depending on the concentration; ergo, the percentage of crystalizable sugar present in the solution as well as the the depth of column of the liquid. The polariscope as at present used embodies these principles, the salient features of the instrument consisting of a long metallic tube mounted on a stand; in these are enclosed two prisms of a peculiar construction, in proper fastenings; between the two a space remains for inserting the tube containing the solution of sugar, a rotation of the plane of light ensues, the degree of rotation depending on the degree of concentration of the liquor, in other words the percentage of crystallizable sugar present.

In the various instruments of different constructions the essential principles remain the same, the only difference consisting in mechanical modification, or the ways and means by which the results are obtained.

The Ventzke-Scheibler instrument as it is called, is to-day more in use than any other instrument, by reason of its ingenious arrangement of parts, the comparative facility with which it can be manipulated to yield accurate results, combining, as is seldom the case with instruments of this kind, dispatch and accuracy. The method adopted for the determination of raw sugars in the markets is essentially as follows: The sampler, as he is called, removes from each bag with a certain mark or lot a small amount of sugar on a hollow auger; the whole is then mingled in one mass, carefully wrapped up, thus constituting a fair average sample of that lot. It is then speedily transferred to the laboratory or operating room. 26.048 grammes of it are carefully and rapidly weighed out into an appropriate receptacle placed on the pan of a good chemical balance; the dish is then removed and about 40 cubic inches of pure water added until the sugar is for the most part dissolved. The solution is next carefully poured out into a flask graduated to 100 cubic centimeters, the undissolved residue once more treated with water, and so on until all the sugar is completely removed, and the dish rinsed with the spray from a Faraday washing bottle. A convenient form of dish now used

in most laboratories, is made of German silver and provided with a projecting lip, thus diminishing the danger of spilling the contents when held over the flask. Should a number of samples require examination, a most convenient method to preserve accuracy would be to properly label each flask with the corresponding lot of the sugar.

The liquid in the flask is now acted upon by an aqueous solution of basic acetate of lead. This reagent possesses the property of precipitating the larger part of the organic coloring matter affecting the sugar. A precipitate varying in quantity with the purity of the sugar is immediately formed; great care must be observed in the application of the lead solution, from 4 to 6 intances will suffice, while an excess not only depreciates the true percentage reading of the sugar present, but also renders the liquid turbid in consequence of the absorption of carbonic acid gas from the air, the latter difficulty however can be removed by adding a few drops of acetic acid.

It is even advisable at times to forego the use of lead solution entirely, other decoloring agents may be employed such as bone black, tannin, alum, hydrate of alumina or sulphur salts, the choice between which must be largely left to the skill and experience of the operator. The foregoing directions having been carefully observed, the flask is next carefully filled to the graduation mark, any doubt as to the proper position of the liquid in the neck of the flask may be removed by a little vapor of ether which dissipates entirely the bubble and froths on the surface.

The liquid is now ready for filtration and may be best conducted in funnels of about 4 inches diameter and 60° inclination, over jars about 8″ high and 2″ in diameter. The first portions of the filtrate should always be rejected and enough of the remainder passed over to fill the observation tubes, these are usually supplied with the instrument, made of metal or glass exactly 200 millimetres in length and perfectly cylindrical throughout. Both ends have screwed into them brass caps with apertures and holding in their places small glass discs for preserving the transparency of the solution. To fill the tube one of the caps, with discs, is removed, the liquid carefully poured in so that no air may be held imprisoned and when perfectly full the disc is carefully slid across and the cap gently, but securely screwed firm. The tube is now placed between the two prisms before mentioned, a hingeable cover fastened down preventing the entrance of external rays of light, the observer gazes through the telescopic end, while the field is illuminated by a monochromatic flame generally an argand lamp at the other end.

The field of vision will now exhibit two halves differing in color, a little ratchet is then turned until this is no longer the case and uniformity of color is restored. When this result is secured the operator ascertains the amount of rotation to which the ratchet has been subjected by means of a graduated scale connected with it and which in the instrument under discussion exactly corresponds or is identical with the true percentage of sugar contained in the examined sample. If for example 89.5 is the amount read off on the scale after the colors have blended into one then is 89.5 the true percentage of crystallizable sugar whether pound or bag or ton, if the samples have been properly made and the analyst be conversant with his business.

It is advisable however not to determine uniformity of color after one trial, the eye looses its power to accurately discriminate if the operator's range of vision is persistently confined to the instrument, only by repeated alternations of looking away, turning the screw a little to

the right or left, can a correct check upon any error in the first instance be obtained and if the solution is too dark as is sometimes the case rendering a sharp discernment difficult, an application of a small amount of bone black whose absorptive properties are known will speedily discolorize the most obstinate solution.

The methods made use of in boiling exert an important influence on the final polarization of the product, unripe canes, insufficient defecation, or liming in excess, slow boiling and improper curing all tend to diminish the rotatory power. The rationale is exceedingly simple. The above causes effect an alteration of the crystallizable substance into uncrystallizable molasses and invert sugars having strong rotation to the left instead of to the right, like cane sugar. The depreciation of polarization percentages from the No. 1's through the 4's is an illustration of this truth; again, too much lime, besides rendering the juice difficult to clear and crystallize, has the same effect on polarization in consequence of the dark nature of the liquid, and also diminishes it, besides entailing greater expense to the refinery by necessitating more frequent renewal of large quantities of bone black for discolorization.

Another fact not to be lost sight of, is the deteriorating effect upon sugars by being exposed any unusual length of time to the deleterious influence of air and atmosphere, or stowed away for months in store-houses or holds of vessels. In the two latter instances no external need be present to further fermentation and consequent inversion; while lastly the manufacturer must needs exercise great care in the choice of proper defecting agents, like salycylic acid, selycylate of soda, etc., which, though all strong antiseptics, are great friends to inversion.

The value of the polariscope is not alone exemplified by its quantitative determination of raw and refined sugars, its actual benefits are inestimable when used for controlling in the different processes of manufacture; raw juice, for example, when expressed from the cane can be made to exhibit its axact amount of crystallizable material far better than by any other method. The Baume Sarcharometer for instance is altogether empirical, although we all know that juice standing 10°, as it is called, should yield more sugar than juice standing 8°; and again the Balling instrument, though indicating the actual per centage in a *pure* solution is comparatively worthless when used for cane juice, so that after all recourse must he had to one instrument to accurately fix the relation between saccharine and non-saccharine in terms of per cent. of the former by such a process as before explained.

There are other methods of course leading to the same ends, both chemical and technical, all however calling forth a full knowledge of chemical laws and the utmost dexterity of manipulation; still for the same reason the liabilities to error and accident are largely increased, and the common polarization method, as it is called to distinguish it from the "Scheibler Rendement," the inversion method and others, remains the one in most frequent use among buyers and sellers wherever accuracy and dispatch are essential desideratums, while in conclusion it would not be amiss to say that the ability to polarize accurately can only be acquired by him who makes himself familar with the functions of the different parts of his instrument, whose balance is in perfect adjustment, who can discriminate between varying color tints, and in whom is exemplified that cleanliness is not alone next to Godliness, but in chemical investigations an element of success.

A. L.

SUGAR—A GLANCE AT ITS HISTORY, PRODUCTION AND MANUFACTURE.

At a recent meeting of the Massachusetts Institute of Technology, W. B. Rogers, the president, introduced Mr. Jacob A. Dresser, who spoke upon the "History, Production, and Manufacture of Sugar."

Mr. Dresser first referred to the very early knowledge of sugar in China and India, and the fact that before 1000 A. D. the substance and the cane had passed into Arabia, Egypt, and Cyprus. Thence it passed probably along the northern coast of Africa, and by the Moors was taken into Spain. Its use in Europe does not appear to have been at all general until introduced by the returning Crusaders. By Spain and Portugal it was transferred to the West Indies and Brazil. The cane was probably not indigenous to America. The wonderful development of the production of sugar from the beet-root has taken place in Europe almost wholly during the present century.

The entire amount of sugar produced in Europe is from the beet, and amounts to 1,500,000 tons, being fully three-fourths of the 2,000,000 tons now produced for commercial purposes in all other countries from the sugar cane, the original source of the substance.

The advantageous growth of the sugar cane seems to be confined to the belt within about 30° both north and south of the equator, with occasional variations coinciding with the isothermal lines, and an average temperature of seventy-five to seventy-seven degrees.

That of the beet, as illustrated in Europe, seems to range between 45° and 55° north latitude, but in our own country the range will, no doubt, be found, when developed, to be essentially below that, corresponding with the difference in the isothermal lines, perhaps more nearly from 35° to 45°. In this last season some 1,800 tons of fine quality were produced in Maine and Massachusetts.

As a statement of the total sugar production of the world it may be said that each of the great central empires—France, Germany, and Austria—produces about 400,000 tons, equal together to 1,200,000; Russia, 220,000; Belgium and Holland, 100,000—total, 1,520,000. Cuba, 600,000; Brazil, 200,000; Demerara, Surinam, and the Windward Islands adjacent, 400,000; and our own Louisiana and the Sandwich Islands, 150,000 tons. This gives us from America 1,359,000; Europe, 1,520,000 tons; East of Good Hope, 700,000—total, 3,570,000 tons.

Confining ourselves to the consideration of the ordinary sugar of commerce, cane sugar, so called, no description seems to be necessary, excepting perhaps to say that the crystal where perfect is rhomboidal, of four or six sides, terminating in two or three sided summits; and, when allowing to crystallize under favorable circumstances, may attain a length of one or one and a half inches, although such are rarely seen. Its specific gravity is 1·6.

Mr. Dresser next proceeded to discuss the wholesomeness of cane sugar, and said that while in the absence of nitro-genous matter it did not offer any nutriment to the muscular system, it does offer a large supply of heat, and is admitted to be fattening in its qualities; also, statistics show that a consumption of 75 to 80 pounds of sugar per person annually produces no ill effects.

Our views of the process of extraction and manufacture will be more complete if we begin at the sugar cane or the beet root.

The first claims precedence for many reasons, so we take the cane. It contains about 90 per cent of juice by weight, of which about 18

per cent is susceptible of crystallization, but this is never realized in practice.

The first problem is to extract the juice; the next to clarify it or purify it as far as possible; then to concentrate the juice, or this solution of sugar, in water with certain impurities by evaporating the water; then to facilitate and induce crystallization of the sweet principles therein, so far as we can; then to relieve these crystals of the mother liquor from which they have sprung, and which will then be molassee, and some of which will continue to adhere to the crystals unless removed by external force and appliances.

At this point we have what is called Muscovado sugar, raw sugar, or, perhaps more properly, sugar of first production, as it has been made in Cuba and elsewhere for many years. According to its treatment from this point onward it may remain as Muscovado, or become either clayed or centrifulal sugar, and is so recognized in commerce. The first process, that of extracting the juice, has been accomplished very imperfectly in various simple ways; the most primitive being still used in the East, and scarcely superior to the mortar and pestle, and quite similar thereto, excepting that the pestle or its correspondent is made to revolve by the power of oxen diagonally around the side of the mortar upon which the cane is held and crushed.

But the mill with upright wooden rollers, similar to our cider mill, seems very early to have been devised, and both forms are said now to be in use in India and China.

The great advance in science and the mechanic arts in the Western world has given us now the magnificent and well-nigh perfect iron mill, driven generally by steam; and visitors to the Philadelphia Exhibition may remember some examples of those exhibited there of giant size and strength.

Another method of extracting the juice from both cane and beet, "by diffusion," so called, long known and more practiced with the beet than cane, is perhaps quite as effective.

In this the canes are cut in diagonal slices, and exposed to successive water baths, by which nearly all the juice may be removed at the expense of increasing the amount of water to be evaporated before crystallization, twenty or twenty-five per cent.

Next, the juice thus obtained, constituting at best perhaps sixty to seventy per cent of that in the cane, is to be clarified or purified, that is, freed from mechanical impurities and foreign matters accompanying it in the cane, such as albumen and certain salts and acids derived from the soil. Great dispatch is necessary, because in exposure the nitrogenous materials rapidly induce fermentation.

Clarification is accomplished by heating in large vessels, formerly by open fires, but often now by steam.

By the introduction of lime the acids are neutralized, and by the heat the albumen is coagulated, and the impurities brought up and removed by skimming, which completes the clarification after a time for subsidence.

The next step is to reduce the volume of water. This is accomplished by heat and evaporation, but with much peril in the process to the sugar, to which heat is destructive and time is ruinous.

At as low heat and in as little time as possible, therefore (two opposing conditions), must this be done; but under the system of open fires, long universal and still used extensively, the destruction of sugar, or its conversion into molasses with its discoloration, was enormous.

SUGAR REFINING.

The refining of sugar of first product, or raw, as now produced, is now almost universally demanded

before its consumption by the civilized world, and it is hazarding little to say that but for one discovery and one invention, both made about the same time (1812), it would be impossible to answer this demand. That discovery was the effect of animal charcoal, or calcined bones, upon sugar solutions, and that invention was the vacuum pan, or the method of boiling in vacuo, by E. C. Howard.

The discovery was made in France (Devoine), the invention in England. Through these alone are stupendous operations in sugar refining now possible.

The sugar may consist of several varieties, apportioned by the judgment of the manager, so as to best attain the particular result desired in quality. It is first dissolved in hot water (say one-third), in a large tank fitted with an agitator operated by steam, and a steam-heating coil for quickening the process. When dissolved it corresponds to the juice when extracted from the cane or beet by the mills, and all possible dispatch is made to restore it again to the crystal form. From the melting tank it is pumped to an upper floor of the refinery into cisterns, called blow-ups, fitted with steam connections for heating. Here it is further clarified by albumen, and any acid tendency is converted by alkali, usually lime milk, and its weight or quantitity of sugar adjusted by addition of water or sirup to some 27° or 28° Baume saccharimeter, the test generally used. In some modes of working the blow ups are now omitted, and the liquor from the melting pan is passed directly to the bag filters, which by great numbers may be made to supersede the necessity of albumen.

Bag Filters.—The construction of these can be best understood by illustration and description. Their purpose is to remove mechanical impurities still remaining in the dissolved sugar.

They consist of two long bags, say 5½ or 6½ feet long, one of close material, and 15 to 16 inches wide, placed within another a little shorter and much smaller, but of very strong open material outside, to support the inner in doing its work. These are suspended inside and from the top of a close iron tank, the mouth of each bag being attached to a circular bell or opening downward in the top of the tank. The top of the tank outside is surrounded by a low but tight fence or inclosure, perhaps a foot high, into which the liquor flows, and is conducted through the openings above spoken of into the mouths of the bags. The inclosure in which the bags are suspended contains from one hundred to six or seven hundred bags, and is steam tight to admit of its introduction for heating and facilitating the flow of the liquor, as well as to remove any sugar that may remain in the impurities or scum arrested by the bags. The tendency of late years has been to increase the number and use of the bag filters, and to dispense correspondingly with other clarifying agents.

Charcoal Filters.—From the bags the liquor, as it is called, now enters a new and most important phase, viz, the animal charcoal filters. The effect of animal charcoal in decolorizing sugar solutions was observed about the close of the last century, and used by M. Derosus, about 1811, who introduced it then into practical use. But at first it was pulverized and mixed with the sugar in the blow-up, and removed with the scum and lost. Afterward it was placed in shallow tanks, and the sugar passed through them; but about the year 1822 M. Dumont devised the tall filters similar in form to those now in use, and with sundry variations in size, and open or closed they have continued until now. The present scale of business requires the use of enormous quantities of this charcoal, and the filters are now made correspondingly large,

say eight or ten feet diameter, and eighteen to twenty feet high. The effect is not only to filter and decolorize the liquor, but to remove acids and lime, and in some mysterious way it also promotes or facilitates the crystallizing power, increasing it, according to some, as much as ten per cent.

The filters are generally capable of being closed, so as to allow the use of pressure, which insures a more uniform distribution of the sirup, so that none of the coal remains unused, as sometimes happens without pressure. This pressure also allows the liquor to be passed over from the bottom of one filter to the top of another, when further filtration of it is required, and saving in such case the cost and expense of pumping, and the heat so desirable in filtering.

CONCENTRATION OF THE SYRUP.

The evaporation of the water, or concentration of the syrup or liquor in the vacuum pan, is the next stage, and by means of this invention of Howard we are enabled to maintain a vacuum of twenty-seven to twenty-eight inches, and hence to boil at a temperature of 130° to 170°, instead of 220° to 250°, as would be required in open air. In the early days these pans were only about six feet diameter and four feet high in the center of the elliptical section, with a capacity of twenty-five barrels of sugar.

Now there are some in New York of seventeen feet horizontal diameter and fifteen to sixteen feet high. One in the refinery of Messrs. Matthiessen & Wiechers has a capacity of boiling four hundred barrels of sugar at once, and evaporates sixty thousand pounds of water in two and a half hours, or fifty gallons per minute.

The vacuum pan and the bone-black filters may be regarded respectively as the heart and lungs of a sugar refinery, being as vitally important to its successful working as are those organs to the well-being of animal life.

A beautiful arrangement of the vacuum pan devised by M. Rilliex, of Louisiana, called "The Triple Effect," consists of two or three pans so connected that the vapor from the first, boiling without vacuum, is conducted to and boils the liquor in the second under a partial vacuum; and the vapor from the second is conducted to and boils the liquor in the third pan, in which, though the liquor is heavier, the pan, being connected with a condenser and pumps, is under a much higher vacuum, and hence is boiled by the vapor from the second. Between the pans is the usual safety receiver, to arrest any sugar that may be carried over by the vapor. This arrangement is used more largely on plantations and in Europe in treating the beet juice.

THE CENTRIFUGAL SEPARATOR.

Formerly the sugar was passed from the vacuum pans through the intervening heater, which received it directly into the moulds (as in the claying process), for separating the mother liquor from the crystals and making them white; but for this purpose centrifugal machines are now most generally used, thus substituting steam power for the slow process of gravity. This machine consists of a kind of round metallic basket, usually about thirty inches diameter (but some are now made larger), with sides of very finely perforated brass, twelve and fourteen inches high, and surrounded by an iron curb a few inches larger, which receives the sirup from the sugar in the basket and conducts it away. This basket is either suspended by a perpendicular shaft from above, or mounted on one from below, independent of the curb which surrounds it. After being filled from one-third to one-half its weight with semi-liquid sugar from the pan, it is made to revolve in a horizontal plane one thousand and

fifteen hundred times per minute. The sugar immediately rises in vertical walls at the sides, the sirup being thrown out through the perforations, and from the native yellow color it begins to grow white immediately, and after a few minutes, if it be of first quality, a little cold water from a sprinkler makes it beautifully pure and white. It is now in condition to be removed and sold as confectioner's or coffee A sugar, or by further treatment to be made into the well-known granulated sugar of commerce.

GRANULATED SUGAR.

This very popular and strictly American style of sugar was first made and introduced by our highly respected fellow-citizen, Mr. Thos. Lamb, who conceived the idea and devised the first apparatus for making it, which he put in operation about thirty years ago at the Boston Sugar Refinery in East Boston, of which he was then president and agent. Although extremely popular in the United States since its origin, it has become popular in England only within a few years past. The apparatus at first consisted of a steam table fifteen or twenty feet long and three to five feet wide, on which the moist sugar was, by an ingenious process or movement of wooden rakes, gradually worked the length of the table, becoming thoroughly dried in so doing. Afterward it was separated by sieves of different grades or mesh, into coarse and fine, and barreled and sold accordingly. This apparatus was superseded ten or twelve years since by a large cylinder of wood or iron, some four feet in diameter and fifteen to eighteen feet long, slightly depressed at one end. The inner surface carries small projecting buckets, by which, as the cylinder revolves, the sugar, entering at the upper end, is lifted and poured through the heated interior. The heat is supplied by a small steam cylinder running through the length and center of the large one, and the position of the buckets is such as gradually to work the sugar through the length of the cylinder, during which it becomes thoroughly dried. An arrangement of sieves, as before, completes the operation.

Loaf and crushed sugar, now somewhat rare, is made in refineries in moulds, much as the clayed sugar was described as being made on the plantations, but the process is carried out far more perfectly.

Cube sugar, so attractive, and now quite generally found in hotels and elsewhere here and in Europe, is made by sawing the large loaves, or by the centrifugal process, using moulds fitted to the machine, and with partitions dividing the sugar into thin layers, or by compressing the sugar when moist, and baking it instead of passing it through the granulator.

The polariscope, or saccharimeter, now used for determining the strength of raw sugar, is a beautiful instrument, of which, or of its operation, I can convey only a very imperfect idea. It is based upon the scientific fact that a beam of polarized light, in passing through a solution of a given strength of pure cane sugar in water, is rotated or twisted toward the right to a certain and uniform extent, and the relative extent to which a similar solution of any other sugar, under the same conditions, rotates the light, indicates the relative purity or crystalizing power of that sugar. The arrangement of lenses in the instrument is not easily made plain without diagrams, but it is such that the operation in itself is very simple, only requiring care, and the result is read in figures on a scale attached to the adjusting thumbscrew. Various elements possibly existing in the raw sugar make experience and judgment in using the instrument very necessary, and subtle and differing conditions in the samples tested require great care and appreciation in arriving at the result.

Mr. Dresser showed samples of the raw beet sugar and the loaf; also the Muscovado, and the various raw sugars as brought from the countries producing them; also the Dutch numbers of standard colors referred to in our tariff act, and for many years acknowledged in the commercial world.

President Rodgers said:

When I think of the time when Black, of Scotland, not long after the middle of the last century, discovered the reduction of the boiling point of liquids by diminution of pressure, and then think of the beautiful and practical application of this principle in the vacuum pan, where the water is extracted from a solution of sugar, I am struck with a most forcible illustration of the application of science to the practical affairs of life.

Another such illustration is again furnished when we observe that the absorbent power of animal charcoal was determined in the chemical laboratory as a scientific fact, and that it is now of such great importance in the refining of sugar.

The explanation of this fact is, however, not so easy as that of the other. Both animal charcoal and vegetable charcoal possess this absorbent power to a great degree, and it seems to be clear that it depends largely on the great increase of surface due to the enormous subdivision in the interior of the mass. The amount of adhesion and detention of a liquid in a mass depends on the amount of surface with which it comes in contact. As a very striking illustration of this, we know that platinum will, with great difficulty, combine with oxygen or hydrogen, but spongy platinum, or platinum-black, absorbs enormous volumes of gaseous matter, so that if such a mass be plunged into a vessel containing a mixture of oxygen and hydrogen it will imbibe so much and condense them to such an extent that they combine and the platinum is brought to a condition of intense ignition.

POPULATION OF THE HAWAIIAN ISLANDS.

In looking over the report of the Minister of Finance, and comparing it with those of previous years, one cannot help noticing a steady increase, not only in the general revenue of the Government, but also a most extraordinary increase in the *poll tax*. This is a tax of one dollar, payable by every male between the ages of seventeen and sixty years, the only exceptions being paupers or disabled persons, and it is supposed to furnish a correct index of the male population between those ages. The number of polls that paid taxes in 1872 was 13,920, when the population was 56,897. In 1882, when the population according to the last census was 57,985, the polls had increased to, according to the last report, 45,988 for two years, or in round numbers 23,000 for one year. Either the number of persons who paid taxes in 1872 was far below what it should have been, or else the number of male was since largely increased, while the total population, as reported by the census, is about the same. This increase in the number of polls is doubtless due to both these causes, and the question naturally arises, What is the present population of this Kingdom, and what does it consist of?

In order to furnish a clear exhibit

of the changes that have taken place let us look back and examine the census returns for say twenty years —those of 1860, 1866, 1872 and 1878:

1860—Total population was 66,984; the foreign population was 2,716; the native and Chinese were enumerated together 64,268, the Chinese numbering less than 1,000.
1866—Total population was 62,959, Natives 58,765; Foreigners 2,988; 1,206.
1872—Total population was 56,897; Natives 51,571; Foreigners 3,428; Chinese 1,938.
1878—Total population was 57,985; Natives 47,508; Foreigners 4,561; Chines 5,916.

Since the census was last taken in December, 1878, there has been a more rapid increase in the Chinese and foreign population than previously. The annual Custom House statistics show approximately what the increase has been. From these I find that, after deducting departures, 8,315 Chinese have arrived during 1879, 1880, 1881, and adding the number reported by the last census, 5,916, we have a total of 14,231, from which should be deducted for deaths during the three years, at least 500, leaving 13,731 as the Chinese population in this Kingdom on the first day of January 1882.

During the same period of three years, 5,892 foreigners have arrived in excess of departures, up to December 31, 1881. Adding these to the last census returns, 4,061, we have a total of 10,454 as the number of foreigners, other than Chinese, in this Kingdom at that date. No allowance is made for deaths among them, as the births exceed the deaths. tI is safe to assume that the increase by births has been between three and four hundred during three years.

The Custom House reports do not specify the number of females arriving from abroad, except Chinese, which, during the above three years was 179 out of a total of 8,315 arrivals. The number of Chinese females in the Kingdom does not exceed 500 out of the 13,731 Chinese.

The decrease in the native population is believed to be about the same as that reported for the last census period of six years, which was 7.80 per cent., and much less than during former census periods. At the above rate the present population, including half-castes, is about 45,000.

With the improved facilities for transporting immigrants by steam, and the special efforts now being made by Government and the Planters' Association to introduce them, and with the establishment of new steamship lines to encourage passenger travel to and from San Francisco, it is quite probable that the arrivals from abroad will greatly exceed those of 1881. Taking 2,500 as a safe estimate of the number of passenger arrivals during the first six months of 1882, and placing the above data in tabular form, we obtain the following estimate of the present population of the Hawaiian Kingdom:

Natives, including about 4,000 half castes	45,000
Foreigners of all nationalities except Chinese	10,454
Increase of foreigners by births since the last census was taken, 3½ years.	350
Chinese, including about 500 females.	13,731
Passengers arrived between January 1 and July 1, 1882, of all nationalities.	2,500
	72,035

These figures leave no room to doubt that the population to-day exceeds 72,000, and that the next census, to be taken in December, 1884, will place it between 75,000 and 80,000. The decrease in population ceased about the time that the Reciprocity Treaty went into operation, September, 1876. Since that date there has been a rapid increase; and this marked change is due more to the treaty than to all other causes combined. How earnestly, then, should the true friends of Hawaii seek the continuance of this life-giving convention.

Referring again to the poll tax, the large increase in it referred to above, is fully accounted for by the influx of foreigners and Chinese during the past three years. Of taxable Chinese alone there are to-day not less than twelve or thirteen thousands now in the Kingdom, and if a

full assessment is made of them the poll list and tax this year will exceed 30,000. In this connection it would be an interesting question to investigate—what proportion of the annual revenue of the Government is paid by Chinese, what proportion by foreigners, and what by natives.

Immigration is a source of wealth to any country, and adds greatly to its annual revenue. But in our case it becomes a serious question—where the Chinese, chiefly of the lower laboring class, have rapidly increased to one-fifth of the whole population, and to one third of the adult males—whether we may not be blessed with a super-abundance of these people, in case the crowds of them now rushing to America, which will be forbidden to enter there after August by the new law passed by Congress, shall turn to Hawaii, and seeking a temporary resting place here, shall eventually continue their voyage to America as passengers from this Kingdom. This may not prove the case; still, it is among the possibilities of the near future. It is just as well not to forget that "for ways that are dark and for tricks that are vain," these wily people stand second to none of their more pretentious neighbors; and in case our ports shall be resorted to for such strategic purposes, it is well also to be prepared to deal with the emergency as it may demand.

H. M. WHITNEY.

INSECT ENEMIES OF THE SUGAR CANE.

The following remarks on this subject are taken from a letter addressed to the *California Farmer* by Mr. John M. Horner of Spreckelsville, Maui: "Of the insect world we have an over supply, and they all seem indigenous to the country. At certain seasons we have millers in countless millions, of all colors and numerous species, and of all sizes, from that of a humming bird to a small gnat; in fact, so exceedingly small are they that they rise in clouds before one as he walks through the fields, and, without thought, he takes them for the fine dust or pollen of the flowers. But close inspection shows them to be tiny millers, that arise before the intruder and propel themselves along instead of being dust floating in the wind. These numerous classes of millers produce as many different kinds of worms, some huge and ugly, others small and only repulsive by being a worm. So numerous are the worms at times that the natives have been known to trench around their houses to keep them out. Now follows the interesting or important part of this worm tale. This numerous class of worms tax the farmer for a living, and prove a source of annoyance and loss to him, frequently destroying the whole investment of capital and labor which he has applied to the soil.

"Think of the thousands of acres of the richest land on the earth, capable of producing to perfection wheat, oats, barley, hay, potatoes, in fact, everything eatable for man or beast, yet all of the above-mentioned articles, and many more, are imported because the worms will not allow them to grow. Three thousand dollars would not pay the damage done to the sugar cane upon this plantation during the past four months. What damage they may

yet do during the growth of the crop can only be conjectured.

"Sugar cane, heretofore, has enjoyed immunity from the worm pest, with the exception of the 'borer,' and having its leaves nibbled by other worms, neither of which killed the cane, and only the 'borer' did any permanent mischief. But the worm that has killed the cane upon the plantation I am superintending seems to be a stranger to the old cane planters of this district, none having seen it heretofore. If they should increase, so as to spread over these Islands, and become as numerous as they are here in some places, the sugar interest must succumb to the worm Curse, as most other agricultural products have done.

"The worm is white, and 2½ or 3 inches long, and as thick as a man's finger when full grown. It lives in the ground, never appearing on top,

"No other crop has been tried during that time, except some barley and oats sown for hay. All of the barley and about one-half of the oats have already been destroyed by them.

"We tried potatoes several times during the past twelve months, but every hill perished. We have ceased trying to raise potatoes. We now eat California raised potatoes, and quit blaming the Kanakas for not raising them, where the climate and soil are so favorable as it is here."—*Daily P. C. Advertiser, June 22, 1882.*

BONE MEAL.

In June and July, 1880, twelve acres of land on Paukaa Plantation, which had been planted and replanted until exhausted for cane purposes, and which had been six or seven years in grass, were planted with Lahaina seed. In October of the same year three and one-half acres more of the same piece were planted with the same kind of seed, and one thousand pounds of bone meal per acre placed in the furrows before placing the seed. It was all well cultivated, and tasselled in November and December, 1881. It was ground in February, 1882. The twelve acres yielded 64,000 lbs. or two tons and 1,333 lbs per acre. The three and one-half acres yielded 24,180lbs or three tons 908lbs per acre. The juice in each as taken from the mill and allowed to stand ten minutes weighed 9° Beaume'.

This seemed to be a gain of 1575 lbs of sugar per acre. The bone meal cost laid in the furrows a trifle less than twenty dollars per acre not counting interest.

The cane which had no meal was worked twice before the bone meal cane needed cultivation.

One hundred acres were planted in May and June, 1881, on similar land with the same amount of bone meal, the cane will be ground early in 1883. It looks well now.

We are applying bone meal to ratoons this year and hope that a good result will follow.

Since our opening article was printed the *Daily Commercial Advertiser* publishes the statement that "no proposal whatever was made to the Government by representatives of the planters to initiate an immigration of Japanese," and that "at the only verbal conference which has taken place between the Ministry and representatives of the planters, it was acquiesced in by all parties that measures were not yet sufficiently advanced to allow of any steps being taken." Upon enquiry of those who were present at the verbal conference above alluded to, they inform us that they understood that Mr. Alexander would not be accredited; also that the Government was not then ready to take steps in the matter of Japanese or other immigration, at that time.