THE HAWAIIAN PLANTERS' MONTHLY

PUBLISHED FOR THE

HAWAIIAN SUGAR PLANTERS' ASSOCIATION.

Vol. XX.] HONOLULU, MAY 15, 1901. No. 5

NEW YORK SUGAR MARKET.—The latest quotation for centrifugals was 4¼c. with a firm market, May. 3.

The British Government has imposed a duty of 4*s.* 2*d.* per cwt. on refined, equal to 91 cents per 100 pounds.

Regarding the effect on the home consumption of the imposition of duty by the English Government, Mr. Sigmund Stein gives the following opinion: "While sugar refiners would welcome a tax, the allied trades—jam, confectionery, and brewing—profess that they would be ruined. The Confectioners' Association have circularized the trade to petition against any tax. Their apprehensions are unfounded, if not insincere, if the information given below is a fact; and the authority is Mr. Sigmund Stein, a Liverpool sugar expert. Mr. Stein states that 30 per cent of sugar is used in jam; a half-penny tax on a pound of sugar would mean only one-sixth of a penny extra per pound of jam. Jam makers make from 3d. to 4d. per pound profit on jam. Confectioners make from 30 to 40 per cent profit; the tax would increase the price of fancy biscuits only one-tenth of a penny per pound and confectionery very little more, so that how, if these statements are facts, the confectioners will be ruined it is difficult to see. Brewers use only 7 per cent of sugar in beer, and the tax would add only one-quarter to the gallon of beer—an invisible fraction for a pint. A sugar tax of one-half penny per pound would add eight millions sterling per annum to the revenue."

During the past two or three years, the banana trade between the West Indies and England has greatly increased, no less than 1,287,442 bunches having been imported during 1900, the freight on West Indies fruits having been largely reduced, while better vessels specially fitted for the trade are now employed. It is stated that the retail price in London is now six pence a dozen bananas, which is certainly a cheap rate, that enables the working classes to obtain it. Jamaica, which supplies most of this fruit to England, produces the finest bananas grown in the West Indies. They are probably

the same as we have, known here as the Chinese variety. Oranges are said to be plenty there, as they come both from the Mediterranean and the West Indies. The importations for 1900 are stated to have been 5,090,386 bushels, valued at over two millions sterling. Both these tropical fruits are in demand in America as well as in Europe, and were the freights reduced, the consumption would probably be doubled in a short period.

The Deming system of clarification, which has now been before the public for several years, is not only successfully maintaining but also considerably extending its ground as the best system known for dealing with obstinate, inferior, and defective juices, and has been made the subject of further patented improvements, which render it still more efficient and on the whole superior to any other method of clarification, especially for the tropics. It will be remembered that its special claims are that it completely supersedes open clarification, is very economical, saving both labor and steam, while the clarification obtained is much better than that effected by the old systems, the juices being consequently more easily and effectually dealt with in the later process of manufacture. Where this system has been introduced into Hawaii, it has given the most unequivocal satisfaction, as a rapid and economical clarifier of cane juice, and a vast improvement over every other that has been tried.

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INSPECTION OF MILK AND WATER.

In several of our exchange papers we note that the water and milk supplies in the large cities of America are being watched very closely. The following will be read with interest:

Reports about an epidemic of typhoid fever in New Haven show that even in that university town the value of a careful sanitary inspection of the sources of the water supply has not been clearly seen, at least by the authorities. Since the beginning of last week more than a hundred cases of this fever have appeared in a part of the city where well-to-do people live, and to which water comes from a lake in the hills, some miles away. Inquiry by the Board of Health proved that the lake had been polluted. There had been three cases of typhoid fever in the family of a farmer living near the lake and on the bank of a stream that flows into it. Here we see the con-

ditions which have caused many an epidemic of this disease. In Plymouth, Pa., there were 1,200 cases, all due to the pollution of the source of the water supply in the hills, where two persons had had the fever in a farmer's house on the bank of the stream. That was a memorable example. The stricken town was forced to call upon other towns for physicians and undertakers, because its own could not supply the demand. A few years later there was an epidemic of the disease in Windsor, Vt., caused in the same way, and other examples might be cited. In all such instances much misery and loss of life could have been prevented by the employment of a competent inspector to guard the shores of the lakes and the banks of the tributary streams. Such inspection, not requiring all of one man's time, would have kept the germs of typhoid out of that lake near New Haven. The expenditure would have been very little in comparison with the money cost of a hundred cases of fever, to say nothing of deaths and the unending sorrow of bereavement.

The agent of infection in epidemics of this fever is commonly the water or the milk. In a long list of them the investigations of experts have shown that the cause was pollution of the milk supply, due to the presence of the fever in the family of a dairy farmer or of a milk man. Such was the history of infection in the epidemics at Springfield, Mass., and Waterbury, Conn.; and one of those who lost their lives in Waterbury was a sanitary engineer who had planned the sewerage system of the city. He could not defend himself against the milk that came from a farmer whose hired man had typhoid fever; but good inspectors, employed to visit the dairy farms, would have saved the lives that were lost in these two cities and in others that have suffered from a similar cause. It happens that at the present time a little epidemic of diphtheria in Montclair, N. J., points clearly to the value of inspection. In that place, a few years ago, the origin of an epidemic of typhoid was shown to have been the pollution of milk by reason of the presence of the disease in the family of a milk man or dairy farmer. The people of that beautiful suburban region were much disturbed by the dreaded infection that invaded their homes, and the history of the case became widely known. This time the germs distributed in the milk supply are those of diphtheria; and the inquiries of a bacteriologist have shown that two employees of the dairyman from whom the affected families were receiving milk

have the disease in its incipient stage. They are not disabled by it, and therefore in this instance inspection might not have been a safeguard. Probably, however, the disease fully developed may be found in their families. If this dairy and the persons employed in it were not subject to inspection, they ought to have been. The experience of Montclair should have taught this lesson so forcibly that it could not be forgotten. Inspection pays. Boards of Health in most cases of this class make investigations and interpose after the poison has been distributed. A good inspector is continually on guard to prevent the distribution of it. The money paid for his services is very profitably invested.—N. Y. Paper.

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SUGAR CANES IN BARBADOES.

The proceedings of the Barbadoes Agricultural Society, of which Dr. Morris is president, are always interesting. Late mails bring the report for the past year. From the address of the President, Dr. Morris, we quote the following relative to the borer which is very destructive there, and to the results of the first crop of the new seedling canes:

Great interest is being taken in the experimental cultivation of new seedling canes for the purpose of increasing the yield of sugar as well as of selecting varieties suited to withstand the attacks of borer and fungus. With reference to the statement that certain varieties are more resistant to disease than others, it has been noticed in British Guiana, for instance, that "over 50 per cent. of the Bourbon variety have been attacked by fungus and less than 10 per cent. of other varieties in the same field." Again, as the result of observation at Antigua, Mr. Watts is of opinion "there is every reason to hope that rind fungus may be effectively fought by the selection of new varieties of canes." The experience at Barbadoes, where new varieties are extensively planted, confirms this. The rind fungus is probably, at the present time, less destructive here than anywhere else in the West Indies. The results of the experiments with seedling and other canes will be the first subject to be dealt with today. I need only briefly refer to them here. I believe there is a reasonable hope of our being able to increase the sugar contents of the cane and eventually of placing within reach of the planter canes that will not only yield 40 to 50 per cent. more sugar than at present, but will also, if placed under suitable conditions, withstand to a considerable extent the attacks of disease. In support of

what is above stated I cannot do better than direct your attention to the "Summary of the Results of the Cultivation of Seedling and Other Canes at the Experiment Stations at Barbadoes in 1900," already published in pamphlet form. These are the results of one year only, but they are of great interest and importance.

The best cane, so far, at Barbadoes is known as B. 147 which, compared with the White Transparent cane as a standard, has yielded according to the careful investigations of Professor d'Albuquerque and Mr. Bovell "44 per cent. more marketable sugar" and "over 50 per cent. more saccharose" than the standard cane. The average weight of canes given by B. 147 was 27.5 tons and the available sugar was at the rate of 3.31 tons per acre. It may be added that B. 147 has now been cultivated at Barbadoes for more than seven years. The present area planted with it is estimated at about 4,000 acres.

It will be within your recollection that last year I drew attention to the fact that, side by side with the raising of new canes and improved systems of manufacturing sugar, it was necessary to consider the possibility of reducing the cost of cultivation. This, it was suggested, could be done by raising larger supplies of good pen manure under cover, by the more skilful use of artificial manures, by extending the growth of leguminous crops for green manuring, and by growing to a larger extent than at present the foodstuffs and supplies imported from other countries. It would appear that what has been described as "a sentiment of aristocracy" once associated with British Agriculture is not unknown in these Colonies. This, no doubt, is responsible for the survival amongst us of not a few unscientific practices and for the reluctance to make changes in harmony with the times. As was shown by Mr. Bovell last year, Barbadoes pays about £175,000 a year for foodstuffs, most of which could be produced in the island itself. In the olden days when sugar was £25 per ton, the practice of importing foodstuffs was economically sound, but now, with sugar at £12 per ton, it is a suicidal policy to purchase dear American foodstuffs with cheap sugar. This is probably one reason why the imports into Barbadoes, are over two million sterling in excess of the exports. To be in a healthy condition they should indeed be entirely the other way.

MISLEADING SUGAR ANALYSES.

Many accounts relating to some special analyses of American beet sugar, testing 99.9 have lately appeared, says Sugar Beet. A well known chemist declares that upon several occasions coming under his notice, the sugar upon being received at the laboratory underwent a washing and was then analyzed, the resulting test being very misleading, as preliminary laboratory preparation of this kind is in reality a sort of refining. During the Paris Exhibition, we were shown Sandwich Island sugars and were assured that they polarized over 99, and yet upon examination they were soft, and would adhere to the surface of the hand. We subsequently learned that the residuum molasses had been worked up with these sugars in accordance with Hawaiian modes, for which custom there is an important reason. The product under these circumstances had all the appearance of a masse cuite and was certainly not unlike it in composition. If these sugars had their adhering substances removed, they, like all other sugars, would be chemically pure, but the product exhibited could not possibly polarize as was asserted, for the impurities do not evaporate when under examination. It is the commercial sugar simply melted and defecated that must be examined, and none other. A leading authority declares that neither the quantity of invert sugar nor the alkalinity can give any exact basis for estimating the quantity of sugar that decomposes during its storage. Sugar is first transformed into inverted sugar, then—owing to its reducing powers—into substances capable of forming acids; this last phenomenon is more complete when there is an excessive alkalinity, and in sugars where there is excessive alkalinity, the amount of decomposed sugar is just as great as in cases where this alkalinity is less; but the fact cannot be proven, as the inverted sugar has been changed into other substances. Sugars, when only slightly alkaline, retain the inverted sugar in an unaltered condition for a longer period. The quantity of sugar undergoing a change is always proportionate to the duration of storage. The only certain way of ascertaining the true conditions would be to estimate the percentage of inverted sugar and the amount of substances forming the acids; the latter may be estimated by boiling a sugar solution with 10 c.c. of sulphuric acid N-10, in a flask having a special cooling attachments, during ten minutes, then with caustic soda N-10, during ten minutes. The difference in cubic centimeters multiplied by 0.012 gives

the inverted sugar, which corresponds to the quantity of substance capable of forming acids. The result will be expressed in milligrams.

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RUSSIA'S COUNTERVAILING DUTY.

The Board of U. S. General Appraisers had a hearing on the question of Russia's giving a bounty to sugar producers of that country. The Jahn case being postponed, a similar one of Downs, Baltimore, was taken up. The Russian Government contends that no bounty is paid, while the importers claim that the Government must show that one is paid. The following stipulations were agreed upon:

"That the translation of the Russian Law and Regulations, as set forth in the Congressional Record, is a true and faithful translation of the said law and regulations and contains the whole body of the Russian statutes so far as the same are relevant to the issues herein.

"The following statements, from one to nine, are also stipulated in evidence:

"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 and 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, all sugar is divided into 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 on 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, consisted 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 issues 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."

TWO NOTED AMERICAN FINANCIERS.

MR. PIERPONT MORGAN.—The Morgan-Carnegie "combine" is the most gigantic trust in the world. Its official name is the "United States Steel Corporation;" its total capital is 500 millions; the united earnings of the eight great companies of which it is composed are one hundred millions yearly. The aim of this monster trust is to control the steel production of the world. The chairman of the Carnegie Steel Company will be the president of the new corporation.

Mr. J. Pierpont Morgan, one of the two men who give their names to this gigantic monopoly, is a man of remarkable and somewhat eccentric character. His personality is as exceptional as his financial genius is phenomenal. And his business methods, as far as his personal acts are concerned, are as unlike those of the average multi-millionaire as they can possibly be.

Self-reliance is the keynote of every thing that Mr. Morgan does. This habit explains in a measure his absolute domination of everything that he connects himself with. No duty is too small or trivial in connection with one of his great deals to be undeserving of his own personal attention. This system gives him a comprehensive knowledge of any transaction he undertakes which makes him its complete master. Other men interested in the same transaction are forced to bow to his superior and more complete knowledge. The average financial magnate trusts to secretaries, assistant secretaries and clerks to do what Mr. Morgan will trust to no one but himself.

He carries his system down to an unexpected point. Any one may approach him in the offices of Mr. J. P. Morgan & Co. There is not even an office boy at the door of his room to take in the cards or messages of visitors. He works at his desk within sight of his whole establishment. It would seem that this plan would expose a man of Mr. Morgan's great fame and heavy responsibilities to all kinds of interruptions. But the reverse is the case.

No man goes near Mr. Morgan unless he has made a previous appointment. No crank or idle talker or troublesome person has ever attempted twice to break in upon the time of the great financier. Mr. Morgan has a habit of suppressing unwelcome or bothersome visitors in a way that the recipient never forgets. In these moments Mr. Morgan is not the personification of gentleness nor the exponent of placid, courtly English.

He is aggressive, emphatic, and seemingly rough in his manner at all times. That is his normal state. He does not mean to offend any one. But when he really wishes to let some person know that his presence is undesirable he does it with a directness and force that leave no doubt of his intentions.

Mr. Morgan is a man of deadly punctuality. He reaches his office every morning at 9:50 precisely, and he remains there until 5 p. m. He works like a steam engine every minute of the business day.

The firm of J. P. Morgan & Co. has many partners and high salaried employees, but not one of them is in the full confidence of Mr. Morgan. They, of course, know in a general way of his schemes, but the details of his plans he keeps to himself. This does away with the danger of "leaks." If a big stock speculator knew what Mr. Morgan had in mind in these days of stupendous deals and reorganization he could make millions in a week. In his social life Mr. Morgan is said to be quite a different man from the Morgan of Wall street. He is a delightful host and an entertaining talker.

MR. ANDREW CARNEGIE.—With the Arabian Nights-like career of Mr. Andrew Carnegie—every one is already fairly familiar. "The present moment is our aim; the next we never see."

"He that dare not reason is a slave; he that cannot is a fool; he that will not is a bigot."

These mottoes adorn the cornices of the library in Mr. Andrew Carnegie's New York house. They are examples of hundreds of sayings of his own which he has ready for all occasions. He guides his business by these old and tried maxims.

From a poor boy Andrew Carnegie worked his way to where he stands, the industrial king of two countries. How he did it is a more wonderful story than imagination could evolve. He had no help, and has never asked for it. All his life he has dominated others. He is worth two hundred and fifty millions in spite of princely gifts to nearly one hundred cities in the United States and Great Britain. He started without a dollar. He was twelve years old when he went to America with his parents and his brother Thomas and Dunfermline.

Andrew began work immediately as bobbin boy in a linen factory. At fourteen he became a messenger boy for the Atlantic and Ohio Telegraph Company of Pittsburg. It was

Carnegie's best move. Nothing he has done since compares with his change of occupation at fourteen years of age.

Describing this change in his career, Mr. Carnegie wrote, after long and successful years: "My entrance into the telegraph office was a transaction from darkness to light, from firing a small engine in a dirty cell to a clean office where there were books and papers. That was paradise to me, and I bless my stars that sent me to be a messenger in Pittsburg telegraph office."

At fifteen Andrew was an expert telegraph operator. And so it happened that when the Pennsylvania Railroad Company needed an operator he was chosen for the place. He soon mastered the details of train despatching. His marked ability led to his transfer to the headquarters of the company, and soon afterward he became superintendent of the western division of the Pennsylvania Railroad. He was then twenty-four years old.

The foundation of the Carnegie millions was an investment in oil fields. Previous to that, however, Carnegie had made the first investment of his life. He bought ten shares of stock in the Adams Express Company, valued at a £100. It proved a good venture, although he made it with great trepidation. It represented hard-earned money.

At thirty years of age, Carnegie began his wonderful career as an ironmaster. With the help of money which he had saved and some borrowed from a bank he started the Keystone Bridge Works. By 1888 Mr. Carnegie owned seven distinct iron and steel works and had controlling interest in several coke works. Since then he has acquired mines, railroads, and steamboats, and can start at the ore and turn out the finished product.—Ex.

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CIVIL ENGINEERING IN AMERICA.

The greatest engineering work of the nineteenth century was the development of the railway system, which has changed the face of the world. Beginning in 1830 with the locomotive of George Stephenson, it has extended with such strides that, after seventy years, there are 466,000 miles of railways in the world, of which 190,000 miles are in the United States. Their cost is estimated at forty thousand millions of dollars, of which ten thousand millions belong to the United States. The rapidity with which railways are built in the United States and Canada contrasts strongly with what has been done

in other countries. Much has been written of the energy of Russia in building 3,000 miles of Siberian railway in five or six years. In the United States an average of 6,147 miles was completed every year during ten successive years, and in 1887 there were built 12,982 miles. The physical difficulties overcome in Siberia are no greater than have been overcome here.

The perfecting of both the railway and its rolling stock has led to remarkable results. There are no accurate statistics of the early operation of American railways. In 1867 Poor's Manual estimated their total freight tonnage at 75,000,000 and the total freight receipts at $400,000,000. This was an average rate per ton of $5.33. In 1899 Poor gave the total freight tonnage at 975,789,941 tons, and the freight receipts at $922,436,314, or an average rate per ton of 95 cents. Had the rates of 1867 prevailed, the additional yearly cost to the public would have been $4,275,000,000, or sufficient to replace the whole railway system in two and a half years. This is a very striking illustration. Such high rates of freight as those of 1867 would have checked traffic. This much can surely be said: The reduction in cost of operating our railways, and the consequent fall in freight rates, have been potent factors in enabling the United States to send abroad last year $1,456,000,000 worth of exports, and to flood the world with our food and manufactured products.

Bridge-building.—About 1885 new material was given to engineers, having greater strength and tenacity than iron, and commercially available from its low cost. This is basic steel. After many experiments, the proper proportions of carbon, phosphorus, sulphur, and manganese were ascertained, and uniformity resulted. The open-hearth process is now generally used. This new chemical metal, for such it is, is 50 per cent. stronger than iron, and can be tied in a knot when cold.

The modern elevated railway of cities is simply a very long railway viaduct. Some idea may be gained of the life of a modern riveted-iron structure from the experience of the Manhattan Elevated Railway of New York. These roads were built in 1878-79 to carry uniform loads of 1,600 pounds per lineal foot, except Second avenue, which was made to carry 2,000. The stresses were below 10,000 pounds per square inch. These viaducts have carried in twenty-two years over 25,000,000 trains, weighing over 3,000,000,000 tons, at a maximum speed of twenty-five miles an hour, and are still in good order.

Bridge engineers of the present day are free from the difficulties which confronted the early designers of iron bridges. The mathematics of bridge design were understood in 1870, but the proportioning of details had to be worked out individually. Every new span was a new problem. Now the engineer tells his draughtsman to design a span of given length, height, and width, and to carry such a load. By the light of experience he does this at once. Connections have become standardized, so that the duplication of parts can be carried to its fullest extent. Machine tools are used to make every part of a bridge, and power riveters to fasten them together. Great accuracy can now be had, and the sizes of parts have increased in a remarkable degree.

We have now great bridge companies, which are so completely equipped with appliances for both shop drawings and construction that the old joke becomes almost true—that they can make bridges and sell them by the mile.

All improvements of design are now public property. All that the bridge companies do is done in the fierce light of competition. Mistakes mean ruin, and the fittest only survives.

Having such powerful aids, the American bridge engineer of today has advantages over his predecessors and over his European brethren, where the American system has not yet been adopted.

The American system gives the greatest possible rapidity of erection of the bridge on its piers. A span of 518 feet, weighing 1,000 tons, was erected at Cairo on the Mississippi in six days. The parts were not assembled until they were put upon the falseworks.

The United States have taken the lead in steel manufacture. In 1873, Great Britain made three times as much steel as the United States. Now the United States makes twice as much as Great Britain, or 40 per cent. of all the steel made in the world.

Mr. Carnegie has explained the reason why, in epigrammatic phrase: "Three pounds of steel billets can be sold for two cents." This stimulates rail and water traffic and other industries, as he tells us one pound of steel requires two pounds of ore, one and one-third pounds of coal, and one-third of a pound of lime-stone. It is not surprising, therefore, that the States bordering on the Lakes have created a traffic of 25,000,000 tons yearly through the Sault Ste. Marie Canal, while the Suez, which supplies the wants of half the popula-

tion of the world, has only 7,000,000, or less than the tonnage of the little Harlem River at New York.

INDUSTRIAL ENGINEERING.—When Dalton first applied mathematics to chemistry and made it quantative, he gave the key which led to the discoveries of Cavendish, Gay-Lussac, Berzeilus, Liebig, and others. This new knowledge was not locked up, but at once given to the world, and made use of. Its first application on a large scale was made by Napoleon in encouraging the manufacture of sugar from beets.

The new products were generally made from what were called "waste material." We now have the manufacture of soda, bleaching powders, aniline dyes, and other products of the distillation of coal, also coal oil from petroleum (known fifty or sixty years ago only as a horse medicine), acetylene gas, celluloid, rubber goods in all their numerous varieties, high explosives, cement, artificial manures, artificial ice, beet sugar, and even beer may now be included.

In a little over one hundred years, those working by the light of science have found the true philosopher's stone in modern chemistry. The value of only a part of these new products exceeds the nominal value of all the gold in the world. The value of our mechanical and chemical products is great, but it is surpassed by that of food products. If these did not keep pace with the increase of population, the theories of Malthus would be true, but he never saw a modern reaper.

WATER-WORKS.—The great increase of urban population, due to steam and electric railways, has made works of water supply and drainage necessary everywhere. Some of these are on a very grand scale. An illustration of this is the Croton Aqueduct of New York as it now is, and as it will be hereafter.

This work was thought by its designers to be on a scale large enough to last for all time. It is now less than sixty years old, and the population of New York will soon be too large to be supplied by it.

It is able to supply 250,000,000 to 300,000,000 gallons daily, and its cost, when the Cornell dam and Jerome Park reservoir are finished, will be a little over $92,000,000.

It is now suggested to store water in the Adirondack Mountains, 203 miles away, by dams built at the outlet of ten or twelve lakes. This will equalize the flow of the Hudson River so as to give 3,000,000,000 to 4,000,000,000 gallons daily. It is then proposed to pump 1,000,000,000 daily from the Hudson River at Poughkeepsie, sixty miles away, to a height sufficient

to supply the city by gravity through an aqueduct. This water would be filtered at Poughkeepsie, and we now know that all impurities can be removed.

If this scheme is carried out, the total supply will be about 1,300,000,000 gallons daily, or enough for a population of from 12,000,000 to 13,000,00 persons. By putting in more pumps, filter beds, and conduits, this supply can be increased 40 per cent., or to 1,800,000,000 gallons daily. This water would fill every day a lake one mile square by ten feet deep. This is a fair example of the scale of the engineering works of the nineteenth and twentieth centuries.

By the application of modern labor-saving machinery, the cost of this work can be so far controlled that the cost to the city of New York per 1,000,000 gallons would be no greater than that of the present Croton supply.

Coal.—Petroleum and natural gas may disappear. The ores of gold, silver, and platinum will not last forever. Trees will grow, and iron ores seem to be practically inexhaustible. Chemistry has added a new metal in aluminum, which replaces copper for many purposes. One of the greatest problems of the twentieth century is to discover some chemical process for treating iron, by which oxidation will not take place.

Coal, next to grain, is the most important of nature's gifts; it can be exhausted or the cost of mining it become so great that it cannot be obtained in the countries where it is most needed; water, wind, and wave power may take its place to a limited extent, and greater use may be made of the waste gases coming from blast or smelter furnaces, but as nearly all energy comes from coal, its use must be economized, and the greatest economy will come from pulverizing coal and using it in the shape of a fine powder. Inventions have been made trying to deliver this powder into the fire box as fast as made, for it is as explosive as gunpowder, and as dangerous to store or handle. If this can be done, there will be a saving of coal, due to perfect and smokeless combustion, as the admission of air can be entirely regulated, the same blast which throws in the powder furnishing oxygen. Some investigators have estimated that the saving of coal will be as great as 20 per cent. This means 100,000,000 tons of coal annually.

Bituminous coal will then be as smokeless as anthracite, and can be burned in locomotives. Cities will be free from the nuisance of wasted coal, which we call soot. This process

will be the best kind of mechanical stoking, and will prevent the necessity of opening the doors of fire boxes. The boiler rooms of steamships will no longer be "floating hells," and the firing of locomotives will become easy.

Another problem of mechanical engineering is to determine whether it will be found more economical to transform the energy of coal, at the mines, into electric current, and send it by wire to cities and other places where it is wanted, or to carry the coal by rail and water, as we now do, to such places, and convert it there by the steam or gas engine.—Ex.

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SUGAR CANE DISEASE.

It may be as well in reverting to this important subject, to give a brief outline of its principal phases, so as to convey a general idea of its nature and the necessity of checking if possible the development of its ravages.

The period of growth at which the fungi parasites vegetate on the cane plant, is from two months onwards until the last blade enclosing the scope of the arrow bloom. Supposing the cane to be planted in December, the time at which the plant is most liable to be seriously affected by the fungi spawn, is from the beginning of March to the end of May, or during "the dry season."

The first symptom indicative of the plant being diseased, is a pale turbid green observed in the blades, which is usually but not always accompanied by a red or scarlet tinge on the sheaths of the lower blades, the margins of which often have a strip of yellow preceded by a faint streak of red; these blades always wilt and turn inwards in the form of tubes during the hot hours of the day, the blades again recovering their turgescence during night. If a plant which shows these symptoms be carefully pulled up after the surface of the soil has been well moistened with water, so as to allow the roots being removed from the soil with the least possible breakage, and a minute examination of these roots is made, a number of mysilial spawn threads will invariably be found embedded in the thin stratum of osmatic mucilage which covers the tender surface of the roots and root hairs, and the stubby roots around the radicle will appear, as if literally, covered with a white musty smelling mysilial deposit, not unlike the minute crystals of hoar-frost. And, if the stem of the plant be split up longitudinally through its centre to the terminal bud or

cone at the top, it will be observed that the greater portion of the fibro-vascular bundles look as if they were stained with a red liquid; that the lateral or confluent elaborating bundles which run transversely through the nodes or joints of the plant are of a light straw color when first exposed to the action of the air, but the latter after a few minutes' exposure gradually change to a pale orange, whilst the nodes and internodes at the terminal bud brighten into a scarlet color; the creamy cellular tissue being little affected by the exposure. I may remark in passing, that the cause of the mysilial spawn being found embedded in the osmatic mucilage of the roots is due more to the accident of position than to the nature of the fungus to which it belongs burrowing in the soil, as the congenial zone of its habit on the host plant is the sheaths of the blades, where it thrives, blooms, and fruits in sanguine luxuriance, and not on the roots. Probably, the sporangia from which they vegetate are buried in the area of root distribution during the process of tillage operations. The musty smelling spawn attached to the radicle belong to a common species of the genus "Agraicus." Should the rainy season set in about the beginning of June, the greater portion of the more advanced sprouts affected by the fungus blight will apparently recover from the effects of the virus which has poisoned them, and become succulently green, the verdant color ever attractive to the mother moths of the larval borers, and which meets the essential condition of their economy, irrespective of the constitutional soundness or unsoundness of the plant selected on which to deposit their eggs, and should the plant continue to be favored with genial weather for six or seven consecutive weeks. And if after that time a young cane be split up in two halves, it will be found on examination that all the former unhealthy discoloration, with the exception of a few scarcely discernible red spots scattered about some of the internodes, has been neutralized or absorbed, and so far as external appearances go, the plant looks healthy, and is often supposed to be so. But if, after the lapse of a couple of months, say in September, a plant which showed signs of unhealthiness in the previous May, be now taken and cut up through the center it will be seen that the scarcely perceptible red spots that were recognized in July, have now become compact masses of mysilial deposit in the center of white spots which are surrounded by dark red and cloudy oxygenized ferment, in the first stage of putridity. These

white spots gradually become larger till they take up the whole of the internal portion of the cane, which varies from one-sixteenth of an inch to one inch in depth. It is at this eruptive phase of the disease that one or either, or all of the three species, xylophaga or woodcutters, enter the cane, more, I believe, in the capacity of sanitary agents than malefactors, which combined conditions soon put an end to the accretive functions of the host plant, and it dies from exhaustion.

Of the twelve species of fungi which vegetate on the cane, six species prey upon the sheath of the blade, two species on the midrib of the blade, one species on the parenchyma of the blade, the other three species being found attached to injuries on the stem of the cane. Four out of the six species which are parasitical on the sheath of the blade are the most destructive of the twelve species. Their order of antecedence and position on the sheath of the blade not being constant, I will confine my remarks to the species which I consider does the most injury. This fungus is produced from what is technically called a Sporangium or spore case, in which is secreted the spawn or vital matter from which the species is propagated and may be named Asmodium infestans, and shortly described as follows—Sessile, pallid, slightly granular, sporangium spherical; the average size of sporangia one-sixteenth of an inch in greatest diameter, germinating by minute buds or beads of mysilial spawn which exude from the sides in the form of transparent, almost invisible threads, which get attached to the sheath of the blade, as the sheath comes up through the soil to the level of the surface. In four or five days after the mysilia have become attached to the sheath of the host plant, they have penetrated and passed through the cellular tissue to the inside of the sheath; then they spread up through the parenchyma to the extent of from six to ten inches, meanwhile penetrating inwards and passing through the sheaths of all the inner blades till they ultimately reach the stem of the cane. Having developed their energy thus far they now commence to weave a thick web of white mysilia felt from which is produced a considerable crop of globular fruit or seeds which are easily recognized on both the out and inside of the affected sheath. In about eight or ten days the fruit falls to the ground, where it remains, if not disturbed, in a quiescent state for a couple of months; again to come forth and glut its insatiable and acrid appetite.

When the cells of vascular bundles and cellular tissue of a

sheath that is affected by the above fungus, are examined, it is found that they are ruptured and otherwise disorganized and have become mechanically unfit to perform their accretive functions either in forming or in distributing the carbohydrates in a condition essential to the healthy maturing of the plant, hence the cause of the increased ravages of the moth larval borers, not from an undue increase of these insects, but solely on account of the nutritive quality of their food having become so poor they have to consume a greater quantity of material in a cane that has been affected by fungi than they have to do in a sound cane. This defect in the nutritive quality of cane affected by fungi parasites, appears to arise from a disorganized association of its ternary constituents with their mineral equivalents in the process of assimilation, and not to a deterioration of accretive energy in a particular variety of cane plants, to which many eminent planters attribute the cause of our present misfortune.

The reiterated assertion that the Bourbon, Otaheite, and other fine varieties of sugar cane in the West Indies have become deteriorated from continuous production in the same soil and the necessity of replacing these varieties by cultivating seed varieties obtained from arrow bloom, deserves the attention of every practical planter. But before we condemn and expunge those fine varieties which hitherto have proved to be under normal conditions so suitable to the climates, and condition of these Islands—in some of which they are now cultivated, if not to the highest perfection, exceeding, so far as my knowledge goes, that of any of the new varieties—it will be as well perhaps if we first consider, and find out whether we are cultivating those despised varieties according to the condition of their normal requirements, before we take the decisive step of pitching them over the garden wall. In order to ascertain what we mean when we talk about a healthy, robust plant, I define a healthy, robust plant to be one that produces under normal conditions the maximum quantity, quality or density possible for the species or variety to which it belongs. To attain that end it is necessary to observe, acquire, and adjust two essential conditions—namely, the necessary and essential store of germinal food in the plant and the various constituents in the soil ready for the plant to take up when required. In all mature sugar canes which have not arrowed, the best seed plants are to be found in the four last developed internodes, as in this portion of the cane is

secreted the material best suited to produce the maltin and diastase ferments so desirable in the process of germination, for, as the internodes reside towards the root they become less and less fit for plant seed, the cause of which—the more sugar there is in the cane used for plant seed the more detrimental will the alcoholic ferment be to germination, and so deteriorate the plant produced from such abnormal conditions. The data that I have collected from the manurial experiment I have made with different kinds of manures, are so opposed to the present system of our applying them, that I do not care to be first to rebuke our previous ignorance in this department of agriculture.—Lou. Sugar Planter.

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THE CUBAN SUGAR SITUATION.

Mr. B. A. Oxnard, the prominent sugar planter of St. Mary parish, returned a day or two ago from a most interesting trip to Cuba. This tour of the island was prompted by a desire to secure a clear understanding as to the sugar interests and learn exactly what the Louisiana planters will have to fear from the tropical island, where the cane yields far more sugar per ton than the cane of this State.

Speaking of the trip and the results of his inspection, Mr. Oxnard remarked that, to use a slang expression, he was anxious to see just what the Louisiana sugar growers "were up against." He has no fear now as to the next 10 or 15 years, but after that time the matter will need legislation.

Mr. Oxnard remained in Havana for quite a little while, and was struck by the remarkable change in the condition of affairs.

Several years ago he visited the island and found the streets unclean, and carelessness everywhere. Now the city is clean, and there is an air of prosperity and Americanism which in previous years was unknown. Of course in the province of Havana, the people are anxious to see the Americans remain and a government established which will last. They are of the class which favors either annexation or protection by the United States. These people are, of course, the best of the island, and the property holders, but they do not make up the majority. In fact, the population seems divided into three classes. Those who favor annexation make up one class, and those who favor a protectorate make up a second class, and those who are for independence pure and simple, and do not favor the United States, compose the third class. In the east

end of the island this class prevails and has the majority by large numbers. Speaking of numbers, the majority of the island's population has no high regard for America and have no desire to see the United States interested in the Cuban government. These people want independence with a free hand.

The sugar interests of the island are at present rather limited in character. It is like a new industry, for the war laid in ruins hundreds and hundreds of fields. Traveling from Havana, through Matanzas and the province of Puerto Principe, the trains pass one field after another which have been burned level. Some were destroyed by the Cubans, but the great majority were ruined by the Spanish, and it will require years before these plantations are planted again and are productive. Once the island of Cuba yielded over a million tons of sugar. In 1899, a year after the war, only 200,000 tons were made, and the year following, which was last season, the one just closed, the output was 300,000 tons. The prospects are that the crop of next season will about double the last named figure, and the Cubans fully expect to reach the million mark.

While these crops are large, they are not of sufficient size to endanger the interests of Louisiana.

Mr. Oxnard found in the eastern end of the island that the labor question was a most serious one. The planters have great trouble in finding the necessary field hands, and until this question has been settled the sugar interests of that country will not be greatly developed.

In the old provinces, such as Havana and Pinar del Rio, the sugar planting is far advanced. However, in these provinces, the yield per ton is not as large as in the east end of the island. In fact, in many localities, the cane does not give more than the Louisiana cane.

There are, of course, wonderful advantages in this island. The climatic conditions remove all danger of freezes, and if the rainy season comes and the planter cannot grind his crop, he can allow the cane to grow on for months until the weather is better. The cane is not injured in the least.

Besides these natural advantages in climate, the planters have other advantages over Louisiana. The cane has more fiber than the Louisiana product, and the cane is much richer. The increased percentage of fiber in the cane enables the planter to secure sufficient bagasse for fuel. In fact, the mod-

ern sugar houses on the island burn nothing else, and they have a sufficient supply to work the seconds. The juice of the cane does not need the working that Louisiana juices do, and there is a smaller amount of fire needed for this reason. This question of fuel is a most important one, and with Cuban planters securing their fuel for nothing and more sugar to the ton than in America, they have a great advantage.

Mr. Oxnard admitted that in the course of the next 15 or 20 years the Cuban sugar crop would prove a most dangerous rival, but he saw no need for the Louisiana planters bothering over the question. The present political condition of the island gives promise of anything. No one can tell exactly what will happen, and no one can tell what the labor question in years to come will amount to. At present, the United States consumes about 2,000,000 tons of sugar. By the time Cuba produces great stores of sugar, the United States will consume more sugar, and the foreign markets will have increased. If ever Cuba reaches a full development of her great natural advantages, then the people of this State will need some kind of protection and legislation. That time can hardly arrive within 15 years.

Mr. Oxnard, while greatly interested in what he saw, does not seem to fear Cuba as a dangerous rival. The possibilities of danger are so remote that he seems willing to treat the matter lightly.

Touching upon the political situation, he remarked that no one could possibly tell what the people of the island will do. The American companies have made some investments in sugar lands, but the majority are holding off, pending the establishment of the government. At present, the Americans do not stand very well in the island. The recent actions of the American government have produced a decidedly unfavorable effect, but while there is talk of insurrection in the eastern provinces, there is really no danger. The people who do the most talking are of the lower classes and the negroes, and while riots may come, they will doubtless be easily checked. There are no powerful leaders with those opposed to the United States, and this fact, coupled with the friendship of the property holders and the usefulness of American soldiers, will soon put an end to any acts of lawlessness.

What may be the first step in the consolidation of the various large sugar interests in the island of Cuba by the purchase of these interests by American capitalists has been

taken. Recently the Chappara Sugar Co., of Cuba, with offices at No. 109 Wall street, N. Y., placed contracts aggregating over $2,000,000 for the equipment of the largest sugar plant ever built in Cuba.

The company has acquired 60,000 acres of land in the eastern portion of Cuba. Nearly 10,000 acres of this land are under cultivation, while on the rest the work of planting sugar cane will be immediately begun. This enormous planting is without precedent in the history of Cuba.

With the exception of 800 acres in the immediate vicinity of the factory location, 10,000 acres under growth are being divided among colonists who cultivate their fields and deliver the cane to the mills for a return of 4 per cent.

A railroad of 30 miles will be constructed on the estate and grinding operations are to begin next December, by which time it is believed some 300,000 tons of cane will be ready to be handled. The mills will have a daily capacity for grinding of 3,000 tons of cane. Power will be derived from a 6,000 horse power steam plant.

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WEATHER PROPHECY.

The nomenclature of storms is not well understood. Any disastrous storm is referred to in the general newspaper press as a cyclone. This is a great mistake. The disastrous storms in the United States should be called tornadoes. They are very different from the cyclone. As we saw in our last article, the cyclone may be one thousand miles in diameter, and traverses our whole country, yes, even pass around the world. The area which it covers is very great, may be even a million square miles. The tornado, on the other hand, is very limited in area. Its width may not be over fifty or one hundred yards, though at times it may reach a mile, which I believe is very exceptional. It may devastate for only a few rods and very rarely works havoc for more than one hundred miles. The rate of wind, however, in case of the tornado is often stupendous. It may reach a hundred miles an hour and has been known in rare cases to attain the surprising velocity of five hundred or even one thousand miles an hour. We see, then, that while the tornado is alarmingly disastrous, it rarely spreads its devastation over any considerable area. The cause of the tornado, as I understand it, is the overlapping of the cyclonic and anti-cyclonic currents. Thus is formed these terrific whirl-winds, very maelstroms in the atmospheric oceans.

The region of these tornadoes is of course the same as that of the cyclones. Thus they may reach from the Gulf to the Great Lakes, and may devastate even from the Rocky Mountains to the ocean. The greatest havoc occurs from Nebraska to Illinois and from Kansas and Kentucky on the south, to Wisconsin on the north. It is well that these tornadoes are so quick to lift their pressure from the earth, else the havoc which they cause would be even more appalling than now. As it is, they mow a swath through the forests for only a few miles, destroy a single town, and kill by the hundreds. They are greatly dreaded in Kansas and Nebraska, where they occur most frequently and are practically absent on our western coast.

The same cause that produces the tornado—interference of the cyclonic and anti-cyclonic circuits—also brings about the terrific thunder showers. These, however, are usually more restricted in area than are the tornadoes and not infrequently go hand in hand with the latter.

There is still another kind of storm which is more tropical. In the Orient these are known as typhoons. They are occasioned by interference in the great tropical cyclones, much in the same way as the tornadoes result from impact of air currents in the temperate regions. These tropical cyclones sometimes invade our own southern districts, and thus our southern coast is not a stranger to these hurricanes. The frightful disaster at Galveston this last year is a vivid illustration of this truth. If we reckon Cuba as a part of our domain, then we are all the more interested in these appalling hurricanes. We have seen that the tornado has a maximum limit of one mile by one hundred miles, the hurricane on the other hand, may reach for hundreds of miles. While the tornado kills hundreds, the hurricane sends thousands into eternity. The tornado razes a single town to the earth, while the hurricane may entirely desolate a hundred cities. The velocity, however, of the wind in case of the hurricanes is much less than that of the tornado. At the center of this atmospheric maelstrom, the velocity of the wind current may reach one hundred miles an hour. The wind has been known to move at sixty miles even at a distance of five hundred miles from the center.

It is easy to see from the above how our government is able to make such reliable prediction in forecasting the weather. She is in telegraphic touch with stations situated all over our

country. Thus she is early apprized of the cyclonic disturbances as they pass at a rate of fifteen to twenty-five miles an hour across our continent. As she learns the character of the wind drift in the far west, she is able to give a very sure prophecy of what will come with these wind drifts as they reach more easterly points. The barometer is always truthful, and always decides accurately between the cyclonic and the anti-cyclonic wind drift. Science has shown that the anti-cyclonic means fair weather, while the cyclonic ever comes with threatening mien. It will readily be seen how it is that it is more difficult to predict with certainty on the Pacific Coast than it is in the far East. If we could have telegraphic stations on the broad Pacific, then we should know just as surely of the cyclonic wind drifts on our west coast, and could predict with the same assurance of success. As it is, there is scientific basis for prediction in our west coast States. We have noted that the cyclonic circle is contrary to the hands of a watch, and this is the great cyclone that brings the storm. Thus with the barometer and the wind circle, the expert director of the Weather Bureau in his office at San Francisco can send out with pretty sure certainty of success the forecast as to our storms. We have all learned how generally he "hits the nail on the head." In view of our position we wonder that he so rarely fails of a truthful prediction. It is to be hoped that all our editors will aid the government work, and will teetotally cease from any notice of the quack weather prophet.—Exchange.

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RUSSIAN SUGAR.

The countervailing duty on Russian sugar has caused a great deal of trouble. Secretary Gage is acting entirely within the law. If the law is wrong Congress should attend to it. All that the executive can do is to carry out the law.

The question is of considerable interest to us as being a sugar growing territory. The Argonaut puts the matter as follows:

"The production of sugar in Russia is an industry which is conducted under strict government control, and, in order to maintain such oversight, the minister of finance each year estimates the amount of sugar which the home market will demand. Upon this quantity an excise tax is payable amounting to about two and one-half cents per pound. The minister also prescribes the quantity which may be exported. On the

exportations no duty is placed, but any sugar sold in the home market in excess of the amount prescribed is subject to a double excise tax, and any sugar already sold at home but afterward exported is entitled to a rebate. The tariff law of the United States provides that when any foreign country grants a bounty on sugar exported to this country, a countervailing duty shall be placed upon the importation equal to the bounty received.

"Upon representations that Russian sugar received a bounty, a countervailing duty of 90 cents per hundred pounds was imposed in December, 1898, by the Treasury Department of the United States under the tariff act of 1897. Doubts as to the exact status of Russian sugar caused the temporary removal of the duty last April, pending investigation. Since then the officials of the Treasury have conducted an inquiry, the result of which has been the recent order re-imposing the countervailing duty."

The sugar men in the United States hold that there is a bounty paid for export of Russian beet sugar, and Secretary Gage thinks the same. The manufacturers who have interests amounting to three and a half millions a year in Russia trade take an entirely opposite view, because Russia is retaliating by putting duties upon United States manufactures.

This small rift within the commercial lute is going to grow larger and larger as time goes on. The policy which guards the manufacturer is not identical, and the United States is beginning to feel the difference.

It is true that as far as figures go this matter of Russian sugar is not a very important one. Of the $100,000,000 worth of sugar imported by the United States in 1900, only $22,000 odd came from Russia. Among the beet sugar producing countries Russia stands fourth. The crop of Germany is 1,000,000 tons greater than that of Russia for the season 1900-1901. But this is not the argument by any means. It is not a question of how much sugar is imported into the United States. If only a ton of Russia sugar were imported, the position would be exactly the same. The question is whether Russia pays a bounty. To any one who gives the matter a thought it is evident that she does. It is insidiously and cleverly done, but the bounty is paid all the same.

The argument of many papers on the mainland upon this matter, is that the question at issue is so small, while the exports to Russia are so large, that it is not worth while

to bring on a tariff war. But this argument is only on a par with that of the servant girl, who on being accused of having a baby said "Please ma'am it was only a very little one." The policy of the United States in the matter of tariff does not depend upon the amount of goods imported, but upon distinct principle. Whether it is a pound or whether it is a billion pounds matters not a jot. If a tariff policy has been adopted, no matter whether it hurts particular manufacturers or not. The remedy of the latter lies with Congress. If the policy is wrong Congress can right it. As far as Secretary Gage is concerned he can do nothing but support and carry out the law as he finds it. Expediency is what many people aim after, but expediency is a very weak battle horse.

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A TRUST IN RURAL BEAUTY.

Mr. Sylvester Baxter, in The Review of Reviews, calls attention to the fact that Massachusetts has established a trust to which there can be no possible objection. He terms it "A Trust in Natural Beauty." Massachusetts about ten years ago created a board of trustees of Public Reservations. The official duty of this board was to acquire by purchase or by gift, to the value of one million of dollars, real estate, that for its peculiar natural beauty seemed worthy to be kept in the name and for the benefit of the public. What this board has already accomplished almost surpasses belief. In its first year of existence Mrs. Fanny Foster Tudor, of Stoneham, conveyed to the board, as a memorial of her daughter Virginia, a piece of woodland wilderness of about twenty acres —a noble park of hemlock and pine bordering a stony brook. Soon after Mr. Joseph Story Fay transferred to the board a tract of seventy-one acres, which he had himself purchased for the purpose of preserving it from desecration. This property consisted of woodland and pasture, including also two delightfully situated ponds. Mr. August Hemenway, of Canton, soon after made over several hundred acres along the Neponset River and the Blue Hills. This was but the beginning of a work that has gone on steadily, placing plots of both scenic and historic interest in charge of the board. Among these are Monument Mountain in the towns of Stockbridge and Great Barrington; and Mount Anne Park, a tract of fifty acres of woodland, on the granite hights of Cape Ann. The work done by the State has stimulated fine tracts of woodland, or rocky glens, and lakes, and mountains. Perhaps the

grandest achievement of all has been the acquisition of old Greylock in the Berkshires, and Mount Wachusett in the center of the State. We recall several small but delightful reservations which owners will not permit to be desecrated; but which are not safe in case of the death of these public spirited citizens.

The example set by Massachusetts has gone beyond the state, and is likely to spread through the whole county. It is even claimed that it has been a stimulant to the establishment of a National Trust in England, for the preservation of historic places of interest. It will give special pleasure to those who have traveled among the White Mountains of New Hampshire to know that the Appalachian Club has secured a right to acquire and hold in trust places of peculiar beauty and interest in that State. New England has lost irreparably by allowing its noblest hills to be denuded of forests, and its grandest glens to be turned into gutters for spring floods. But Pennsylvania is not far behind. Her magnificent mountains have been turned into scenes of devastation and horror. New York has acted more wisely, but none too soon, in placing her Adirondack Reservation under the control of a Cornell School of Forestry.

In Massachusetts, Mrs. J. B. Harrison, who was so influential in New York State in securing the preservation of the scenery around Niagara, and the Adirondack forest, has led the way to the recovery of State rights over the "Province lands," of four thousand acres, at the end of Cape Cod. This domain, which was an original reserve of the colony, was nearly ruined by being denuded of trees. Sand dunes had been allowed to accumulate, until they were burying the forests as well as the meadows. The reclamation of this public property has been brought about by Mr. Harrison; and the dunes are being pinned down with judiciously planted vegetation. The work of the Trust thus runs collateral with the work of forest preservation.

The Massachusetts Trust has not only taken in charge mountains and glens, and places ennobled by scenic beauty, but had undertaken extensive systems for beautifying cities and towns. The Boston Metropolitan Park system includes several thousand acres of hills, woodland and seashore, through which flow the Charles, the Mystic and Neponset rivers. For miles the banks of these rivers are gardens.

A contemporary calls attention to the collateral work under-

taken by the New York society, created for purposes very similar to those of the Massachusetts society. The preservation of the Philipse Manor, the Morris Mansion, Fraunce's Tavern and the Poe Cottage would alone make this society a great public benefaction. But of even greater importance are the steps taken for the preservation of the scenic beauty of the Palisades. It would be a national loss to allow this memorial of the geologic past to be further mutilated. Watkins Glen is now public property—the most charming resort of the kind in all the Atlantic States. The power of such societies should enter the competition for the preservation of its scenic beauties from the hands of the spoiler.

A good deal can be done by auxiliary town effort; and this will rapidly come about by the impulse given through the State institutions. There are everywhere notable gems of scenery, bits of woodland, small natural parks, and even groups of historic trees, that the State can hardly reach. A public spirit may, however, be roused, that will encourage towns and private citizens to stand firmly in the way of that commercialism that would reduce such gifts of nature to destruction, for private advantage. Meanwhile the general Government is extending its care over places of national interest. There are now over forty-two millions of acres under reservation and Government control—in all thirty-six reservations.

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THE PINEAPPLE INDUSTRY.

Pineapples attain to greatest size in the West Indies, some weighing 12 to 13 pounds. Great care is taken in packing them to secure their arriving in England in sound condition. The stalk is cut several inches below the fruit: an ordinary large sized flower pot is then filled with mould, into which the stalk is inserted in such a manner that a casual observer would almost take it to be the way it was grown. Each pine is then put into a skeleton wooden case made just enough to hold it, so that it can be safely handled without the risk of being bruised or injured.

Pineapple culture is yet in its infancy in Florida, but the success that it has already met with in some parts of the State promises to establish it as one of its most profitable industries. The following varieties have given the best satisfaction: Spanish, Sugar Loaf, Cayenne (noted for its large fruit and the absence of stickers on its leaves), and the Egyptian Queen or Trinidad. This latter is probably the first variety

grown in Florida: the fruit is of large size, superior quality and with an almost entire absence of the toughness noticeable in some varieties. Cotton seed meal is found to be the best fertilizer, and generally fifteen thousand plants are put to the acre, yielding an average of ten thousand fruits. Three or four annual crops are produced without replanting. Last year a crop of Egyptian Queen yielded to the planter a net income of seven hundred dollars per acre. The lowest returns the same individual ever received were three hundred dollars. The net price received is from three cents to twelve cents each, depending upon size, quality, season and condition of the market. But the pineapples area is limited. The bulletin of the agricultural division of the Census Bureau states that there are now 23,496,000 bearing plants in Florida, which is the only State in the Union where it is cultivated.

MEXICO.—In the tropical districts of this country the culture of the pineapple is being rapidly promoted owing to the increased demand from the United States. Experiments made last year demonstrated that it was better to have the plants wider apart (say 8000 to 10,000 per acre) as they then produced larger pines. The close planting hitherto practiced is the cause of the larger quantity of small fruit that floods the markets. Between the rows of pines they planted corn, the product of which more than compensated for the necessary labor in caring for the pines. The pineapple not needing a very rich soil and only moderate food was benefitted rather than retarded by the corn: it was discovered that too much fertilizing actually retarded the growth of the pines, for being allied to air plants a large share of its nutriment is drawn from the air, leaving the roots but little to do.

OTHER COUNTRIES.—In Ceylon, there are about 9000 acres covered with pineapples, in Cochin China about 8000 acres, and in India enormous quantities are grown in great ranges in Assam, in Rangoon, in the Tenasserim provinces and at the foot of the Himalayas. But it is mostly consumed locally and does not figure in foreign exports. From Acapulco there are annually shipped to San Francisco about 800,000 pineapples realizing about $6 per 100. Cultivation is increasing owing to the large demand from the Pacific Coast.

Honduras annually exports to the United States about 150,000 of three kinds—the horse, cherku and sugar-loaf.

Antigua exports to England about 5000 barrels annually of the black-pine pineapple.

Havana exports principally to the United States the surplus over local consumption, about 60,000 barrels each containing 35 pines of first, 45 of second, or 50 of third cullings. The average price per barrel ready for shipment is $6, $5, and $4, for each quality respectively, and the freight to New York is 30c. to 50c. per barrel. There is a continued increase of production.

The annual import into the United States from the West Indies is over 5,000,000 pineapples.

PRESERVES.—In Florida an excellent wine and cider are made of the pineapple; and in the Azores wine and alcohol are largely made.

In Nassau the local demand of fruit for tinning equals the amount of fresh fruit exported. The operation of peeling and slicing is performed on tables in the yards near the waterside. The cans are carried to the warehouse on wooden trays (each containing fifteen), to be immersed in syrup. The tops of the cans are soldered on, and they are lowered in an iron framework, 400 and 500 at a time, into the steam boiling vats. After boiling, the cans are perforated at the top to allow the steam to escape. They are then hermetically sealed and spread over the yard to cool. Each can of fruit, before the syrup is added, weighs two pounds.

All the aparatus and the tins used in the canning factories are imported from New York.

Almost every modern cook book furnishes receipts for making jellies, marmalade and preserves from the pineapple. The following, which has been tested by the writer, is a receipt largely used in Florida for making pineapple marmalade for family use or in large quantities for trade. "Select large sugar-loaf pineapples, peel them, take out the eyes, which are not very deep in the sugar-loaf, and grate them on a porcelain grater into an earthen dish. Do not grate the core. Weigh the juice and pulp and measure out to every pound three-quarters of a pound of sugar. Mix the sugar with the pulp and boil it for an hour to an hour and three-quarters, until it is a smooth, clean paste and firm."

Chichi or pineapple wine is a delightful and favorable drink made of the pineapple in Mexico and other tropical countries. A small quantity is made as follows: Over the peelings of two pineapples pour one quart of boiling water: allow it to steep until cold, then sweeten to taste, strain and bottle. Tie down the cork and place the bottle on its side; if placed in a

warm place it will be ripe in 24 hours. A small piece of ginger placed in each bottle will improve the flavor. If made in large quantities, the whole pineapple chopped should be used.

PINEAPPLE FIBRE.—The plant affords fine fibre of practical utility from the leaves, which are about 3 feet long by 1½ to 2 inches wide, strongly edged with spines except in the one variety known as the smooth-leaved Cayenne. Besides the fineness of the fibre for textile fabrics, it is remarkably strong when made into cordage. A government test made in India proved that a rope 3¼ inches in circumference would bear a weight of 42 cwt., it actually breaking with 57 cwt. We quote from published reports concerning this fibre. This fibre however is produced chiefly from a species of wild pineapple, though the fibre of the cultivated plant is of excellent utility:

"The pineapple grows in great abundance in the Philippine Islands, but produces only a small dry fruit. We require, however, more precise information to enable us to determine whether this is actually the plant escaped from cultivation. Mr. Penelet, of Pondicherry, considers it a distinct species, and has named it Bromelia pigna.

"In preparing the fibre for weaving, the fruit is not allowed to ripen early; its removal causes the leaves to increase considerably both in length and in breadth. A woman places a board on the ground, and upon it a leaf with the hollow side upwards. Sitting at one end of the board, she holds the leaf firmly with her toes, and scrapes its outer surface with a potsherd, not with the sharp fractured edge, but with the blunt side of the rim; and thus the leaf is reduced to rags. In this manner a stratum of coarse longitudinal fibre is disclosed, and the operator, placing her thumbnail beneath it, lifts it up and draws it away in a compact strip, after which she scrapes again until a second fine layer of fibre is laid bare. Then turning the leaf round, she scrapes its back, down to the laver of fibre, which she seizes with her hand and draws at once, to its full length, away from the back of the leaf. When the fibre has been washed, it is dried in the sun. It is afterward combed with a suitable comb, sorted into four classes, tied together, and treated like the fibre of the lupi. In this crude manner are obtained the threads for the celebrated web "nipis de pina," which is considered by experts the finest in the world.

"In the Philippines, where the fineness of the work is best

understood and appreciated, richly embroidered costumes of this description have fetched about £200 each.

"This fine muslin-like fabric is also embroidered by the nuns of the convents in Manila with great skill and taste.

"The manufacture of the pina fabric is carried on in the metropolitan province of Fondo. From the extraordinary facility with which the pineapple is grown in the vicinity of the equator, it seems almost certain that by the application of modern skill to the process of separating the fibre from the pulpy matter of the leaf, a valuable raw material composed of it might be obtained for the nations of Europe. The fibre by the hackling process could be rendered fit for the finest fabrics. The leaf consists of two different structures, the upper side being of a soft or pulpy character, easy of removal; and the under side, of a harder or more ligneous nature, and more difficult to separate. These two external bodies hold the fibre between them.

"In the Straits Settlements the Chinese laborers have taken kindly to this new and promising branch of industry. The process they adopt in preparing the fibre appears to be much the same as that pursued in the Philippines. After being scraped with a bamboo plane they are steeped in water and washed and then laid out to bleach on rude frames of split bamboo. The process of steeping, washing, exposing to the sun is repeated for some days, until the fibres are considered properly bleached. Without further preparation they are sent into town for exportation to China."

Nearly all the islands near Singapore are more or less planted with pineapples, covering an extent of about 2,000 acres. But the manufacture of the fibre or trade in fruit does not amount to much.

"The wild brother of the pineapple has a larger leaf and longer fibre. It is common in the Antilles, growing in the most arid spots. It makes excellent mats, hammocks, and ropes. Almost all the fishing tackle of the American mercantile marine is made of it.

"The leaves are 5 to 8 feet long, and from 1½ to 3 inches wide, thin and lined with a tough fibre. The plant is self-propagating, and left to itself in an open field will soon cover the ground. In Central America, but particularly in Nicaragua, it is so abundant in the forests as to be a serious obstruction to man or beast. It is largely cultivated in the districts of Mexico. It is indifferent to soil, climate and season,

while the simplicity of its culture, and the facility of extracting and preparing its products render it of universal use. From it is fabricated thread and cordage, mats, bagging, clothing and hammocks."

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HOW THE BEET-SUGAR INDUSTRY IS GROWING.

By Ray Stannard Baker.

"The Evolution of Human Diet" is one of the fascinating books that is yet to be written. When it does appear it will contain much that is curiously interesting about sugar and how it has invaded the world's pantry. A chapter on this subject might well be given the title, "Sugar versus Pork." It seems odd to link together such foods as sugar and pork, and yet the more sugar man eats the less pork he needs, each serving the same purpose in the human system, that of fuel to supply heat and energy. Fifty years ago sugar was a rare luxury, of poor quality and high price; our grandfathers obtained the heat and energy which their bodies required largely from pork and other fats. Then sugar grew cheaper, it was a vegetable product pleasant to the palate, easily kept and pure in quality, and the consumption of it grew in enormous proportions, no doubt cutting heavily into the pork industry. Today it has become a table necessity, and the amount of it eaten every year is increasing at a rate out of all proportion to other foods. Next to the English the Americans are the greatest of all consumers of sugar, and the total of our purchases yearly is far greater than that of any other nation. We eat over 2,000,000 tons a year, or nearly 63 pounds for every man, woman, and child in the country. That means one and one-fifth pounds a week. Twenty years ago the consumption was only 38 pounds annually for every person—certainly a striking evidence of the growing use of sugar. It is said that the Americans are the greatest eaters of sugar in the world. The English consume a greater quantity—over 86 pounds per capita—but much of it goes into fine marmalades, jellies, and so on for exportation purposes. After the Americans, the Danish and Swiss are the greatest sugar-eaters, and then in order come the Dutch, the French (with 30 pounds a year for each person), the Germans, and the Swedes. The Southern people of Europe, the Italians, Spanish, Grecians, and others are very light consumers of sugar, partly because

they have not the wealth of the Northern nations, and partly because they live in a warm climate where they do not need heat-producing foods. Generally speaking, sugar is one of the indices of national progressiveness; the more enterprising and energetic a people, the more sugar they eat.

Sugar has not risen to its present prominence among commodities without working great changes in agricultural conditions, even to the extent of causing wars, for commercial economists show that the Spanish-American war grew directly out of the conflict for supremacy between the sugar-beet growers of Germany and the cane-sugar growers of Cuba, Porto Rico, and the Philippines. The wonderful success of science and brains applied to sugar production in Europe enabled the Germans to undersell the Cubans, thereby causing the discontent and hardship which finally led to the Cuban insurrection against Spain and the subsequent interference of the United States. Cane-sugar and beet-sugar are exactly the same in composition, in appearance, and in taste, but the struggle between the growers of these two great sources of production has not yet seen its conclusion. A comparatively few years ago beet-sugar was almost unknown; the world's sweets came entirely from the cane, and the semi-tropical countries where cane grew most luxuriantly earned all the profits of the industry. Today, more than half of the world's sugar is made from beets. The Northern races have again outstripped the Southern races. It is probable that many Americans, thinking they are using sugar from the cane of Cuba and Louisiana, are in reality eating sugar from the beets of Germany, or California, or Michigan.

WHY DO WE IMPORT SUGAR?

Sugar is one of the few great commodities in the production of which the United States is weak and dependent. In almost all of the great necessaries of life—food, clothing, fuel, and shelter—the country is more than self-supporting, but in the matter of sugar ye are largely dependent on foreign supplies. And our sugar bill is the largest by far of any of our foreign accounts—twice that of coffee, which stands next in prominence, and much greater than that for india rubber, tea, silk or hemp. Every year we pay about $100,000,000, or $1.35 for every man, woman, and child in the country, to foreign countries for sugar. Indeed, out of more than 2,000,000 tons of sugar which the United States con-

sumes annually we produce a paltry 270,000 tons, mostly from the cane-fields of Louisiana. This does not include the production of the new island possessions, Porto Rico, Hawaii, and the Philippines; but these would add only 460,000 tons to our production, still leaving us to obtain much more than half of our sugar from the foreigner. And all this in the face of the fact that so good an authority as Secretary Wilson of the Department of Agriculture says:

"We have no more need to import sugar than to import wheat."

Secretary Wilson spoke from a thorough knowledge of the remarkable strides made during the past two or three years by the sugar beet industry in this country. The American farmer has suddenly discovered that he can raise with large profit as good sugar-beets as there are in the world, and the American manufacturer has learned that he can make those beets yield the highest grade of pure sugar. Twelve years ago the total production of beet-sugar in American was 255 tons; six years later the production had jumped to 16,000 tons, and last year (1899) the production was about 80,000 tons. For 1900 those who know predict a production exceeding 150,000 tons, nearly doubling the output of a year ago and making the beet-sugar yield of the country nearly equal to the cane-sugar yield. And thus, out of almost nothing, the United States has built a sugar industry in half a dozen years, the output of which this year will be about double that of the island of Porto Rico. And the work has barely begun. In 1898, Michigan had one sugar-beet factory; two years later in 1900 she had ten factories. In California the largest beet-sugar factory in the world has just been completed, larger than anything in Europe, although Germany has been years at the business. This enormous factory cost $2,750,000, and it will turn out upward of 400 tons of sugar every day, using 3,000 tons of beets for the purpose and consuming yearly the product of 30,000 acres of land. Capital is always shy about venturing into new industries, but it has taken beet-sugar making to its heart. Indeed, one who reads of the growth of the industry in Illinois, Nebraska, Colorado, New York, Iowa, Minnesota, New Mexico, and other States can hardly resist the contagion of the beet-sugar enthusiasm. At the rate at which the industry is now growing, it will be only a few years before the United States will supply her own sugar needs, great as they are, thereby keeping at home the large

profits of growing the beets and manufacturing the sugar, and saving the expense of shipping the sugar hundreds or thousands of miles.

ENCOURAGEMENT FROM WASHINGTON.

Sugar-beet growing is typically a new industry, born of scientific investigation and intelligent governmental encouragement. In the first place, the sugar-beet is nothing more than the ordinary garden-beet, bred and developed by years of careful selection until it produces a very large percentage of sugar. To the Germans belongs the credit for working out this development, and for beginning the manufacture of sugar from beets. Their success encouraged other nations in Europe to take up the industry, and more recently it obtained a foothold in California. But it was not until the United States Department of Agriculture began a campaign of systematic sugar-beet education and experimentation that the industry showed signs of spreading widely over America. It required faith and perseverance to induce men of capital to venture upon an unknown industry, the profits of which, uncertain enough in themselves, were dependent on the efforts of farmers who never had grown sugar-beets, and who were reluctant about undertaking a doubtful new crop which cost much more money and labor to grow than any other common crop.

Fortunately, however, the agitation was begun just at the close of hard times in 1897, when the farmer was discontented and willing to try new things. At the same time capital, which had been timidly withholding from investment until times were better, was eager to investigate new and promising chances, such as the sugar-factory industry might afford. The Government in 1897 imported from Europe a large quantity of sugar-beet seed, and distributed it free among the farmers of various States, upon condition that beets should be grown and samples sent for examination. When the samples came in the analysis showed that many were very rich in sugar, much richer than the ordinary crops of Europe, especially favorable results being obtained from the Pacific Coast States, from Colorado, and from the Great central States of Michigan, Wisconsin, Iowa, Nebraska, and Illinois. Interest was everywhere awakened and some of the States, through their Agricultural Colleges and Experiment Stations, took up the work of promotion vigorously, and in several cases

a bounty was offered by the legislature for all beet-sugar produced. In Michigan, Dr. R. C. Kedzie, chemist of the Agricultural College, and Prof. C. D. Smith, director of the Agricultural Experiment Station, wrote bulletins, made speeches to farmers, talked with capitalists, visited the beet-fields, indeed, made a business of assisting the new industry. As a result, Michigan built ten factories in two years, and the cheapest of them did not cost less than $300,000, and several of them cost very much more. Other States were only a step behind. Certainly, there never was more conclusive proof of the value of intelligent scientific and educational effort in building up a new industry. The work of the Department of Agriculture and of the Experiment Station and the Agricultural College in the single State of Michigan has thus added, by conservative estimate, from 20 to 50 per cent. to the value of the lands suitable for beet growing in the vicinity of many of the factories, and it has created a new source of employment for a large number of working men and women.

SOME RESULTS IN MICHIGAN.

Recently I visited some of the beet fields of Michigan in company with Dr. Kedzie and was shown through the pioneer factory of the State at Bay City. There are three factories here within a radius of two miles, and there is no better chance anywhere to see the new industry at its best. In fact, sugar-beet growing and sugar-making have appeared as the salvation of that part of the State. Fortunes were once made in central Michigan from the pine-timber industry, but the forest lands are now practically denuded, and the great sawmills, one after another, have been closing, leaving no other great industry to take the place which they filled. Capital had accumulated, and being driven from the old channels of activity, took up with avidity the manufacturing of beet-sugar. Nor is this a merely local condition; in many parts of the United States sugar-beet raising has appeared as the salvation of a failing community.

Here around Bay City the land is flat and rich. It is settled largely by Hollanders, with a liberal admixture of Americans of other origin. The farms are small and thoroughly tilled, and when the farmers were first approached by the representatives of the sugar-factories they showed much more than ordinary willingness to take up the experiment of sugar-beet raising. This enterprise on the part of the farmers is

the more surprising, because sugar-beet culture represents an entirely different kind of farming from that usually practiced in America, a more careful or intensive farming as distinguished from the extensive farming practiced by the producers of corn, wheat, and hay. It more nearly approximates the system in vogue in Europe, bordering, as it does, on gardening. By the old system a farmer planted a field of wheat and paid no more attention to it until it was ready to harvest. But when beets are planted they require constant and costly attention during many months. In the first place, the ground must be much more thoroughly prepared, plowed deeper, and more carefully pulverized than for any other crop; then the seeds must be sown with care in drills, and when they come up, the plants must be thinned out to give room for the beets to grow—work that requires the painful labor of knees and back during the long, hot days of June. Weeds must also be kept down with perseverance, and cultivation must go on steadily until the leaves of the beets are large enough to shade the ground. All this costs immense labor, and care, and expense, especially if the fields are large. The farmer cannot depend on his own family to do all the work, but must hire boys, and women, and sometimes men, to help with the thinning and weeding. In short, it is a much more scientific method of farming than that ordinarily in vogue in this country; it uses the land more thoroughly and profitably, and it requires much more business capacity on the part of the farmer. But if it costs more to raise beets per acre than wheat or corn, the profits are correspondingly much greater, and as soon as the farmer can be made to see this great advantage, he is usually more than anxious to take up the work. The Bay City factory already mentioned, in common with many other factories throughout the country, employs a man whose sole duty it is to go through the country and interest the farmers in beet-raising, showing them how the work is done, making contracts with them, and then watching the crop the whole season, giving his advice and assistance wherever possible. At the time of my visit at Bay City the beets were just ready for harvest, and the great flat fields of them, covered with spreading green leaves, furnished an example of farm wealth to be equaled in few other places in the country. The sizes of the crops of various farmers varied from two or three acres up to 180 acres, all planted to beets. Every acre of these splendid farms will yield from 12 to 20 tons of beets,

and the value per ton is from $4 upward, according to the richness of the beets in sugar. Say, that the yield is 15 tons per acre and that the farmer receives the minimum of price for his product, his income would then be $60 per acre, very much more than any other farm crop would yield.

In order to show what was being done by these farmers, I obtained from Prof. C. D. Smith a number of actual instances of profits made in raising sugar-beets, the year being 1898.

Name	Acres	Yield tons per acre	Cost per acre for raising	Receipts per acre	Profits per acre
G. Hine	24	13.1	$ 41.25	$ 64.59	$ 23.34
S. F. Sayles	4	17.5	46.30	67.52	21.22
J. F. Boes	1	18.8	32.02	89.09	57.08
Thomas Handy	16	12	31.63	57.34	25.71
C. B. Chatfield	13	14.5	38.82	65.25	26.43
J. W. McIntosh	8	17.5	35.15	66.75	31.60

With such profits as these, dollar wheat, as one of the Bay City farmers expressed it, "ain't nowhar'." It is a good crop of wheat that yields a profit of $5 an acre.

THE BEET AS A FERTILIZING AGENT.

Nor are the great profits the only advantage which accrues to the farmer from beet-raising. The thorough working of the soil necessary to the production of a good beet crop leaves it in superb condition for a crop of wheat or corn during the following year, thus adding a new and valuable element to the system of crop rotation. Moreover, the leafy tops and the crowns of the beets, which are cut off, can be fed to stock or left to fertilize the fields, and the pulp which is thrown out from the factory after the saccharine juice has been extracted, also makes a most valuable cattle food. For the present the Bay City factories give away this pulp free to the farmers, the idea being to teach them its excellence for stock-feeding purposes, but in many other States it is sold at a good profit. In Germany this pulp is an important article of commerce, and not a pound of it goes to waste. It will be seen, therefore, that the beet is very thoroughly worked up and saved, and that the crop may be made to return to the farm practically as much fertility as it takes away. Of no other crop can this be said. In shipping sugar from the country no important element of soil fertility is lost, sugar being, as Dr. Kedzie expresses it, "condensed sunshine, wind, and water,"

composed wholly of carbon, hydrogen, and oxygen. In shipping wheat from the country, on the other hand, the farmer ships the very life of the soil—the nitrogenous and phosphatic matter. The grain-raisers of the United States do not fully appreciate this fact as yet, because their land is new and rich; but in Europe, where the fertilizer question is of burning importance, the question is given its due weight. No less accomplished a student of the sugar question than H. W. Wiley, chemist of the Department of Agriculture, calls beet-growing "the salvation of American agriculture."

THE CASH PROCEEDS TO THE COMMUNITY.

The greatest difficulty experienced by the farmers in every part of the country where the new industry is being inaugurated, is to find enough workmen during the busy season to thin and weed the beets. In Europe this question is solved by the cheap labor of women, and to some extent the same class of help is employed in the fields around Bay City, women of foreign birth being hired from the cities of Saginaw and Bay City. Boys are also largely employed at wages as high as $1 a day and dinner. (In Nebraska single families have made $160 or more a month working in the beet fields.) All this has tended to make the poorer classes of the two towns exceedingly prosperous. Indeed, the beet-sugar industry is contributing wealth to the Bay City region in a manner quite unexampled, except in other neighborhoods where the new industry is equally prosperous. This year (1901) the three factories will pay in cash for beets something more than $400,000 to the farmers within a radius of 25 miles of Bay City. Certain it is that the farmers in that part of the State never before saw such a cash income as this.

THE MANUFACTURING PROCESS.

As soon as the beets are harvested, in September, the factories notify the various farmers, and a certain number of loads are brought in every day and dumped into the great reserve bins, adjoining the factory. They are weighed with great care, and a sample is taken from each load to be analyzed, payment being made on the basis of the amount of sugar which the beets contain and the percentage of its purity. All this requires an extended and intricate system of laboratory analysis and the most methodical bookkeeping, so that every farmer shall have justice done to him. Indeed,

the whole process of manufacturing sugar from beets is complex and costly.

I shall not attempt here to give a detailed description of these manufacturing processes; that would require too much space, but in brief they consist in first thoroughly cleaning the beets and then in slicing them into thin pieces, after which warm water is employed to dissolve out the sugar. The juice thus produced is clarified with lime, then concentrated, then evaporated, and finally crystallized. In about twelve hours from the time that the raw beets enter the factory to be sliced, the pure, white-grained sugar comes from the crystallizers ready to be barreled for market. In making cane-sugar, the factories on the ground usually produce only the raw sugar, and this is purchased and refined by the great sugar companies of New York and elsewhere. This work of refining at a point far distant from the place of production has enabled what is known as the "sugar trust" to control in large measure the output of fine granulated sugar. But the advent of the beet-sugar industry, with every factory producing the very best grades of white sugar directly from the beets, may play an important part in placing sugar again among those commodities the prices of which are regulated solely by the law of supply and demand. The "sugar trust," therefore, looks with small favor on the new industry.

A sugar factory requires large quantities of pure limestone for use in clarification, plenty of pure water, and coal for fuel, and the success of the factory is governed to a considerable extent by the abundance and cheapness of these three requirements. The factories of Michigan are very fortunately provided in regard to all of these particulars; coal is especially cheap, the mines being located only a few miles from the factories.

In the production of sugar there is a large by-product of molasses, some of which is saved and used for further sugar-production. Eventually, however, all this molasses will be saved, either by mixing it with the pulp to make a fine grade of cattle food, or else it will be used for producing alcohol, as in Germany. A factory with a capacity of 750 tons of beets a day, a little larger than that of the ordinary factory, but not so large as some of those in the West, will produce 80 tons of pure granulated sugar daily.

One feature of the new enterprise is the part which Amer-

ican engineers and machinists have taken in the work. One would suppose that American promoters of such a new industry would have been compelled to import all their machinery from Europe, where the business of building factories has been long established; but such is not the case. Not only has American ingenuity risen to the occasion, but the work has been done so well that our machinery is actually more effective than that in use in Europe. One factory in Michigan which was originally fitted with German machinery has had to be entirely rebuilt, with the substitution of American-made machinery at a cost exceeding $200,000.

One thing, however, the American lacks. He has not yet learned how to grow seeds of sufficiently high grade for successful beet-sugar production. Consequently, all seed must be imported at considerable expense and with great care and caution from France and Germany. One of the Bay City factories imports seed in large quantities and sells it to farmers who carry its beet-growing contracts, thereby assuring a production of beets of a high sugar value. But the American farmer will not long suffer from this difficulty, because extensive experiments are going on in various parts of the country which have for their object the production of high-grade seed.

In spite, however, of the growth of the new industry, it plays as yet only a small part in supplying the sugar-consumption of the country. I was much impressed by a remark of the owner of the Bay City factory which I visited. He said: "Last year we produced about 6,000,000 pounds of sugar. If we had produced 1,500,000 pounds more, we would have been able to supply the sugar requirements of Bay and Saginaw counties"—two counties out of a great State. Nothing could better show the vast sugar needs of the nation.—R. S. Baker in Am. Review of Reviews.

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THE USE OF OIL AS FUEL IN SUGAR FACTORIES.

[A paper by Capt. P. S. Morris, of the Standard Oil Co., read before the Louisiana Sugar Planters' Association, April 11, 1901.]

We have been requested to present, at this meeting, a paper setting forth in a brief manner principally the benefits to be derived from the use of oil as a fuel for the purpose of generating steam, and as applicable to your line of industries.

We believe, that in all other instances where oil as a fuel

has been considered, there has been no section of the country where the benefits to be derived by the consumer are more apparent than here, and we trust the facts and brief data that we present will be of benefit to you.

The practicability of the use of oil as a fuel is no more a matter of experiment, it having been thoroughly demonstrated, not only in the United States, but in Canada, Russia and other foreign countries. It is now being used by thousands of concerns, who are fortunately located near the base of supply, and its universal introduction and adoption has been limited only by the supply. If, therefore, you are assured of your supply, the only further question of importance to be considered in your case is that of economy. It might not be out of place to mention that just at the present time the different industries and railroads in California, which are not already using oil, are adopting its use as rapidly as they can change their boiler furnaces, the production there having been very materially increased.

In making a comparison, we find outside of cost of fuel alone, oil has many features making its use desirable, for instance: constancy of the fire, freedom of smoke, no deterioration of grate bars, no ashes or cinders to haul away. These beneficial features can only be appreciated and understood after a plant has been in operation for a period of time. A saving, however, that is apparent and can easily be calculated, and which is largely in favor of oil, is the cost of handling. In using oil this expense is almost entirely done away with, especially where a plant is located so that the oil can be delivered direct from tank cars or boats into the storage tank of the consumer. It does not, however, follow that the storage tank must be located close to the railroad or river bank in order to effect this saving, as the oil can be "piped," but should a plant unfortunately be so located as to make it necessary to haul the oil in tank wagons, the cost of hauling the oil is but one-half of that for hauling coal, from the fact that pound for pound, oil has about twice the heat value of coal. Furthermore, after the coal is delivered to the furnace or boiler room, the expense in handling continues. This expense, of course, is controlled by the number of boilers fired, and, as the H. P. increases, the expense follows proportionately; while on the other hand, with an oil fire the ratio of expense decreases, while the H. P. increases, it being conceded that one man can attend to a battery of 12 or more boilers.

The further economies from the use of oil as a fuel depend somewhat upon the type and manner in which the oil burning device or equipment is installed, and the efficiency can be measured between one of modern type, and a primitive one relatively the same, as the modern way of firing coal with automatic stokers is to hand firing. It will, therefore, be seen that while a primitive or so-called make-shift plant, such as feeding by gravity, would reduce the initial expense, in a very short time you would suffer a far greater loss in its operation than the difference in cost due to adopting the very best system.

Knowing no doubt as you do, what the evaporative quality is of the various coals you are using, the comparisons of oil against coal as to heat values, are matters that each individual consumer can determine by taking as a basis that one pound of oil will evaporate 15 pounds of water "at and from" 212. For example—if one ton of coal will evaporate into steam under careful hand firing at the rate of 8½ pounds of water to 1 pound of coal, 1 ton or 2,000 pounds of coal will evaporate 17,000 pounds of water, and as it has been demonstrated by practice that 1 pound of fuel oil will evaporate 15 pounds of water, therefore, 1,166 pounds of fuel oil will do the same work as 2,000 pounds of coal, and as the Beaumont crude oil weighs about 7½ pounds to the gallon, and assuming that it has the same heat producing value as fuel oil, 1,166 pounds of crude oil is equivalent to 155.4 gals. or 3.69 barrels, which amount it would take to equal 1 ton of coal on the above basis.

A tank of from 12,000 to 15,000 gallons capacity, which will have sufficient capacity for plants from 100 to 600 H. P. will cost about $400 f. o. b. cars Chicago or Cleveland. The steel should not be less than ¼" for the shell and heads with screw cover manhole on top, and fitted with flanges for pipe connections and vents.

Consists of one or two pumps, specially fitted for oil, mounted upon cast iron base and drip pans, connected to storage tank and a small receiving tank into which the oil is discharged, filtered and heated and subsequently delivered through an inside pipe to the burners, under such pressure as the requirements necessitate. A system with 2 pumps is recommended, as the pumps can be used alternately and always kept in repair. A system of this description will cost from $400 to $600, and will have sufficient pumping capacity for plants up to 2,000 H. P.

This cost depends largely upon local conditions as to labor and supplies—fire brick being the principal material entering into the construction. In the North the cost averages $150 per boiler. While the different types of boilers require some slight changes in the form of furnace alterations, yet they all lead up to the same feature. It consists of a series of air flues in the ash pit for the purpose of heating the air before it reaches the furnace or combustion chamber. The air passes through and is regulated by the ash pit doors, and as perfect combustion depends largely upon the proper amount and quality of air introduced into the furnace at the right place, you will appreciate the importance of these flues. In addition to the flues a baffle wall, constructed of fire brick checkerwork, is placed in the furnace in front of the existing bridge wall to diffuse and break up the flame, which prevents the heat from localizing.

They are commonly known as oil burners and can be purchased for from $10 to $25 each. There are any number of different makes on the market, and good judgment should be exercised in your selection, as some are not worth the name and merely inject but do not pulverize. The quantity required depends upon the number of boilers to be equipped; as a rule, one burner is introduced for each 125 or less H. P. The atomizing agencies used are compressed air at high or low pressure and dry steam. The high pressure air is produced by means of an air compressor, and the low pressure by means of a positive blast blower. Of the three atomizing agencies, we consider steam the best for boiler fires, as it is always at hand in a steam plant and you are not dependent upon any auxiliary machinery to furnish atomizing power; its expansive energy vaporizes the oil speedily and thoroughly.

Unloading-suction and feed lines should be placed under ground wherever possible, and all branch lines provided with shut-off valves as well as the pipes rising to the burners. Where pipe is exposed it should be protected in a way that will least subject it to injury. The cost must be figured according to the quantity and size used.

Having set forth the various advantages, economies, relative heat values, and probable cost of equipment, not from a theoretical standpoint, but from actual practice and experience, we believe all the essential points have been covered, so that you can determine with intelligence, after knowing what the price of oil is, whether it will warrant its adoption.

Sight, however, should not be lost of the economies and advantages oil has over coal, which entitles it to consideration, even if the cost of the two fuels was alike at point of delivery.—Sugar Planters' Jour.

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THE NEGRO IN THE MILLS.

* * * The relative value of the mixed blood has given me a great deal of thought, and I have observed it for years. As a general rule, I would say that the mulatto is more intelligent and less reliable, and the black negro less intelligent and more trustworthy. The best class of negroes, however, that I have ever seen for reliableness and intelligence combined are the copper colored negroes.

I am changing my mind very much as to the value of educating the negro, starting out with the belief that an educated man or woman is far superior to one with equal capacity uneducated; I have about concluded, so far as the negro is concerned, that a lady expressed the true philosophy in speaking of educating the negro when she said that every one of them that you educate beyond the point of being able to read their Bibles and to write their accounts you utterly unfit for their mission in this world, and change a satisfied and helpful citizen into a worthless and frequently criminal encumbrance.

The most serious want that the South will feel in the next ten or fifteen years, if cotton manufacturing increases the world over as it is doing at the present time, will be hands to cultivate the crops. In the last ten years the cotton crop has increased probably 50 per cent., and we are making now an average of about ten million bales per year, and the world is consuming fully that much cotton. Our population has not increased in that period more than 20 per cent. We are now cultivating all the land in cotton that the South has labor for, and altho we have sufficient area to produce one hundred million bales of cotton, we cannot do it until we get more labor that is willing to work hard and live very economically. You can see, therefore, why it is not to the interest of the South, or any other people depending on the South's cotton, for the negro to be taken from the cotton fields and put into the mills.

Another reason why I do not think the negro should be put in the mills is that this industry furnishes almost the only refuge for the laboring white people of the South from

the strong competition of cheap negro labor; on the farms, in the cotton gins and oil mills the negro fills practically every place except the boss's. The poor white man in the South with a family dependent on him finds it very hard to pay rent on land and buy supplies on credit and compete with the negro in raising cotton. That was one of the greatest hardships during slavery, for the white man either owned or controlled negro slaves, or came in direct competition with them in labor. One can readily understand, therefore, that this class of people have found great relief by going into the cotton mills, where they not only receive better wages than they could make on the farms, but secure better school and church facilities, and are freed from the hateful competition. There is a very strong antipathy between that class and the negro, which is natural, and tho it may be only a prejudice it is unconquerable. A man may be poor enough to be forced to work his family in the fields alongside of the negro, but nothing but dire necessity makes him do it; and he would resent most bitterly any intrusion of the negro in the cotton mill work, which he now regards as his own. It is all right where men alone work, in the mines, at masonry and all kinds of hard labor, to mix the races, but it is wrong to work negroes in association with white women and children.—James L. Orr in N. Y. Independent.

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The imports of free and dutiable sugar into the United States for the year 1900 were 3,757,029,255 pounds, valued at $91,742,493. Continental Europe furnished 27 per cent of the total; the West Indies and South and Central America, 39 per cent; Hawaiian and Philippine Islands, little over 6 per cent; Chinese Empire, 23 per cent; all other countries, 5 per cent. The exports of refined sugar were 14,510,859 pounds, and of raw sugar, 3,577,489 pounds.

We have received the Report of Sugar Cane Experiments in the Leeward Islands during the season 1899-1900. In Antigua experiments were conducted with seedling and other canes, thirteen varieties in all, five of these being closely allied to the white Transparent type, the others D 95, D 102, D 115, D 116 and B 109 and B 147. The latter does not appear to suit the Antigua soil quite as well as it does that of Barbados, but it gave the largest yield of juice per ton of cane. It is difficult to establish a comparison with the results obtained elsewhere, as it is evident that certain sorts suit certain islands and localities better than others. The tables are voluminous, and they can only be satisfactorily summarized by an expert. Mr. Francis Watts, F.I.C., F.C.S., is the Chemist in charge of these experiments.—Int. Sugar Journal.

HONOLULU STOCK AND BOND EXCHANGE, JUNE 20, 1901.

STOCK	Capital Authorized	Shares Issued	Capital Paid up	Par Value	Last Sale
MERCANTILE					
C. Brewer & Co	$ 1,000,000	10,000	$ 1,000,000	$ 100	415
N. S. Sachs' Dry G'ds Co. L'd.	60,000	600	.....	100	100
L. B. Kerr & Co, Ltd	200,000	4,000	.....	50	.....
SUGAR					
Ewa Plantation Company	5,000,000	250,000	5,000,000	20	27½
Hamoa Plantation Company	175,000	1,750	175,000	100	.....
Hawaiian Agricultural Co	1,000,000	10,000	1,000,000	100	300
Hawaiian Com'l & Sugar Co.	10,000,000	100,000	2,312,750	100	80
Hawaiian Sugar Company	2,000,000	100,000	2,000,000	20	40½
Honomu Sugar Company	750,000	7,500	750,000	100	172½
Honokaa Sugar Company	2,000,000	100,000	2,000,000	20	33¼
Haiku Sugar Company	500,000	5,000	500,000	100	.....
Kahuku Plantation Company	500,000	25,000	500,000	20	25½
Kihei Plant. Co. Ltd,	2,500,000	50,000	2,500,000	50	11½
Kipahulu Sugar Company	160,000	1,600	160,000	100	.....
Koloa Sugar Company	300,000	3,000	300,000	100	150
Kona Sugar Company	500,000	5,000	500,000	100	.....
McBryde Sug. Co. L'd. Assess	1,850,000	.....	1,036,000	20	7
McBryde Sug. Co. Ltd. Pd up	1,650,000	.....	1,650,000	20	11
Nahiku Sug. Co. Ltd. Assess.	675,000	33 750	.....	20	.....
Nahiku Sug. Co. Ltd. Pd. up	75,000	3,750	.....	20	.....
Oahu Sugar Co	3,600,000	36,000	3,600,000	100	140
Onomea Sugar Co	1,000,000	50,000	1,000,000	20	30
Ookala Sugar Plantation Co.	500,000	25,000	500,000	20	16
Olaa Sugar Co. Ltd., Assess.	2,500,000	125,000	865,000	20	4
Olaa Sugar Co. Ltd., Paid up	2,500,000	125,000	2,500,000	20	14½
Olowalu Company	150,000	1,500	150,000	100	.....
Paauhau Sug. Plantation Co.	5,000,000	100,000	5,000,000	50	.....
Pacific Sugar Mill	500,000	5,000	500,000	100	.....
Paia Plantation Company	750,000	7,500	750,000	100	250
Pepeekeo Sugar Company	750,000	7,500	750,000	100	.....
Pioneer Mill Company	2,250,000	22,500	2,250,000	100	102
Waialua Agricultural Co	4,500,000	45,000	4,500,000	100	100
Wailuku Sugar Company	700,000	7,000	700,000	100	370
Waimanalo Sugar Company	250,000	250,000	250,000	100	155
Waimea Mill Company	125,000	125,000	125,000	100	90
MISCELLANEOUS					
Wilder Steamship Company	500,000	5,000	500,000	100	100
Inter-Island Steam Nav. Co.	600,000	6,000	600,000	100	100
Hawaiian Electric Company.	300,000	3,000	300,000	100	110
Honolulu R. T. & Land Co	250,000	2,500	250,000	100	.....
Mutual Telephone Company	150,000	13,900	139,000	10	9⅝
Oahu Railway & Land Co	4,000,000	40,000	4,000,000	100	105
People's Ice & Refrig. Co	150,000	1,500	150,000	100	85
BANKS					
First National Bank	500,000	5,000	500,000	100	.....
First Am. Sav. B. & Trust Co.	250,000	2,500	250,000	100	.....
BONDS	Amt. of Issue				
Hawaiian Govt. 5 per cent	1,251,200	Dec. 31, 1900	.....	.....	92½
Hilo Railroad Co., 6 per cent	450,000	.....	.....	.....	100
Hilo R. R. Co., 6 per cent	150.000	.....	.....	.....	.....
Hono. R. T. & L. Co, 6 p. c.	300,000	.....	.....	.....	.....
Ewa Plantation 6 per cent	500,000	.....	.....	.....	100
Oahu Railway & L'd Co 6 p. c	2,000,000	.....	.....	.....	104
Oahu Plantation 6 per cent	750,000	.....	.....	.....	.....
Olaa Plantation 6 per cent	1,250 000	.....	.....	.....	.....
Waialua Agr. 6 per cent	1,000,000	.....	.....	.....	.....