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PLANTERS' LABOR AND SUPPLY COMPANY,

INCORPORATED MARCH, 1882.

OFFICE—HONOLULU, HAWAIIAN ISLANDS.

ANNUAL MEETING IN OCTOBER OF EACH YEAR.

EDITORIAL AND GENERAL.

The Inspector-General of Immigrants has been visiting the plantations on Hawaii.

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Mr. Shaefer, of the firm of Schaefer & Co., returned to Honolulu September 2nd, after visiting his home in Germany.

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The *Queenslander* copied in full the article published in the PLANTERS' MONTHLY relative to "Young's Automatic Cleaner."

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Mr. P. C. Jones returned from California by the Zealandia September 2nd. Mr. T. Rain Walker, Acting British Vice-Consul, was also a passenger.

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A visitor to the Queensland plantations speaks of the "Lahaina" cane at Messrs. Oram Brother's plantation, near Maryborough, and remarks upon its juice qualities.

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Mr. J. B. Atherton, of the firm of Castle & Cooke, has been made a Privy Councillor, and takes a seat at the Board of Immigration. The appointment gives universal satisfaction.

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The volcano is very active just at present. Visitors give enthusiastic reports of the scene in the crater. Professor Dana, who has recently made the trip, reports himself thoroughly pleased with what he saw.

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Slavery will come to an end in Brazil in the year 1,900, but many owners of slaves are already liberating their men on condition of working from three to five years. Another blot wiped from the record of mankind.

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Last year proved a very depressed one in the Phillippine Islands. The value of hemp exported fell off nearly half a million dollars, and sugar fell off one-tenth compared with the export figures of the previous year.

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The Hon. H. M. Whitney, Editor of the PLANTERS' MONTHLY, left Saturday, September 3rd, in the Sarah S. Ridgeway for Port Townsend. Mr. Whitney goes in search of health, and we heartily hope he will return improved.

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Hon. S. G. Wilder has not been successful in negotiating his loan for the Hilo Railroad, but hopes are entertained that when the news of a settled Government in Hawaii arrives in England he will find no difficulty in obtaining what he wants.

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A number of articles have recently been copied from the PLANTERS' MONTHLY by papers abroad, and in many cases no credit is given—this is especially noticeable in Australia. Take all you want, gentlemen, but let people know where you get it from.

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The cultivation of the sugar cane in the Island of Madeira, Consul Pauncefate reports, has completely ceased in consequence of the destruction of the plantations by the disease which attacked the plants, and the sugar factories have ceased to work.

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Colonel Spalding, of Kealia, Kauai, celebrated his 50th birthday, September 2nd. There were grand doings at the plantation. The Colonel was the recipient of a handsome gold watch from the officers of the Makee Sugar Company, and other presents from the employees. Between 1,200 and 1,400 people sat down to a sumptuous dinner, and in the evening there was a display of fireworks.

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Cocoanut refuse is thus alluded to in an article in *Forestry* on the "Resuscitation of Choice Trees by Top-dressing:" "Failing loam, the next best top-dresser is, on the whole, cocofibre refuse. It is less feeding, and perhaps almost more conservative alike of heat and moisture, also free from offensive odor, decomposes very slowly, and finally forms a fine mould of which the roots of all trees seem specially fond."

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A writer in the *Spectator* says that in Venezuela, where men no more think of shoeing their horses than of "nicking" their tails or "hogging" their manes, he has ridden horses over 30 years old as clean-limbed as on the day they were foaled. And these horses travel over all sorts of ground, rough and smooth, hard and soft; they are as nimble as cats, never fall, and, save as the result of accident, never go lame.

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The *Straits Times* says:—"The abolition of the Government tobacco monopoly in the Phillippines has taken effect unfavorably not only on cigars, but also on leaf tobacco exported. Four years have passed away since that measure came into force. However beneficial the reform may prove to be in after years, tobacco as raw material or as cigars, still falls short of the mark reached in monopoly times, both in yield and quality." This accounts for the bad cigars smokers are now poisoned with on these islands.

The *Queenslander*, commenting upon the tree planting in these islands, says it is glad to see that Australian varieties have been extensively experimented with, "for certainly no forest growth is so suitable for the purpose aimed at, inasmuch as once get them established it will probably prove, as in the case of the coast districts of Queensland, almost impossible ever again to denude the hills." A visit to the plantation behind the Lunalilo Home may prove interesting to anyone who wishes to confirm the opinion of the *Queenslander*.

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The Colonial Sugar Refining Company of Sydney, and the Victoria Sugar Company of Melbourne, amalgamated July 1st. The former company was formed in 1854, the latter in 1856. Until this year the two companies have been carried on as separate undertakings on mutually friendly terms, but the changes which have recently taken place in the sugar market have shown the desirability of closer union, and the present amalgamation is the result. The name of the Colonial Sugar Refining Company, as having the larger and older business, is retained.

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Sugar Cane says: "The increase of specie in the United States Treasury since 1881 is very remarkable. It is as follows:

	GOLD.	SILVER.	TOTAL.
May 1, 1887	£55,067,000	£48,563,000	£103,630,000
January 1, 1887	53,620,000	43,800,000	97,420,000
January 1, 1886	50,670,000	39,460,000	90,130,000
January 1, 1885	47,000,000	36,080,000	83,080,000
January 1, 1884	43,803,000	30,240,000	74,043,000
January 1, 1883	34,301,000	25,000,000	59,361,000
January 1, 1882	34,523,000	19,800,000	54,323,000
January 1, 1881	31,340,000	15,800,000	47,140,000

It will be seen that whilst the growth of the silver has been more rapid than that of gold, yet the gold alone exceeds by nearly £8,000,000 the gold and silver combined on January 1, 1881."

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Mr. A. Notley, writing about his new plow in the *Hawaiian Gazette*, says:—"This plow consists of three plows, so arranged that the whole space between the cane-rows is turned over by passing once in the row; the two outside plows throw a light coating of soil on the stools and center plow, which is a double mould-board, throws the soil toward the cane-rows, thus slightly hilling the row. From three to four animals are required to draw it, and, in good ground, it will plow ten acres a day, one man being sufficient to drive and tend the plow. This plow is now in successful operation on the Hamakua Plantation, Hawaii, and can be seen by anyone so desiring. I feel satisfied that the planters have only to know the merits of this implement to adopt it."

The Hana Plantation was sold at public auction at the main entrance of Aliiolani Hale on Monday, September 5th, for the sum of $103,000. Messrs. Grinbaum & Co. were the purchasers.

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Whoever wishes to see a real model form should get permission from Mr. Henry Macfarlane to visit Ahuimanu. The farm buildings are commodious, the dairy a model of neatness and cleanliness, and the stock admirably selected and in excellent condition. It is a treat to see farming done in such style on the Hawaiian Islands.

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HEMP.

Though our minds are chiefly set on sugar, yet with the many clouds which are constantly appearing on the horizon of the planter, it is absolutely necessary that we should give close attention to any product which we think can be made profitable. A few months ago in the PLANTERS' MONTHLY we drew attention, among other things, to hemp, and since writing have come across a considerable amount of information upon the subject. The report of Mr. Stoddard to the Government of Jamaica says that the Sisal or Aluequen hemp is produced in Yucatan from the *ayaue regida* or *sacqui*, as it is locally known. The land which supports the fibre industry in Yucatan is of a gravelly, stony, and in some places of a rocky character. The plants thrive best and yield the largest amount of fibre in comparatively arid districts, only a few feet above the level of the sea. Moist land or rich land is considered unsuitable, for although the plants will grow in the latter, the quantity of fibre yielded under such circumstances is comparatively small. Shade is a disadvantage. Plants are generally set out at twelve feet by six feet in holes proportionate to their size. After planting, the chief cultural operations are confined to keeping the fields clear of weeds, and removing suckers which grow round the parent plants. These latter are utilized by being planted in nurseries, or are thrown away. Any appearance of the pole or flowering spike is watched, and when three or four feet high it is cut out, otherwise the usefulness of the plants for fibre purposes would cease.

The lenrth of leaves cut for fibre should not be less than 3 feet; their ripeness is judged by the color and by their position in the rosette. Consequently the outer leaves are always cut first, being the oldest. The harvesting of the leaves, which goes on all the year after once started, is effected in the following manner: Men armed with suitable knives select ripe leaves, cut them close to the trunk, remove prickles from the edge. and make them up into bundles of 30 each. Thirty such bundles is a day's task. These are then carted to the works. Cutters, carters and machinists are paid so much per 1,000 leaves.

The power of the engine and the number of machines required all depend on the size of the plantation. One fibre machine is stated to be required for every hundred acres of plants.

After the fibre has passed through the machine it is placed on a drying stand fully exposed to the sun and thoroughly dried. If it is desired to bleach the fibre to a high degree of whiteness it is left out all night and during the next day, and carefully turned. The fibre is made up into bales by means of a screw or hydraulic press ; care being taken to keep the fibre straight and prevent "fringes."

Each plant when matured yields 30 to 35 leaves per annum, and the return of hemp is at the rate of 1,000 to 1,200 pounds per acre, or about half a ton per acre per annum. The net return on a fibre plantation in Yucatan is estimated at between $20 and $25 per acre.

We would suggest to the owners of land in Kona, Hawaii, to take a look into this subject and see if something cannot be done in hemp there. The peculiarity of Yucatan is the absence of running streams, and Kona, Hawaii, has the same sterility.

Turning to Mauritius we learn that hemp fibre is obtained there from the *Furcræa gigantea* or *aloes vert*. This plant requires no cultivation ; it was introduced into the Island from South America about 1790. It has evidently found a congenial home there, for without any effort on the part of man it has covered waste lands and abandoned sugar estates to such an extent as to lay the foundation of a considerable fibre industry. The leaves are often 8 feet in length and from 6 to 7 inches in breadth. The pulp of the leaves when crushed gives off a strong pungent odor, and hence this species is sometimes called the *fœtid aloe*. The juice strongly corrosive and soon acts upon wrought iron; it is said to produce less effect on cast iron, while it is practically inoperative on brass and copper.

The plant grows in all soils and up to an elevation of 1,800 feet above the level of the sea. It has, however, more generally disseminated itself on the lowlands near the coast, and on a few of the abandoned sugar estates that have become too dry for sugar cultivation.

The same plant has been introduced into St. Helena and has been cultivated with satisfactory results.

Yet another fibre plant which has been tried in Jamaica is the *Farcræa cubensis*, or silk grass. This yields a hemp equal to, and some experiments better than the Sisal hemp,

Experiments with these plants not only *might* but *ought* to be made here. It will not do for us to sit down with our hands folded and wait till the California beet sugar scheme effectually cuts our throats. We recommend the consideration of this subject to the next meeting of the members of the Planters' Labor and Supply Company.

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THE COMING MEETING.

In October will meet in Honolulu the members of the Planters' Labor and Supply Company, and the various committees will bring in their reports. This meeting is one in which all classes of the country take the greatest interest, for the information given and the discussions raised do not bear solely on matters of interest to the sugar planter, but take a wider field and open up lines of thought for every agriculturalist, and even give very solid ideas to the politician. We have heard sound political doctrine talked among the planters at their meetings long before the general public cared to express itself decidedly upon the matter.

The Committee on Labor ought to furnish a valuable report, and make suggestions that will assist in elucidating the question. Now that the government is being conducted for the people, and by the people, there will be some chance for the introduction of labor being carried on on sound principles, and not on those of jobbing which have obtained in the past. Some means should be resorted to to get the Chinese resident in the country to work. There are large numbers of Chinese who are supported in idleness by the workers in order to keep up the price of labor. This subject would naturally come under the supervision of the Committee on Legislation. With a House constituted, as the next one will be, there will be no difficulty for the Planters' Labor and Supply Company getting a hearing, and having some attention paid to its suggestions. In the past it was only necessary for the Government to know that a suggestion emanated from the workers of the community and those interested in the national prosperity to have it pooh-poohed aside; but those days have gone forever. Another point that the Legislative Committee will, doubtless, consider is the valuation of growing crops, over which there has been some injustice in the past.

Methods of cultivation should bring an interesting report. Much attention has been paid to the matter during the past year, and considerable information upon the soils of the various sugar estates has been collected. These analyses have been published from time to time in the PLANTERS' MONTHLY, together with information on the same point from experiments made in Louisiana. Much detail, however, which would be interesting to planters has not been put forth, and a great deal of valuable information has yet to be made public.

Machinery and the manufacture of sugar must also call forth information of a highly useful and interesting character. There has been so much attention given to these matters all over the world, and our planters have given such close attention to the many improvements and new methods which have been put forward that the committees will really suffer from an *embarras de richesse.* There will be so much to say, and so many things to talk about that a very large portion of the time of the meeting will undoubtedly be taken up by these subjects.

Forestry is another subject upon which much can be said, It has passed from the domain of theory into actual practice. and the actual value of various forest trees should now be pretty accurately known. Information of this kind will be extremely valuable to the owners of estates whose sole dependence is at present upon sugar, but who have large tracts of land which might be utilized for other purposes, and bare hill sides that certainly need to be clothed with forest.

Fruit culture is a growing industry among us, and will continue to increase in importance, especially if the Hilo railroad is built, when large quantities of land will be opened up suitable for cultivation of many varieties of fruit, and a direct communication with the San Francisco market established.

Last, but not least, in interest and importance will be the report upon live stock. It is a very hopeful sign that so much interest is manifested in stock. Some years ago the number of men who took an interest in such matters might have been counted on the fingers of one hand; now that number has been multiplied many times, and the herds of various animals on the Hawaiian Islands have been very much improved.

All these points to a very interesting and instructive meeting. The best thought and the best workers of the Islands will be present together, and good, common sense views will be expressed. Nothing can be better for the planters and millowners than this yearly meeting. There is an interchange of thought and practical ideas by word of mouth which no amount of mere writing can facilitate. The road is clear before the planter; the government of the country is on a solid basis; economy is the watchword of the Administration, and yet money is to be spent where needed upon improved roads, upon landings, and the general facilities which the planter requires as a return for the taxes he pays. With intelligence and skill to get the most out of his cane at the cheapest rate, in spite of the dull sugar market the Hawaiian planter will succeed.

We have sketched faintly what may be expected at the coming meeting of the Planters' Labor and Supply Company, and we have no doubt that the practical results and lessons taught will far exceed those of any previous meeting.

THE ENGLISH SUGAR-GROWING COLONIES.

British Guiana is exercised over the sugar question, and the *Colonies and India* have some remarks to make on the subject. These have not a direct bearing upon our industry here, but at the same time our planters should be thoroughly acquainted with the opinions, hopes and measures of their fellow planters throughout the world. The *Colonies and India* says:

"The future of sugar remains a matter for anxious consideration. An article which is eaten by all the world and his wife, and the consumption of which must increase with the growing population of all countries, should have no fear as to its position. But at least half the total supply is placed in jeopardy by the artificial stimulus of State bounties given to the other half, and this latter half feels its position so precarious, and has increased unnecessarily its production to such an extent that beet sugar, even with the advantage of the bounty, cannot but be unremunerative. At the same time, the unsubsidized industry must be the first to go, and the continental grower and manufacturer will then be amply compensated for any losses in the past. Now, there are two points for the sugar-growing Colonies to consider. First, whether Government aid might not be given to the sugar industry; and secondly, whether this aid might not be given in connection with the obtaining of fresh and improved machinery for the expression of the juice and its subsequent manufacture into sugar. The Combined Court of British Guiana has just spoken with no uncertain sound on this matter. The first proposition is that it is necessary for the welfare of the Colony that the sugar industry should be supported by the Government. This is not by any means a novel view to take, but it is one, in present circumstances, of much significance and force. The whole population of the Colony is dependent upon the sugar industry, and should that fail in any way the Government will have a serious problem to solve, and will have incurred an enormous responsibility.

In Colonies not so entirely dependent upon sugar the Government has frequently come forward to assist in the maintenance of the principal industry. But in British Guiana itself the whole principle of public assistance is admitted in the fact that the general revenue contributes one-third of the cost of immigration. In St. Lucia large sums have been actually advanced by Government for a central factory. In Barbadoes the money for a scheme of similar character could no doubt be easily raised under a Colonial Government guarantee. In British Guiana, where the estates are so large that each one is practically a central factory in itself, the demand is for new processes and improved machinery. This the planters "are unable to procure on the most favorable terms from the want of ready money."

The truth of this is undeniable. The recent large failures in Trinidad and Barbadoes, the smaller ones at home which have followed, the published reports of public companies connected with sugar estates, all emphasise the situation and bear witness to the drain of capital which has been caused by a long spell of very low prices. The Combined Court have therefore passed a resolution in favor of the advance of money to owners of sugar estates on loan, for the purchase of machinery. This practical proposal has now been laid before the Secretary of State, and it deserves the most favorable consideration.

At the present time such a scheme is particularly opportune, because the new diffusion process promises to revolutionize in some degree the existing system of manufacturing sugar. As the adoption of this, however, would render the present plant to a large extent useless, and would itself be of the nature of a costly experiment, owners of estates may well shrink from such a scheme without aid being given to them upon grounds of public interest. Mr. Quentin Hogg is the pioneer in this important matter, and much depends upon the results of his experiments, which are either now in progress or in an advanced state of preparation. To try the scheme throughout the Colony would cost a large sum, which could not be easily raised by individual planters. But it must be some time before any general adoption of it can take place. What is wanted first is sufficient proof that diffusion can be used, balancing its drawbacks (such as the uselessness of the megass for fuel) with its advantages, on a large commercial scale. The process has been successful with beetroot, but the different form and more fibrous character of the cane have presented difficulties. Some canes, very excellently sliced, however, have recently been seen in London, and, this initial difficulty being removed, the remainder of the process becomes comparatively easy.

Now the introduction of this new process, which promises to obtain a larger yield of juice from the cane, to economise labor, to make the cane industry fully up to the scientific level of the beet, is one that eminently deserves the support of the public revenue. The interests at stake, which concern nothing less than the whole future of the Colony, demand an effort which is justified by precedent, by past experience, and especially by present circumstances. The cane, according to recent statistics, shows signs of being outstripped by the beet. Out of a total production of 4,821,000 tons, beet contributes 2,657,000 and cane only 2,163,500 for the crop of 1886–7. This is probably the first time that such a relative position has been disclosed.

CORRESPONDENCE AND SELECTIONS.

THE CHEMISTRY OF PLANTS AND SOME OF ITS APPLICATIONS.

BY PROFESSOR VAN SLYKE, OF OAHU COLLEGE.

V. *The Relations of the Atmosphere to Plants.* (*Continued.*)

Having in the previous number considered the relations of the four principal constituents of the atmosphere to vegetation, we will now give our attention to some substances which, although they occur in the air in exceedingly minute quantities, are nevertheless of great value on account of their influence upon plant life.

Of these substances the most important for our study is *Ammonia.* Its chemical composition is expressed by the formula NH_3. In a pure state it is a colorless, invisible gas, having a peculiarly pungent odor and an acrid taste. Ammonia gas is remarkable for its extreme solubility in water. At freezing point water absorbs 1150 times its bulk of ammonia. The *aqua ammonia,* or *spirits of hartshorn* of commerce, is a solution of ammonia gas in water.

Ammonia is formed most readily and abundantly by the decay or dry distillation of organic bodies containing nitrogen. It is generally found in the exhalations of volcanoes. Urine contains ammonia in combination, which is set free by decomposition, and can readily be recognized by the odor.

The ammonia of commerce is mostly obtained from the distillation of bituminous coal in the manufacture of illuminating gas.

Ammonia gas may, in the presence of water, combine with carbon dioxide and form ammonium carbonate, as follows:

Ammonia.		Carbon dioxide.		Water.		Ammonium carbonate.
$2\,NH_3$	$+$	CO_2	$+$	H_2O	$=$	$(NH_4)_2\,CO_3$

In a similar manner ammonia combines with different acids, forming various ammonium compounds, as follows:

Ammonia.		Sulphuric Acid.		Ammonium Sulphate.
$2\,NH_3$	$+$	$H_2\,SO_4$	$=$	$(NH_4)_2\,SO_4$;
Ammonia.		Nitric Acid.		Ammonium Nitrate.
NH_3	$+$	HNO_3	$=$	$NH_4\,NO_3$;
Ammonia.		Hydrochloric Acid.		Ammonium Chloride.
NH_3	$+$	$H\,Cl$.	$=$	$NH_4\,Cl$.

In the atmosphere the ammonia occurs mainly in combination with carbon dioxide as ammonium carbonate. Ammonium carbonate occurs in commerce as "salts of hartshorn," "smelling salts," or "sal volatile." Like camphor, it passes at ordinary temperatures directly from the solid state to that of invisible vapor, without passing through the intermediate liquid form. Ammonium carbonate is sometimes found in guano beds in the form of large transparent crystals.

The quantity of ammonia in the air is very minute and very variable. The average amount may be put down as about one part in fifty million parts of air. The country air contains less than that of cities.

It is satisfactorily established that ammonia in its combinations is an important plant food. Used as a fertilizer it produces very telling results. The improving effect of watering potted plants with very diluted solutions of ammonia is well known.

Ammonia is taken into plants mainly through the leaves, though probably through the medium of the soil. The absorption of ammonia by foliage does not seem in any way to be affected by the presence or absence of sunlight. When taken into plants the ammonia goes chiefly to the production of albuminoid or nitrogen-containing compounds; and the nutritive value of ammonia compounds used as fertilizers is measured by the amount of nitrogen which plants assimilate from them.

The influence of ammonia on vegetation is shown by at least three striking effects. First, the growth of stems and leaves is greatly promoted, while that of buds and flowers is retarded. Ordinarily most plants, at a certain period of growth, cease to produce new branches and foliage, or to increase those already formed, and commence to produce flowers and fruit, whereby the species may be perpetuated. If, now, a plant is provided with as much ammonia as it can use just at the time it begins to flower, the formation of flowers may be checked while the activity of growth is transferred back to and renewed in stems and leaves, which take on a new vigor and multiply with remarkable luxuriance. Should flowers be produced under these circumstances, they are sterile and produce no seed. The second effect is to deepen the color of the foliage, which is a sign of increased vegetative activity and health. The third effect is to increase the relative proportion of nitrogen in a very marked degree.

The ammonia of the atmosphere does not seem to be absorbed readily by the foliage of plants, when they are not exposed to the dew and rain. In a heavy rainfall the ammonia is taken up by the rain and brought down to the earth in the immediate vicinity of vegetation. The amount of ammonia distributed through the air would be largely useless were it not gathered and brought to the plant in this way. The amount of ammonia in rain-water has been the subject of numerous investigations, and, while it varies greatly, is always quite significant. The quantity in rain-water in the country ranges from one to thirty-three parts of ammonia in ten million parts of water. In the rain of manufacturing towns and large cities, the amount is very much greater. The water falling during the first part of a shower contains more ammonia than that falling later; hence, in a long continued rain, the water falling last may be quite free from ammonia, while in the rain of brief showers, and also in dews and fogs, the proportion of ammonia is apt be very large. The amount of ammonia is also greater where rains occur at greater intervals. The quantity of ammonia brought to the earth in rain-water may amount to ten or twelve pounds per acre in a year.

Ozone is another constituent of the atmosphere existing in very small quantities but performing some highly important functions in the vegetable economy. Ozone is nothing more or less than condensed oxygen and, as such, is peculiarly energetic. It is of great importance in agricultural science, although its precise office is not yet understood as thoroughly as could be desired.

Ozone may be produced in several ways. One of the most common forms of its production is by electricity. When lightning strikes the earth or an object on its surface, a peculiar odor, generally described as "sulphurous," may be noticed in the immediate vicinity. The same odor is noticeable near an electric machine which has been working vigorously for some time. This odor is due to the formation of ozone, the name being derived from a Greek word meaning to smell.

Ozone is a colorless gas, not at all soluble in water. It has an irritating action on the lungs, producing coughing. Small animals quickly die in an atmosphere impregnated with it. It is readily decomposed by a moderate degree of heat, forming from its decomposition ordinary oxygen.

The characteristic feature of ozone, which makes it interesting in connection with plant life, is its *oxidizing power*, by which is meant the ability to yield up oxygen to other substances having a strong affinity for oxygen. Ozone posesses this power of uniting with other substances to a much greater degree than oxygen in its ordinary form, but the presence of water is necessary to its action.

Besides being produced by electrical action, ozone is formed by chemical action. Ether and alcohol, if kept in partially filled bottles in the sunlight, produce ozone; oil of turpentine, oil of lemon, and many others act in the same way. Though the question can hardly be considered as settled, there is reason to believe that vegetation itself is a producer of ozone and exhales this substance, together with ordinary oxygen from the foliage, when acted on by sunlight.

Ozone is said to impart its odor to a million parts of air. The attempts that have been made to estimate ozone in air indicate one part of ozone in thirteen to sixty-five million parts of air.

The direct influence of ozone on plant life is not well understood; but, indirectly, it causes chemical changes which are of the greatest importance in supporting plant life, by converting into nutritive and assimilable conditions substances which would be of less value in other forms.

Nitrogen occurs in the atmosphere in other forms than that of ammonia, principal among which is *Nitric Acid* (HNO_3). Under certain conditions this may be changed to *Nitrous Acid* (HNO_2), to ammonia (NH_3), or to some other compound containing nitrogen. On the other hand, nitrous acid and ammonia may be converted into nitric acid. A detailed study of these changes, though important, cannot be given here, as it would require a considerable knowledge of chemistry on the part of the reader in order to be at all intelligible.

It is probable that most of the nitric acid of the atmosphere exists in combination with ammonia as ammonium nitrate (NH_4 NO_3). It is removed from the air by falling rain and carried down to the soil. The nitrates do not find their way back to the air directly by vaporization but remain in the soil or streams of water until decomposed and changed into some compound which does vaporize readily.

The effects of nitrates upon vegetation are similar to those of ammonia. Nitrates reach the plant mainly through the medium of the soil, and a fuller discussion will more properly belong to a consideration of soils.

The following tabulated statement, mostly after Johnson, will serve as an excellent summary and outline of the relations of the atmosphere to plants:

Absorbed by plants.	OXYGEN, by roots, flowers, ripening fruit, and by all growing parts.
	CARBON DIOXIDE, by foliage and green parts, but only in the light.
	AMMONIA, as *carbonate*, by foliage, at all times.
	WATER, *as liquid*, through the roots.
	NITRIC ACID, NITROUS ACID, *united to ammonia*, and dissolved by water through the roots.
	OZONE, uncertain.
	NITROGEN, in some cases.
Not absorbed by plants	NITROGEN, in many cases.
	WATER, in a state of vapor.
Exhaled by plants	OXYGEN, OZONE (?), by foliage and green parts, but only in the light.
	WATER, *as vapor*, from surface of plants at all times.
	CARBONIC ACID, from the growing parts at all times.

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The deliveries in the United Kingdom up to 23d July, show an increase of 17,533 tons as compared with the same period in 1886, and the imports an increase of 3,078 tons.

THE NEW RATTOON PLOW.

To the Editor of the Planters' Monthly:

Dear Sir: I have had another opportunity of witnessing the working of Notley's "Rattoon Plow," and as others may wish to know what I think of it, I write this for their information. The plough was drawn by four animals, and went between two rows of cane, and made four furrows, turning two furrows towards each row. Thus by going through once the row was finished and the work *well done.* I don't think the best plowman could have done better work with a common plow by passing through four times. Upon the depth of furrow and firmness of the soil depends whether the draft is hard or easy on the team. The implement being carried on wheels, the depth of the furrow is easily regulated. The right and left plows being interchangeable, the furrows can be thrown either in or out as the plowman may elect.

The principle upon which this instrument is made is good, but the material of this particular plow is rather light. I am of the opinion that to avoid the difficulty arising from irregular width of cane rows, more satisfactory work (but not so rapid) can be done with the tool by using first the two side plows, taking off the centre or double mould-board, and thus be able to stride the cane row, following either to or from the row on both sides at the same time. It performed this work most perfectly, requiring only two horses, and the horses, one on each side of the row, have ample space to work without crowding or tramping on the young cane.

For plowing out the unplowed land between the rows, remove the two side-plows and replace the centre one, then by passing between the rows once the work will be well done by turning one furrow towards each row, and in half the time it would take to do the same with a common plow.

Hamakua, Hawaii. Jno. M. Horner.

WATERING HORSES.

Horses are greater epicures in water than is general supposed, and will make a rush for some favorite spring or rivulet where water may have once proved acceptable to their palate when that of other drinking places has been rejected or scarcely touched. The groom's common maxim is to water twice a day; but there is little doubt that horses should have access to water more frequently, being, like ourselves or any other animal, liable from some cause—some slight derangement of the stomach, for instancs—to be more thirsty at one time than another. It is a well known fact that where water is easily within reach these creatures never take such a quantity at a time as unfits them for moderate work at any moment. If an arrangement for continual access to water be not convenient, horses should be watered before every feed, or at least thrice a day; the first time being in the morning, an hour before feeding (which hour will be employed in grooming the beast); and it may be observed that there is no greater aid to increasing their disposition to put up flesh than giving them as much water as they like before and after every feed. A horse should never be watered when heated, or on the eve of an extraordinary exertion. Animals which are liable to colic or gripes, or are under the effect of medicine, particularly such as an act on the alimentary canal and predispose to those affections, should get water with the chill off. Watering at public troughs or places to which every brute which travels has access, must be strictly avoided. Infectious diseases may be easily contracted in this way.—*Exchange.*

MORE ON THE BEE QUESTION.

WAX EXTRACTING.

Persons who are only acquainted with the old system of straining honey object to keep bees in consequence of the attendant messing and slopping, preferring to purchase such honey as they require; while others again there are who will undergo the disagreeable task, and having obtained the honey from the comb cast away the remainder as refuse, either because they are ignorant of its value, or because they draw the line at honey, and consider that rendering wax is not worth the trouble and time it takes. In a former article I said that in place of bee-keepers who follows the bar-frame system entering the market as wax-producers they would enter it rather as consumers, and would depend for their supplies upon those who keep bees in the old style, and upon bee-hunters, and that the tency oi the system would be to considerably increase the price rather than reduce it. Apiarians must always have a considerable supply of pure beeswax for comb foundation; and, even should the price advance to five times its present value, they will not find a substitute, for beeswax is the only substance yet discovered which possess the necessary qualities for their purpose. Comb foundation has been manufactured out of other material, but all attempts have failed, and the same result has followed when the wax has been adulterated. Pure beeswax is the only substance which is soft enough to be worked at the moderate heat of the hive, and yet tenacious enough to sustain upwards of one hundred times its own weight without stretching or bulging in the hive, much less to stand whirling around in the extractor. The expensiveness of wax production will prevent the apiarian from giving much attention to this portion of the industry; he will endeavor as far as he can to divert the labor of his workers in a more profitable direction. Yet he will often have a small piece of comb to dispose of that it would be exceedingly bad policy to leave lying about to become a harbor for moths. Drone comb will want cutting out, and the capping of the cells when extracting will accumulate, and there is no utensil handier than a properly constructed wax extractor, into which he can put them at once out of his way. But it is rather to box-hive men or bee-hunters that I would address myself, and endeavor to show them that it will be to their interest to consider what are the requirements of apiarians, and how they require these articles to be manipulated to suit their purposes. First, they require the article in all its natural purity. Adulterated wax can easily be detected, not so much by its color—it may be of various colors, and still be pure—but by both taste and smell. If any foreign matter can be detected, it will surely be rejected by them. Secondly, it must not be scorched in the slightest when rendering, or the bees will positively refuse to work upon it. Third, it should not be exposed to the weather, or it will bleach and become too hard for the bees to manipulate, and consequently for bee purposes useless. Many persons allow their wax to bleach without intending it, not being aware that it is thereby deteriorating in value. After they have strained the honey they place the refuse, before proceeding to render it, where the bees can get at it, so that the bees can gather the little honey that was left in it. It is far easier to keep bees honest than it is to cure them of the evil propensity of robbing their neighbors, and making unprovoked attacks upon unoffending passers by. They generally get their first lesson in this vice from the unwary or ignorant bee-keeper, who gives them access to honey in the open, after which they will almost immediately proceed direct to the weakest hive, and, beating down their defence, pilfer them of their stores. The result of a case of this sort came under my notice a few days ago. One of our wealthy farmers informed me that he had nine swarms which had lived peaceably enough until he brought a weak swarm home after robbing it. They fed it on honey for a few days, when the others pitched into it and killed them all. They then tackled the old hives one after the other, and destroyed each other until there was scarcely a handful left in the last hive. There is but little honey left, not sufficient to do the bees any good, but sufficient to do incalculable harm when bees have been robbed so close, or so late in the season that they cannot obtain winter supplies. They should be fed in a proper manner, and giving them access to the crushed comb is not a proper manner.

It is my place to show that messing and slopping is no necessary part of the work performed on the bee farm. Persons only acquainted with the old method of handling wax or honey are convinced that a certain amount of mess is unavoidable. I propose to show that such is not the case, more particularly with regard to wax, and that by the use of the Solar wax extractor, which is hereafter explained, so that any person may make one in a few hours at a cost of less than 5s., the rendering of wax is well worth all the trouble required. It is designed to only require the lid raised and the comb placed in the extractor, when, in a few minutes, the melted wax will run separated from all refuse into the dish placed to receive it, from which it is taken and sent to market as purified beeswax. The idea of the solar wax extractor I took from "Gleanings in Bee Culture," which appeared in December of 1885, so I suppose Mr. Green should have the credit of it. The following is his letter:

"I made myself a solar wax extractor last August while I was waiting for that honey which never came, and I would not want to do without it for several times its cost. We had very little hot weather after I got it finished, but it worked to a charm, and proved to me beyond doubt that, during ordinary summer weather, wax can be made with it in far less time, worry, and mess, than by ordinary means; and, what is more, the wax made is of the finest and most uniform quality, and there is not the slightest danger of getting it scorched or otherwise spoiling it in the making. Moreover, when making wax from cappings (which was my principal purpose in making mine) a large amount of honey is saved that would be wasted by most other methods.

"My extractor consists of a V shaped trough made of tin, 20 by 24 inches at the top and 8 inches deep, cased in a wooden box. To the top is hinged a sash, holding two sheets of glass, each the whole size of the top, separated by a three-quarter inch space. Over the whole is hinged a cover, which is lined with bright tin and a light board, 20 by 24; it is also covered with tin on one side. These tin surfaces are for reflectors.

"The comb to be melted is placed on a sheet of perforated zinc resting on the sides of the trough, about three inches below the glass and held in that position by the reflector board, which is provided with hooks for that purpose, and is placed in the angle between sash and cover. In the morning it is placed on the west side, and at noon is changed to the east side. When the extractor is not in use this board is laid on the top of the sash, and the cover is closed down over it. You will see there is a large reflecting surface throwing heat into the extractor besides that given by the direct rays of the sun, while the double glass retains the heat. Before using the reflectors, I found that on a warm day a thermometer inside registered 60 degrees higher than one outside. We shall probably use it to bake bread, roast meat, etc., next summer. You may be sure that such a temperature melts down the combs very fast. Several lots can be melted down in the course of a day. The wax and honey drip down through the perforated zinc, below which there is considerable space. When the weather is not hot the wax does not form in a solid cake, as it is shaded by the zinc. When the lower part is full take out the zinc, when the wax can be easily melted, and, if desired, kept in a melted condition all day without disturbance, thus perfectly purifying the wax. The honey is drawn off through a tube at the bottom. I am satisfied that a single sheet of glass would answer, although it should be large enough to cover the whole top, as a shadow made by a cross-bar would prevent the melting of part of the comb. It be best to have the reflectors of cheap looking-glass instead of tin, as the tin will soon tarnish and rust.

"To those who do not wish to make an extractor of this description, but who intend using the ordinary utensils for the purpose, very good wax can be produced by the following method: Get an ordinary oil drum and remove the top; cut a piece of wood circular shape to fit in the bottom to prevent burning; upon this piece of wood place the pieces of comb from which the honey has been strained until it is about three-parts full; cut a piece of perforated zinc or wire cloth to neatly fit the can; place it upon the comb; fill up with water to about three inches of the top; the top of the weight should then be below the water; place it upon a moderate fire and allow it to boil steadily for some hours, when the wax may be skimmed off as it rises or removed in a solid cake. If the wire cloth has fitted properly no impurities will get through. All the discolored wax should be again boiled in clean water, and repeated as often as may be deemed necessary."—*Melbourne Leader*.

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THE ABOLITION OF THE SUGAR BOUNTIES.

From time to time we have noticed the Sugar Bounties, and in reply to those who have urged the necessity of England's imposing retaliatory duties, it has been shown she would do nothing of the kind. We have always said that, so long as the Bounty paying countries remained insensible to the injuries the system inflicted upon themselves as well as upon other people, so long would the system be maintained; but that, when once their eyes became opened to their folly there would be a chance of some improvement taking place. It would almost appear as if they were becoming tired of growing cheap sugar for the benefit of other people, and, perhaps, a few local growers; and there is at least a prospect that, within the near future, some change will be made in the system of paying bounties, if they are not abolished altogether. It is now 20 years since some of the continental countries first began to grant bounties on the export of sugar, but it is only quite recently that the evils of that system have been severely felt. Up to 1870 the production of beet sugar was not excessive; but the industry has assumed enormous proportions since that date. In 1865 the production of beet was about 27 per cent. of the total sugar produced in the world. In 1875 it had risen to 43 per cent.; and in 1885 it was 55 per cent. of the total. We know only too well that this rapid and enormous increase has seriously affected the price of sugar, and that, during the last three years, cane sugar has been manufactured without profit, if it has not in many cases entailed serious losses upon the producers.

After the Franco-German war in 1870, the French Government, for revenue purposes, raised the duty very considerably on imported sugar. At the same time, the drawback allowed was likewise considerably increased, and the difference between the duty and the drawback left a handsome bonus for the manufacturer. This was soon felt by British refiners, and others interested in sugar, and, at their instance the Home Government remonstrated with the French Government, stating that their action was in direct contravention of the agreement entered into in 1864, by which England, France, Holland and Belgium agreed to abolish all bounties on the export of refined sugar. For three or four years a diplomatic correspondence was carried on between the countries inserested. But France continued obdurate. Some time afterwards, however, the French Government of their own accord made a slight alteration in their fiscal policy, the tendency of which was to somewhat reduce the amount of the bounty paid by them. But by that time, every loaf sugar refinery in Great Britain, except one, had been compelled to cease operations through the selfish policy of the French Government, and the profits of every British sugar grower had been seriously affected. Almost immediately after this, the Dutch Government, that had been loudest in their complaints against the French bounties, so altered their laws as to allow Dutch refiners almost as great a bounty as that allowed by the French to their refiners. The Dutch were remonstrated with, but without effect. After this action on the part of the Dutch, Germany thought it was time for her innings, and she became a bounty paying country. It was not apparently the intention of Germany to directly subsidise the manufacturers, for the duty and drawback were so arranged as to apparently balance each other. But the designs of men and mice are both defeated sometimes, and this proverb both Germany and other bounty-paying countries are beginning to find out for themselves. Owing to improved methods for extracting sugar from the beet, even German manufacturers are now reaping a handsome bounty. The duty was charged on the roots, and the drawback was calculated on the estimated quantity of sugar to be got from them. The actual quantity extracted was soon very far in excess of the estimate, and the increased production gives a large bounty. This action of Germany re-acted upon the original sinners. It was a species of retribution justice at which British refiners, and cane growers of all nationalities, ought to regard with complacency. It entirely crippled the refiners of France, Belgium, and Holland, but more especially the refiners in France. Austria then attempted to follow the example set by her neighbours, but was not long in finding out the loss it inflicted upon her revenue. In the campaign of 1879-80 the bounties not only swallowed up the total revenue obtained from duty on sugar, but the Austrian Treasury had to pay 1,373,362 florins besides. The Austrian Government then made an alteration in their laws, the effect of which is to gradually reduce the bounties paid to refiners. In 1883 the Government of the United States passed a law by which American refiners receive a bounty of about 2s. per cwt. on all refined sugars. This has recently been remedied to a certain extent, and it may soon be done away, with altogether. In July, 1885, Russia, in order to prevent the ruin of the industry by over-production, granted a bounty on exports of about £6,5s. per ton. But, as this entailed a heavy loss on the revenue, the bounty has not been allowed for the present crop. The German bounty was slightly reduced last year, and at the end of the present crop will be reduced still further. On the other hand the French bounty has been considerably increased. The Government are now paying between £7. and £8. per ton. The enormous bounties paid by France resulted, in 1884, in a loss to the Treasury of 50,000,000 francs (£2,000,000), and which, should the law remain unaltered, will entail a loss of 125,000,000 francs or £5,000,000! This serious position of affairs could not fail to attract attention, as we have over and over again predicted it would do; and there seems some probability that the laws will be altered before next crop time.

The stimulating effect of the bounty has, however, resulted in a production far exceeding requirements, and this has caused a serious fall in value. This has not only affected beet, but we know to our cost its effect, combined with the bounties, upon cane sugars. It has been the ruin of many planters in every country where cane sugar is produced. It may, perhaps, be some consolation to know that beet manufacturers have also suffered severely, notwithstanding the bounties they have received; and, as shown by their balance-sheets, only a few of the numerous companies have been able to pay any dividend during the past two or three years. It has been shown conclusively that an industry thus artificially bolstered up cannot stand. At the same time the public in the bounty paying countries have had to pay higher prices for their sugar, while the revenues in all instances have suffered severely. The consumer has been taxed in favour of the manufacturer, and even then the industry has not been made profitable. It is the unsatisfactory state of this industry, and the severe losses the bounty-paying Goverments are sustaining all round, that seems to hold out a stronger hope than formerly existed that they may come to an agreement to abolish sugar bounties altogether. This is the view entertained by an Australian contemporary, from whose columns the foregoing statistics have been obtained. A convention is to meet shortly, and should its labours result in such an agreement the sugar industry will soon be placed upon a more satisfactory footing. Too much, however, must not be expected from this convention. Other conventions have met, and failed to agree. Still, the present time seems more favourable than those which preceded it; and even if a gradual reduction, with a view to ultimate extinction of the bounty were agreed to, a great deal would have been accomplished. The decision of this convention, when called, will therefore be anxiously awaited by every one connected with the sugar industry.—*Mauritius Gazette.*

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SUGAR TREES.

Some trees are valuable, not only for their timber, but will yield an income while growing. The sugar maple is one of these. This tree is widely distributed over the country, and is especially at home throughout a large part of the northern half of our territory. Its timber ranks very high for both fuel or lumber. The sap taken from it during the brief season of sugar making makes no perceptible reduction in its vitality or check in its growth, and the cost of the syrup or sugar made from it is small. The necessary fuel is supplied by fallen branches, which should be cut out, and the work comes at a season when every little else can be done on the farm. There is no expense for planting or cultivation. Expensive appliances are not required, and the work can all be done at home. Maple syrup or sugar known to be pure always finds a ready sale at a good price. Considering the readiness with which it grows and the value of its wood, the sugar maple would stand very near the head of the list of trees to be grown, even though it gave no income while growing.—*American Agriculturist.*

EXPERIMENTS IN THE MANUFACTURE OF SUGAR.

(*Continued.*)

Mr. Heine, of St. Burghard, near Halberstadt, Germany, made a number of experiments to determine the effect of using too much water. He analyzed the juice at different stages of the displacement process. The press used was a twenty-four chamber, Kroog system.

The normal juice from the presses had a coefficient of purity of 83.38.

The results of these experiments are given in the following table. Under the column marked "litres" the quantity of displacement water is indicated:

Litres.	Degree Brix.	Sucrose, per cent.	Co-efficient of purity.	Lime salts in 100 parts of dry matter in the juice, not precipitated by carbonic acid. Weighed as CaO.
40	9.23	7.78	84.29	0.9010
80	8.40	7.13	84.87	0.9095
120	7.83	6.41	81.89	0.9820
160	7.00	5.70	81.43	1.1265
200	5.50	4.15	75.04	1.6464
240	3.10	2.15	69.36	2.9750
280	1.83	1.04	56.83	5.1745
320	0.93	0.43	46.23	8.7973
360	0.80	0.31	38.75	12.0902

The water employed in these experiments was cold. The reason for limiting the quantity of water to 160 litres per twenty-four-chamber press is evident from an inspection of the above table.

KLEEMANN PROCESS.

In reply to a letter of inquiry, Mr. Kleemann, the inventor of this process, has kindly given me a detailed plan for working. The following extracts from this letter will be of interest to the planters:

The charcoal you mention as having used I suppose was vegetable charcoal ground to a fine powder. * * * Certainly you have employed a substance that, next to coal, is the best aid to filtration, owing to its specific gravity and its absorbing powers of mucilaginous matters. Certain precautions, however, have to be adopted in its use, and its price compares unfavorably with that of brown coal. Even when close-woven filter-cloth is used in the press, fine particles of char have a tendency to pass through the cloth along with the juice for some time after filtration has started, and this liquor has to be turned back to be filtered over again after a sufficiently fine filtering surface of feculent matters and charcoal has been formed on the surface of the cloth.

Juice treated with brown coal, on the other hand runs quite bright or nearly so from the first running of the press, decolorizes considerably, and the cakes formed in the press part easier with their sugar when it is desired to wash them out than cakes formed of vegetable char.

For your future guidance allow me to suggest what I consider the best mode of treating juice with brown coal to effect rapid and good filtration, and at the same time use the minimum amount of brown coal in the operations. I make this suggestion on the supposition you are carrying out your experiments on an estate containing all the most modern appliances for successfully treating after it has been filtered, namely, double or triple effect vacuum-pans and centrifugals.

After the juice has been defecated in the usual manner allow it to subside for a few minutes, then brush off the skimmings into a tank and run the juice into another (preferably a circular one fitted with revolving stirrers), where the brown coal has to be added. As soon as the bottoms are reached they have also to be run into the skimmings tanks. The brown coal is now added to the tank containing the juice, and after being thoroughly mixed it is forced through the filter press, finishing off with a pressure of about 75 pounds per square inch. In some cases 50 to 60 pounds pressure will be found quite sufficient, and a speed in the filtration ought to be obtained of nine gallons per square foot of filtering area per hour, or for a press containing 400 square feet of filtering area 3,600 gallons per hour of filtered liquor. After the thin juice has been brought to about 20° Baume in the triple effect, certain albuminous compounds that were soluble in thin juice now precipitate out at the higher density, and it is necessary to again add some ascertained proportion of brown coal to the liquor and pass through a press before being taken into the vacuum-pan.

By the action of the brown coal the liquor is considerably decolorized at this point, and as all gummy matters have been previously taken out of the juice the liquor will filter through rapidly by simple gravitation from a tank situated 6 to 10 feet above the press. The cakes taken from this press are used over again for the filtration of the defecated juice. The skimmings and bottoms are mixed either with fresh brown coal or with that taken from the gravitation-press and filtered in a press by themselves. By dividing the work in the manner I have suggested, more work can be got through in a given time, with better results and using a smaller proportion of brown coal, than if it had been added to the juice, skimmings, and bottoms together in the defecating tank.

Tests were made on the laboratory scale with lignite from Avery's Island. The results were very satisfactory. It is proposed to repeat these experiments on a large scale.

TEST OF THE KLEEMANN PROCESS AT MAGNOLIA.

Early in December, at the request of Mr. D. D. Colcock, of the Sugar Exchange, New Orleans, the Commissioner of Agriculture directed me to test this process on a practical working scale.

A sufficient quantity of lignite could not be procured, so, in accordance with the suggestion of Mr. Ernst Shulze, representing the owners of the process, finely ground charcoal was substituted. Experiment on a small scale showed that a slight modification of the process must be made where charcoal, bituminous coal, or certain other substitutes for lignite are employed.

The clarifiers at Magnolia are of the ordinary form, and have a capacity of 533 gallons. The filter-presses were manufactured by Hallesche Maschinenfabrik, of Halle, Germany. An ordinary piston-pump was used to force the juice through the presses. The juice was limed as usual, *i. e.*, to neutrality. In order to determine the amount of charcoal required, experiments were made with varying quantities.

1. Ten per cent. of the weight of the sugar in the juice.
2. Seven and a half per cent.
3. Five per cent.

Any difficulty in filtration would indicate too little charcoal. As a result of this experiment it was found that the juice filtered equally well with 5 per cent. as with 10. Five per cent. is probably as little as could be successfully employed.

The juice was rapidly heated to the boiling point, after liming, before the addition of the charcoal. The charcoal having been added the mixture was boiled and stirred thoroughly for ten or fifteen minutes, and then forced through the presses.

One twenty-one chamber press filtered 2,670 gallons of juice in three hours, at the end of which time it was opened and the press-cake removed. The chambers of these presses are not as large as those of the Kroog presses.

The filtered juice was perfectly clear and bright. It was immediately converted into sirup in the double effect. This sirup was as bright as the filtered juce. A portion of the sirup, after standing several days in a glass vessel, did not show the slightest sediment.

Analysis were made of the juice at frequent intervals during the work. A portion was taken from each sample for the determination of the albuminoids.

The proportion of albuminoids are expressed, in the table, both as a percentage of the weight of the juice and in terms of the sucrose.

The first sample of the juice was taken from the first clarifier; and the first sample of clarified juice from the first portion of the filtered juice, consequently these samples represent the same juice before and after clarification. The rest of the samples were taken at intervals from the presses and from every third clarifier of juice.

The average of these results will represent as nearly as possible the same juice before and after treatment.

TABLE XI—Showing analyses of juices before and after treatment by Kleemann process:

Average of twelve analyses:—A. Total solids (degree Brix), per cent., 15.75; sucrose, per cent., 13.31; albuminoids, per cent., .2394; albuminoids, per cent. sucrose, 1.81; co-efficient of purity, 84.46. B. Total solids (degree Brix), per cent., 16.47; sucrose, per cent., 14.40; albuminoids, per cent., .1552; albuminoids, per cent. sucrose, 1,11; co-efficient of purity, 86.60. Average increase in co-efficient of purity equals 2.14.

In the preceding table A represents raw juices, B juices treated by Kleemann process, Referring to the table we find the average increase in the coefficient of purity by the ordinary process to be 1.24. Table XI shows an increase of 2.14 by the Kleemann process. This large increase in the purity of the juice would give a decided increase in the yield of sugars.

THE ALBUMINOIDS.

The reduction in the percentage of albuminoids was not as large as by the ordinary process. By the Kleemann process an average of 35.17 per cent. of the albuminoids were removed; by the ordinary process the reduction was nearly 45 per cent. I do not know to what extent this difference in the albuminoids would affect the working of the sirup. The sugarmaker reported that the sirup made by the Kleemann process in this test worked as easily as by the ordinary.

THE PRESS-CAKE.

The following analysis of the press-cake shows its value as a fertilizer:

Per cent. moisture	46.08
Per cent. phosphoric acid ($P^2 O^5$)	1.64
Per cent. nitrogen	.42
Pounds phosphoric acid per ton	32.8
Value of phosphoric acid, at 9 cents per pound	$2.95
Pounds nitrogen per ton	8 4
Value of nitrogen, at 19 cents per pound	$1.60
Total commercial value per ton	$4.55

This process yields twice as much press-cake as the ordinary.

ADVANTAGES OF THE KLEEMANN PROCESS.

The increased coefficient of purity is not the only advantage of this process. There is an increase in the yield of sugar due to rapidity of working both juice and sirup. The quantity of sugar lost in the scums is reduced to a minimum, and the expense for labor is less.

In addition the press-cake is in an excellent mechanical condition for use as a fertilizer.

This process certainly merits a more thorough test both by the Department and the planters. Lignite of good quality, I am informed, is abundant near the sugar area of Louisiana, and can be obtained at a small cost.

CUBAN SUGAR-HOUSES.

Although the average Cuban sugar-houses does no better work than the average in Louisiada, there are many estates where the results obtained are as good, if not better, than those of this country.

The enormous size and the great strength of the milling machinery is very noticeable. The carts are backed up to the carriers upon which the cane is thrown without attempting to place each stalk lengthwise of the carrier, as is usual in Louisiana. The mills are fed very heavily. The average percentage of extraction of the juice is low. This is largely due to the woodiness of the cane. The proportion of marc or fiber is considerably higher than in Louisiana.

On leaving the mill the juice passes through a calorisator, which utilizes the waste heat from the double or tripple effect and condenses a large proportion of the vapors. This is a double economy. It reduces the quantity of water required for the house and effects a notable saving in consumption of fuel. Very few Cuban sugar-houses have a sufficient supply of water.

After leaving the calorisator the juice is conducted into double-bottom pans of 750 gallons capacity, termed defecators. Here it is limed and heated to the boiling point, then settled. The clear juice is drawn off and the scum and settlings are run into "blow-ups." The contents of the "blow-ups," after heating to the boiling point, are filter-pressed as at Magnolia. The clear juice, including that coming from the filter-presses, is immediately concentrated.

Many of the houses still employ high-pressure vacuum-pans. The best practice for obtaining a maximum yield of first sugar is to make a medium grain, boiling at as low a temperature as possible and discharge the *masse cuite* as stiff as the strike-valve of the pan will permit. The *masse cuite* is dropped into wagons and left several hours to become cold.

Through the courtesy of Mr. E. F. Atkins, of Soledad, I am enabled to present a table showing the work of his house last season. This house employs double-milling. The treatment of the juice is essentially that described above. The Soledad estate is the property of Messrs. E. Atkins & Co., of Boston. It is located on the Caunao River, about 15 miles from Cienfuegos.

Monthly Results of Work on Soledad Estate for year 1886.

	Jan.	Feb.	March.	April.	May.	Entire crop.
Juice from cane	66.79	66.73	66.94	65.77	65.25	66.30
Density of juice Baume	9.40	10.17	10.70	11.00	11.19	10.49
Polarization of juice	15.29	16.32	17.10	17.46	18.20	16.87
Co-efficient of purity of juice	88.30	88.86	88.43	88.10	90.00	88.74
Total sugars in juice	10.21	10.89	11.44	11.48	11.87	11.18
Yield of first sugars from cane	7.89	8.50	9.02	8.88	8.98	8.66
Test of first sugars	96.61	96.70	96.40	96.60	96.31	96.52
Yield of second sugars from cane	1.49	1.53	1.82	1.75	2.08	1.74
Test of second sugars	88.00	86.60	86.80	86.80	86.87	87.01
Total sugars from cane	9.38	10.03	10.84	10.63	11.06	10.40
Test of first molasses	50.36	53.63	54.10	53.20	54.56	53.17
Test of second molasses	38.10	38.00	41.50	39.70	40.43	39.55
Yield of first sugars, calculated into pure sugar of 100 polarization	7.62	8.22	8.70	8.58	8.64	8.35
Yield of second sugars, calculated into pure sugar of 100 polarization	1.31	1.32	1.58	1.50	1.81	1.50
Total yield of sugars, calculated into pure sugar of 100 polarization	8.93	9.54	10.28	10.08	10.45	9.85

Above percentages are calculated upon 100 pounds of cane ground.

Mr. Atkins is conducting a series of experiments to determine what cane will give him a maximum output of sugar at the least cost. Such experiments if made in Louisiana would probably prove very valuable.

The following table gives the results of analyses of cane from experimental plots:

			Per 100 lbs cane.		Analysis of juice.						
Number.	Variety.	Date.	Juice extracted.	Bagasse.	Solids.	Density, Baume.	Co-efficient of purity.	Polarization.	Glucose.	Impurities.	Sugar extracted from 100 pounds cane.
1.	Crystalina ...	March 26	72.78	27.22	20.9	11.6	91.8	19.2	·66	1.04	13.97
2.	Red Ribbon..	March 26	73.17	26.83	20.2	11.2	91.5	18.5	·14	1.56	13.54
3.	Red Ribbon..	April 9	73.17	26.83	21.7	12 0	93.0	20.2	.10	1.40	14.78
4.	Crystalina....	April 9	71.58	28.42	22.0	12.2	81.3	17.9	1.80	2.30	12.81
5.	Crystalina ...	April 17	73.07	26.93	21.7	12.0	89.8	10.5	.13	2.07	14.25
6.	Red Ribbon..	April 17	70.29	29.71	20.4	11.3	90.1	18.4	.15	1.85	12.93
7.	Crystalina ...	April 19	74.52	25.48	22.6	12.5	90.7	20 5	.20	1.90	15.27
8.	Red Ribbon..	April 19	76.23	23.77	22.3	12.3	91.7	20.5	.15	1.65	15.63
9.	Crystalina ...	April 20	71.48	28.52	22.4	12.4	90.1	20.2	.28	1.92	14.43
10.	Red Ribbon..	April 20	71.85	28.15	21.9	12.1	91.3	20.0	.31	1.69	14.37
11.	Black Java...	April 21	71·68	28.32	22.0	12.2	96.8	21.3	trace	·70	15.26
12.	Black Java...	April 24	71.64	28.36	21.4	11.8	96.3	20.6	.08	.71	*14.75

NOTE.—Samples 1 and 2 from fields four years planted; samples 3, 4, 5, 6, 7, 8, 9 and 10, spring cane, ten months planted; samples 11 and 12, known as *cana obscura* field, eight years planted. The samples 1 and 10 were from river lands, 11 to 12 from side hill.

* Sucrose in juice from 100 pounds cane.

The results of these and other experiments indicate that the Black Java is the largest sugar producer for this locality.

These experiments are under the charge of the chemist of the house, Mr. F. A. Terry, of 19 Exchange Palace, Boston.

CAROLINA ESTATE.

The work of the Carolina estate, near Cienfugos, will be of great interest to Louisiana planters. Mr. John O'Bourke, the administrator of this estate, has kindly given me a statement of last season's crop. This is the only house in Cuba employing an eight-roller mill.

THE MILL.

This may be termed a combination mill, consisting of four pairs of rolls of uniform length and diameter, and driven at the same periphery speed. The rolls are so arranged in a horizontal plane that the cane passes from one pair to the next without the use of a carrier, a narrow knife only being employed.

Dimensions.

	Length.	Diameter.
Rolls, inches...	66	33
Journals, inches..	21	14

Periphery speed of rolls from 18 to 20 feet per minute. Maximum capacity of the mill, 30 tons of cane per hour.

The bagasse is saturated with live steam between the second and third, and third and fourth pairs of rolls.

The mill is double-geared, fifteen to one, *i. e.*, fifteen revolutions of the engine to one of the rolls. The motive power is a pair of engines 21 inch cylinders and 41 inch stroke. The steam for the house is furnished by six boilers 40 by 6 feet; two flumes. The milling machinery was built by Brissonneau, Freres & Cie, of Nantes, France.

TREATMENT OF THE JUICE.

The juice is defecated in the usual manner. The clear juice is drawn off and is clarified by boiling and skimming. The sirup is boiled, as at Magnolia, in a high-pressure pan. The *masse cuite* falls directly into the mixer and is centrifugaled hot. Two molasses sugars are made.

Statistics of the Crop of 1886.

Cane ground (2,000 pounds) tons	33,750.87
Juice extracted, per cent.	68.15
Sugars extracted, per cent	10.637
First sugar, per cent.	7.534
Molasses sugar, per cent	3.103
~~Sugar made, pounds~~	~~7,948.525~~
Sugar per ton of cane (2,000 pounds) pounds	212.74

Unfortunately this house does not employ a chemist, consequently these figures are of but little value for comparison with those obtained at Magnolia.

The management of the Carolina estate should be congratulated upon the neatness and the sytematic working of the sugar-house.

CENTRAL SAN LINO.

Reports of a successful burner for bagasse led me to visit this estate.

The American planters are probably aware that the handling of the bagasse is a large item in the expenses of a Cuban estate. The bagasse is carted to the yard and spread out to dry. After drying it is carted back to the sugar-house and is deposited in front of the boilers. It requires a large force of firemen to handle this material.

At San Lino the green bagasse is handled in a different manner from the above, and is burned directly after leaving the mills. This method of burning bagasse is known as the "Sodal."

This invention consists in a plan for burning green bagasse or any other damp combustible. The combustion of the bagasse, itself dries the fresh bagasse, which is fed to the fires from the end opposite to the grate bars. A very simple device is employed to carry the fuel to the fires. It requires ten minutes to transport the bagasse the length of boilers, in which time the flames passing over it evaporate a large proportion of the moisture.

The apparatus for charging the furnaces is driven by an independent engine and is perfectly automatic in its operations. This apparatus has reduced the number of laborers employed by about 150 men. In addition, the house is enabled to work in all kinds of weather now that it is not dependent upon the sun to dry its fuel. This process is especially applicable to large houses rolling thirty to forty or more tons of cane per hour.

Through courtesy of the owners, Messrs, Montalvo, and M. Boulanger, chemist of this house, I have obtained the following statistics, showing average of several seasons' work of this house.

Statistics of Crops at San Lino.

	Dec.	Jan.	Feb.	March and April.
Extraction, per cent.	71.50	70.90	70.29	69.80
Baume	8.00	8.80	9.50	10.50
Brix	14.20	15.50	16.80	18 60
Sucrose, per cent	11.50	13.02	15.09	16.75
Glucose, per cent	1.45	1.10	0.70	0.65
Co-efficient of purity	80.99	84 00	89.82	90.04
Glucose, per cent. sucrose	12.60	8.44	4.62	3.88
Masse cuite, per cent. cane	11.09	12.34	13.40	13.99
Yield of first sugar from masse cuite	64.00	65.59	65.40	67.90
Yield of first sugar, per cent. of cane	7.10	8.10	8.90	9.50
Yield of second sugar, per cent. cane	0.85	1.10	1.45	1.55
Polarization of first sugar	95.50	96.00	96.50	97.00

CENTRAL SUGAR-HOUSES.

The manufacture of sugar in Cuba is gradually being consolidated into large houses, the smaller estates furnishing the cane.

The Cuban manufacturers are beginning to realize what the Germans long since learned, viz, that it is more profitable for the sugar-house to attend to the manufacture only and leave the agriculture to tenants or independent farmers.

This system should be adopted by the planters of Louisiana. Our houses are too small to be worked economically. One house making 10,000,000 pounds of sugar can manufacture for a far smaller proportionate cost than three estates working three and a third millions each.

One of the owners of the largest houses in Cuba and probably the largest cane-sugar house in the world, told me that on the scale in which they manufacture (175,000 to 200,000 pounds per day) they make good profits even with the present prices. This house purchases its cane from tenants and independent farmers at a price dependent upon the average market value of sugar for each month. Hence, if the price of sugar rises, the cultivator profits by the rise; if it falls he divides the loss with the manufacturer. In these contracts, which are made for a term of years, it is specified that the density of the juice must not fall below a certain degree, but if it should, the manufacturer pays a lower price for the cane. The time of harvesting and the price to be paid for burnt cane in case of the fields being swept by fire also enter into these contracts.

THE ECONOMY OF STEAM.

The cost of fuel is a very large expense on Cuban estates, especially if this fuel is coal, which must be imported from other countries. The best houses employ every device for economy of combustible.

The evaporation is conducted in multiple-effect pans. The juice is pumped from the mill to a calorisator, consisting of a large number of tubes about which the vapors from the last pan of the system circulate, and accomplishes a large proportion of the condensation. This is a very considerable economy. In the final concentration in the strike-pan exhaust steam at about five pounds pressure is employed.

I believe that the work at Magnolia could be done with a very largely reduced quantity of coal, and possibly with bagasse and a very little wood only, if these improvements were adopted. This would not include the bone-black department.

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An article from the pen of Mr. John A. Scott, of the Hilo Sugar Co., has come hand too late for publication this month. It will appear in the October number.

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A CORRECTION.

Glasgow, 12th August, 1887.

Editor Planters' Monthly:

Sir—In an article on Agricultural Chemistry in your number of May last, when referring to some experiments carried out in Demerara with "Os-ammonite" Special Cane Manure, we notice that another firm is mentioned as the makers of that manure.

We would like to point out to you that we are, and always have been, the sole proprietors and manufacturers of "Os-Ammonite" manure.

Please have the goodness to insert this correction in a future number. Your Obedient Servants,

D. MacCalman & Co.

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BONE AS A FERTILISER.

As many as ten years ago, one of the best farmers living in the vicinity of the Rural Farm, began the use of bone flour as a fertiliser. The effect was very satisfactory indeed; his crops were evidently increased. The neighbors saw this, and bought bone and spread it upon their fields. Of late years bone is less popular. The farmer above referred to thinks it does not have the same effect as at first, and some of the neighbors who followed his lead agree with him. Now, potash is just as much a plant food as bone, which, besides a little nitrogen, furnishes only phosphoric acid. During these ten years where has the potash come from which the crops required? Evidently from the soil; and the soil has been growing poorer and poorer in potash every year until now it cannot supply the quantity which the plants need, and the lighter yields are attributed to the fact that "bone does not have the same effect now that it did ten years ago." Try potash, friends, and if this does not give satisfactory crops, you may conclude that it still needs bone as well as potash, and, very likely, nitrogen as well. But don't condemn bone.—*Rural New Yorker.*

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THE DIFFUSION PROCESS.

REPORTED BY WILLIAM DEAKIN ITHELL, FOR THE DEMERARA ARGOSY, AND CAREFULLY REVISED BY THE AUTHOR.

On June 27th, Mr. Quintin Hogg delivered at the Exchange Rooms (Georgetown), his promised lecture on Diffusion. There was a numerous attendance of proprietors, attorneys and managers of estates; most of the leading mercantile houses in Georgetown also were represented. Mr. P. H. Hind M. A., President of the Planters' Association, presided, and briefly introduced the lecturer, who on rising was warmly welcomed.

Mr. Quintin: I am glad that Mr. Hind has described the subject matter of my lecture in the terms he has just made use of, as I shall deal rather with the twenty years' experience Mr. Minchin has gained at Aska than with the rather crude attempts which we have as yet been able to make at Nonpareil. I should like also to make it clear that I do not stand here as an advocate of diffusion, but my desire is, mainly, to let others know the facts and data which I have gathered in connection with the subject, which so far as I know could not have been obtained save through the instrumentality of Mr. Minchin, or his chief manager Mr. Kollman at Aska. My first introduction to Mr. Minchin was in 1877, shortly after I had tried the system known as Tooth's, which I believe to have been one of the very best ever introduced into this colony. Mr. Minchin called upon me in London and asked me for the figures which I had got together in connection with Tooth's process. Those I gave to him, and we afterwards had a conversation on diffusion. It then appeared to me, on comparing notes with him, that he was doing, from a money point of view, very little, if at all, better than I was. This put diffusion out of my head for some years; nor did I again seriously think of it until my last visit to the colony in 1886, when Mr. Schultz, the representative of the Sangerhausen firm, called upon me and endeavored to persuade me to order a plant. As you know, the state of affairs last year was not such as to induce proprietors to go in for extensive speculative trials.

Mr. Schultz however was so earnest in the matter, and offered to back his opinion to such an extent, that I at last entered into serious negotiations with him. Finally, the terms settled between us were somewhat as follows: He undertook on the part of his firm to furnish me, landed in Demerara, with a complete diffusion plant at his own risk, which plant he guaranteed should be capable of dealing with four hundred tons of canes in twenty-four hours; also that the diffusion juice should not be less pure than that which came from the mill, and that the total extra dilution should not exceed 22 per cent.

On my return to England, I found that this last point was not quite clear. By 22 per cent. I had understood that not more than twenty-two gallons of water were to be added to every one hundred gallons of juice, whereas my German friend apparently had understood something quite different. Finally, however, the Sangerhausen firm defined their idea of 22 per cent. by stating that it represented a dilution of 2° Baume; that is to say, if our mill juice is at 9° the diffusion juice from their battery should not be less than 7°. Subject to this, they undertook to give me within a very small decimal point the whole of the sugar contained in the cane. Furthermore, I was to be the sole arbiter as to whether the terms had or had not been fulfilled. Having this responsibility laid upon me, I made up my mind to proceed to the one place in the world where I could really study diffusion as applied to sugar cane. So I booked my passage for India and found my way to Aska, making use of the cordial invitation which Mr. Minchin had given me nearly ten years before.

Aska is situated in the extreme north of the Madras Presidency, about thirty-two miles from the sea, and about the same distance from the Chilka Lake, the one great lake of India. The place is not easy to arrive at, as it can only be reached by slow coasting steamers which entirely subordinate the convenience of passengers to the exigencies of freight. After a week's coasting however, we arrived at Gopalpur, and proceeded thence thirty-two miles in a bullock cart to Aska. The works themselves are of very considerable size, occupying an area considerably larger than the works of any of our East Coast estates, although the weekly outturn is comparatively small, say, about one hundred tons per week. The buildings are of much more substantial character than those we erect here. They include, besides the ordinary machinery for sugar manufacture, arrangements for char filtration, a large distillery, and a foundry, where all kinds of small jobs and castings can be done, Mr. Minchin occasionally taking a Government contract for pieces of machinery needed in the district. Nothing could exceed the kindness with which I was treated by Mr. Minchin, the Duke of Aska as he is generally styled in the Madras Presidency. His wealth, his commanding personal appearance, and his long residence of 35 years at Aska, have given him an almost unique position in the Presidency. He not only gave me a full run of the works, but he introduced me to Mr. Kollman, and he instructed that gentleman to let me make any experiments I liked, to take down any notes I pleased, and to have complete access to his books.

With such an introduction it would have been my own fault if I had not got fairly complete data as to what they were doing. You will see, of course, that some of the figures given me must necessarily have been of a private nature, but still I have, I believe, full liberty to give you sufficient details to enable you to form a fair idea of the outturn of sugar and of the method and cost of manufacture at Aksa. Mr. Minchin himself is an enthusiast in sugar-making in general, and diffusion in particular. He sleeps in a small room adjoining his pan loft throughout the whole of the diffusion season of one hundred days; and alongside his bed there is a steam pipe with a pressure gauge upon it, enabling him to tell, at any time, night or day, the pressure his boilers are being worked at.

I think, perhaps, the most convenient method for me to adopt will be to give you first a short description of the machinery in the buildings, and then to go through them with you a second time dealing with those details of the subject which more particularly require elucidation. In the diffusion house, which was the first we entered, there are five slicers, of which four are six feet in diameter, furnished with six knives each, and run at two hundred revolutions per minute. Those slicers were made on the spot by Mr. Minchin, with the exception of the disks, which were cast in Calcutta, and he estimates their cost at £40 sterling—as against £200, the price he was asked by an English engineer. The fifth slicer was five feet in diameter, but is rarely, if ever, used. Two of the six feet slicers are kept always at work, and each runs through sixty or seventy tons of cane in the twenty-four hours, working continuously, or say, three tons per hour each. As, however, constant stoppages are necessary for the purpose of changing and sharpening the knives, an operation which at Aska takes about an hour, three cutters are kept in harness, two of which are as a rule running while the third is either at rest or having its knives changed.

I mention these details somewhat minutely, as it was the complete breakdown of the cutters furnished by the Sangerhausen people which brought our experiments at *Nonpareil* to a standstill; and I wish to show you that the worst that can happen to us in this respect is having to adopt the Aska pattern of cutter instead of that furnished by the Sangerhausen Company. The rest of the machinery consists of a diffusion battery of twelve cells, each cell containing three-quarters of a ton of cane chips and holding four hundred gallons of water when empty, or two hundred when filled with chips.

Then there is a sulphur box very similar to what we use in this colony, and measuring tanks for ascertaining the proper charges to draw from the battery; six defecators, holding 450 gallons each, of the old French kettledrum pattern, and a range of filter bag presses used at the rate of one bag for every ton of diffusion juice passed through them; two concretor batteries of eleven and twelve plates each respectively; a double effect containing 1720 square feet of heating surface; two vacuum pans striking about seven tons, and three tons of dry sugar; nine under-driven centrifugals of the old Manlove and Alliot pattern, and the usual *massecuite* boxes. In addition to these there is an immense range—or, perhaps, I should say, several immense ranges—of other boxes for receiving the second *massecuite.* These boxes are only constructed of wood, and the sides do not make the slightest pretence of being watertight; the bottoms are slightly V shape, and are caulked and perforated with holes. The inside of these boxes is lined with bamboo matting, and the second *massecuite* is discharged into them. They find the molasses drain quite sufficiently through this matting to enable them to bag the sugar and sell it without passing it through the centrifugals. The consequence is that they get a very large return of sugar from their second *massecuite,* 3 cubic feet, giving them as a rule 1½ cwt. of molasses sugar. I have brought a large number of these mats with me, intending to try how they will work in Demerara. It must be borne in mind, however, that in order to obtain the white sugar made at Aska considerable washing is necessary in the centrifugals—(only 41 to 44 per cent. of white sugar is obtained from the *massecuite*)—the consequence of course being that their molasses is of exceptionally good quality.

The distillery is furnished with two continuous French stills, and rum-making there produces such good results that Mr. Minchin is quite careless as to the quantity of sweets he sends to his liquor loft. The scum and bottoms of the boxes are all remorselessly sent off to the distillery, so that no attempt is made to use filter presses or to obtain the best possible sugar results from the juice. The return in rum is from 30 to 40 gallons per ton of sugar.

I am sorry that I had no means of getting the molasses and juice properly analyzed. As it is, I am unable to describe the constitution either of one or the other, or to state the percentage of crystallizable sugar left in the molasses. The motive power consists of one twelve horse-power engine, with a cylinder of 14 inches diameter, and 3 feet stroke. This drives the cutters, the two elevators connected with the cane chips and the grind stone. Then there is a large beam engine of twenty-five horse-power (nominal) which works the pans, the steam water pumps and the centrifugals. There is also an eighteen horse-power horizontal engine which drives the pumps for the double effect, and one water pump. In addition to these there is an horizontal engine with double-acting pump which drives a single effect of the ordinary Rellieux type, which, however is scarcely ever used. The boilers are eight in number,—multitubular by Mirrlees, 14 feet long by 7 feet 6 in. in diameter; two single flue Adamson boilers, 30 feet by 6 feet 6 in.; two smaller single flue boilers 20 feet by 6 feet, and two boilers made from old char cisterns bolted together, one of which is 74 feet long by 5 feet in diameter, and the other 36 feet 3 in. in length and 5 feet in diameter. Neither of these two latter have any flues, the fire simply playing round the outside. I may mention that the large 74-feet boiler is worked up to 36 lbs. pressure, and is used to supply steam to the diffusion battery. Of these eight boilers, six are kept in use for all purposes, and these six boilers with engines of a nominal capacity of fifty-five horses furnish the whole motive power for the Aska works. The fuel used is wood of good quality, fully equal to good courida as supplied in this country. I have estimated it as being worth about one-third of its weight in coal. Huge stacks of this wood are kept piled in the various large yards enclosed by the factory, and its cost at the furnace door was 3 rupees 4 annas per ton. Taking three tons of wood as equal to one ton of coal, the cost of the fuel is about 10 rupees, or £1 in silver currency, or say 15s. in gold, per ton of coal. Labour is, of course, very cheap, a man's pay being about two annas, a woman's one anna and four pies, and a child's one anna. As an anna is nominally worth 1½d. in silver, these wages represent in gold only about 2¼d. per day for a man, and less than 1¼d. for a child. The following is a list of the laborers employed inside the Aska works: it being borne in mind that diffusion is necessarily a continuous process, it will be understood that the list includes two gangs, which relieve each other every six hours, so that one half of the people mentioned in the subjoined table are resting while the other half are at work:—

LABORERS IN ASKA WORKS—February, 1887.

Department.	Maistries, *i.e.*, Mechanics or Headmen.	Coolies	Boys	Total
Cane Cutters	2	20	4	26
Diffuser Fillers	2	6	6	14
" Emptiers	2	12	2	16
Truck for Slices	2	8	4	14
Diffusion Engine	.	2	.	2
Oil Men	.	2	.	2

Department.	Headmen.	Coolies	Boys	Total
Sulphur box and measuring tanks.	.	4	2	6
Water Pumps	.	..	2	2
Six Defecators	2	4	2	8
Bag Filters	1	8	.	9
Concretor Trays	4	..	4	8
" Stokers	2	8	4	14
" Juice Cistern	.	2	.	2
Water Floor	.	2	.	2
Double and Single Effect	2	..	.	2
" " " " Engine	.	2	.	2
Syrup Cleaner	.	2	2	4
Large Engine	2	..	2	4
Boilers (six at work)	2	20	.	22
Head Maistries	2	..	.	2
Second Maistries	2	..	.	2
Mechanics for Cutters	2	..	2	4
Pan Stage	2	2	.	4
Centrifugals	2	22	8	32
Coolers	.	2	.	2
	33	128	44	205

Well now, to go a little more into detail as to what is done in this factory. In the first place the canes are all grown by the neighboring peasantry, and perhaps the best proof I could possibly give you as to the financial results of diffusion may be found in the fact that Mr. Minchin is able to pay three dollars and thirteen cents ($3.13) per ton for his canes, though their juice only stands at barely $8\frac{1}{2}°$ Beaume. Yet he is one of the few sugar manufacturers not complaining of the present depression of the times. The canes are brought to the factory door in bullock carts, bound in bundles of, say, about 28 lbs. each, which bundles are stacked end on in sheds immediately contiguous to the cutters. About eight coolies are constantly employed taking these bundles on their heads and putting them on a platform 7 or 8 feet high, on which stands the mechanic who feeds the slicers. This man takes a knife, cuts the trash band binding the bundle together, and gathering a small armful of canes, puts them into the hopper down which they appear to be drawn by the rotary motion of the knives. No pressure was needed on the part of the man feeding. These vertical cutters give none of the trouble we experienced with our horizontal cutters at *Nonpareil*. In connection with these machines Mr. Kollman's advice was something as follows:—"Mind, you keep your knives sharp; you must have a mechanic for this work, and he may just as well be employed in doing his work as in eating rice. The very instant therefore that the slices begin to show the least sign of being torn or jagged instead of being cleanly sliced, the machine must be stopped, the knives taken out to be sharpened, and the spare cutter set to work." Another great point is that the slices should be as thin as possible. Mr. Minchin aims at having his one millemeter, say the 32nd of an inch in thickness; as a matter of fact they are as a rule more nearly approach to two millemetres than to one, but the latter was the ideal desired.

(To be continued.)

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THE SAMOAN ISLANDS.

A SKETCH BY HENRY F. POOR.

The Navigators, or Samoan Islands, are an extensive, populous and fertile group of islands of Central Polynesia, lying in the South Pacific between 13° 30′ and 14° 20′ S. latitude, and 169°·24′ and 172° 45′ W. longitude. They lie almost in a direct line between Honolulu and Auckland, about 2,200 miles south of Honolulu, and 1,600 miles north of Auckland. There are ten inhabited islands extending from east to west, the extreme points being within a radius of 265 miles. The total area is about 1,650 square miles, and the population about 35,000.

TOPOGRAPHY.

Commencing on the east are three small islands known as *Manua*, originally separate and distinct from Samoa, but long since conquered and submissive. The first is *Ta'u*, ten square miles in extent. *Olosega*, the largest, 3½ miles west of Ta'u, with an area of about twenty-four square miles. Almost adjoining Olosega on the west is *Ofu*, with an area of about ten square miles. The coast line of each island is lofty and bold, and there is but little low land.

Tutuila is sixty miles west of Ofu. It is 17 by 6 miles in extent, and about 240 square miles in area. Mafao, its highest peak, is about 390 fathoms above sea level.

Aunuu is a small is a small island one mile east of Tutuila.

Upolu is thirty-six miles west of Tutuila, and is the second in size of the group. Its circumference is about 200 miles, and its area about 560 square miles; its highest peak about 500 fathoms.

Nuutele adjoins Upolu on the east—a very small island.

Manono is two miles west of the south-west end of Upolu. It is about two by one and a half miles in extent, and about nine square miles in area. It is attached to Upolu by a reef and shoal.

Apolima is two miles west of Manono. It is about two miles in circumference and seven square miles in area. It appears to be a mass of sterile cliffs 80 fathoms high, but on entering it through a narrow opening on one side the whole centre proves to be a vast basin sloping from its centre to its circumference, clothed in a verdant mass of vegetation, and forms a unique and beautiful picture.

Savaii, the largest island of the group, is four miles west of Apolima. Its extent is about 48 by 25 miles, with an area of about 700 square miles. It rises from the sea like a vast dome of green, its highest elevation being about 4,000 feet. On this island is a volcano—now extinct—which was seen in action by the Dutch Expedition in 1722.

The existing surveys of the islands are by no means accurate, and the coast and harbors should be re-surveyed. Very little is known of the interior, but there are many strange traditions and tales about it which suggest that there may be wonders and beauties yet to be revealed to the adventurous explorer.

POPULATION.

The population of Samoa is divided among the islands about as follows:

Upolu (including Nuutele)	16,000
Savaii	13,000
Tutuila (including Aunuu)	3,500
Manua	1,300
Manono	1,000
Apolima	200
	35,000

The white population of Samoa is about 250, of whom about 100 are Germans, and the rest principally English and American.

NATURAL FEATURES, SOIL AND CLIMATE.

The fertility of Samoa is wonderful and unexcelled, and it is safe to say that about three-fourths of its area is rich, cultivable land. The scenery—particularly on Savaii and Upolu—is in some places grand and beautiful. The islands are densely wooded, and present a great variety of verdure, luxuriant and beautiful, from mountain summit to shore. All along the line of the shore are thick clusters of cocoanut and breadfruit trees, and, except on certain portions of rock-bound coast, rank vegetation meets the rising tide. The settlements are almost entirely on the coast line, and the interior is a vast and unexplored wilderness of gorgeous tropical vegetation and great forests. Upon the limited area of the narrow alluvial belt of lowland extending around each island on its shore line the whole population of Samoa is supported. There are a few settlements here and there inland a few miles from the coast known as bush towns. The numerous valleys and upland plains, with their thousands of acres of rich soil entirely untilled, could be made vastly productive, and would support a large population. The islands are fairly well watered by springs, lakes and streams, but not sufficiently, especially on Savaii, where many streams are dry in the dry season, and most of the mountain streams disappear as they approach the coast. The soil is porous, and though kept damp by continuous rain, it is absorbed rapidly, and, combined with the streams that soak away, breaks out in innumerable springs of sweet water on the rocky beach. Possibly this underground flow could be tapped and the water saved. The climate is salubrious and generally healthy. There are two seasons—wet and dry—; but the winds are irregular, and change from every direction during the year. From 78° to 90° Fahrenheit is about the extreme range during the year. The rain-fall is enormous, very heavy in season, with frequent showers the year round. The grass and verdure keeps perpetually green, and droughts are unknown. The average rainfall for the year is 130 inches—never below 100. Though not in the hurricane region, hurricanes are felt periodically. It is four years since the last, which only skirted Savaii, the other islands suffering only by the heavy sea.

PRODUCTS.

The soil of Samoa is prolific, its natural products numerous, and growing in wild profusion with scarcely any cultivation by the natives. I will enumerate them in the order of their abundance: Cocoanuts, in eight or ten varieties; breadfuit, in a number of varieties; bananas, in fourteen or more varieties; mountain plantains, in two or more varieties; taro, yams, oranges, limes, kava, tobacco, sugarcane in many varieties, citrons, arrowroot, coffee, pineapples, ginger, fungus, sweet potatoes, pumpkins, melons, guavas, ifi (native chestnut), vi, tamarinds, mangoes, gogofiafia (similar to our ohia), and other fruits of which I have not the name. There is also a tree having a nut resembling the nutmeg of commerce, but without its flavor. The lama (our kukui) is also abundant. All these may be found growing profusely and without cultivation. The natives occasionally plant a few cocoanuts and breadfruit to replace those that may be destroyed, and tobacco, yams, taro and a few other things are cultivated to some extent. The soil, however, is so wonderfully prolific, and everything grows so spontaneously and in sufficient abundance to feed all the people, that there is no need, or much desire, on the part of the natives to enter into regular cultivation for purposes of profit. There are a number of foreign plantations, however, mostly owned by Germans, where cocoanuts, cotton and coffee are systematically cultivated, and with great success. It is estimated that there are from six to seven thousand acres thus under cultivation, and the area is being continually extended.

Experiments are being made with other tropical products by a competent forester. The cacao tree is the first to develop, and has proved successful, the trees being now in prolific bearing. Three varieties of castor-oil plant have been tried, and the first and a prolific crop shipped to San Francisco. Sugar planters who have visited the islands give their opinion that the conditions of soil and climate are splendidly adapted to the culture of cane. Small patches of cane which the natives plant for their personal use produce luxuriant stalks, 15 to 18 feet long.

On the plantations cocoanuts are planted in rows 30 feet apart each way. This is to prevent the leaves of the tree thrashing off the flowers of its neighbor when it is windy. The time of bearing varies irregularly from three to six years of age; 75 per cent. will bear at four years. The average production of nuts on the plantations or in the original groves is about 100 to each tree per annum. It is not unusual to see 200 and 300, and occasionally 500 on a single tree, and they are ripening throughout the year; 100 nuts makes 50 to 60 pounds of copra. Not much labor is required in cultivation, for as soon as the trees attain a certain height cattle and horses are turned in to keep down the undergrowth of shrubs, etc.

Cotton is planted 10 feet apart, and 12 feet between rows; coffee, 7 by 7. Both grow luxuriantly, and bear enormously, but are planted in the higher lands. The coffee is planted at an elevation of a 1,000 feet. Breadfruits are planted along the roads in some places 60 feet apart, to furnish in part food for the laborers, and as a break-wind to protect the plants.

The names of the various kinds of cocoanuts and their qualities are as follows:

Niu Vai—Large shells, 12 to 16 inches in circumference, used as water containers.

Niu Ofa—From the husk of this, cinnet is made.

Niu Ipu—Kava bowls are made from this; when polished, they are a glossy black.

Niu Ui—The nut is small; a light yellow in color, and the milk is very sweet.

Niu Lea—A dwarf cocoanut. It commences to bear when the trunk is only 3 or 4 feet high, and it grows very slowly, and never attains a great height.

Niu Laita—A profuse bearer, a single stalk having 100 or more nuts.

Niu Utonau—Known as the sugar cocoanut. The husk is pulpy, and is edible. The milk and meat are very sweet.

Niu Mea—A common nut.

The more commonly known varieties of plantains and bananas are named as follows:

Tai Amaneo—Large bunches of long fruit of about 18 inches.

Tai Leusi—Yellow fruit, short and thick.

Tai Puakailo—A foreign banana.

Tai Aumalie—Short thick fruit.
Tai Taimano—Red skin, white inside.
Tai Pupuka—Short, and very thick.
Tai Tanamanu—Small fruit.
Tai Mamae—Pink fruit, small.
Tai Papalagi—The China banana.
Tai Tuamauluga—Bunches of fruit 6 feet long; fruit, 8 and 10 inches long.
Tai Pata—Large four-cornered fruit.
Tai Samoa—Large fruit resembling the plantain.
Tai Tapua—Small, hard fruit.
Tai Manifi—Short yellow fruit.
Tai Pulu—White, tasteless fruit.
Tai Soaa—Wild mountain plantain.
Tai Taiputa—Wild mountain plantain.

FORESTS.

The whole interior of the islands is a vast forest of great beauty, possessing timber trees in wonderful variety and great value, some of which are of huge growth. Most of them are evergreens, some noted for their flowers, some for their fragrance, and some for their fruit. There are many varieties of beautiful cabinet woods which are very handsome when polished. With but two or three exceptions, all the trees named below are each found in great abundance. The following is a list of the principal trees:

Ifilele-taia—So losely grained as to resemble ivory-wood, and so heavy as to sink in water like a stone. It is black, and takes a beautiful polish.

Ifilele-fau—A hard wood that sinks; light yellowish color; used mostly in making tanoas.

Ifilele-ulu—Hard yellow wood with a fine grain, and polishes beautifully.

Talie—A hard, dark yellow wood, finely grained; much used in boat and canoe building.

Toa—Otherwise known as iron-wood; redish brown, and very hard. Formerly a sacred tree, to be cut only by chiefs—now scarce; clubs, spears, and staffs are made of it.

Pau—A heavy, dark red wood, used in making tanoas, canoes and staffs.

Masami—A heavy, dark red wood, similar to pau, and similarly used.

Tamanu—Grow to a large size—often to 5 feet in diameter; valuable for ship-building; holds a nail with great tenacity, and iron lasts longer in it than in any other wood. It is color of ash, and has a viny and beautiful grain, and is susceptible of high polish, an excellent cabinet wood.

Pomufi—A hard, light red wood. It never rots: will last for generations, even if put under ground in damp places. Used in canoe-building and for house posts.

Leasi—Called a bastard sandalwood, only slightly scented; used for building purposes.

Tauanave—A light yellow wood, beautifully grained, with blended tints; a beautiful cabinet wood.

Puapua—A hard, light yellow wood, used in making canoes and paddles, etc.

Pipi—Soft when green, dries hard; used in building.

Tuafua—A hard wood of light color, from which planks are made.

Malili—Grows to large size, and makes splendid timber for ship-building; it looks like oak.

Tavai—A dark red wood with cross-grain, hard, but light in weight; used in boat-building, etc.

Tau—Two kinds, black and white; a hard wood, used in building canoes, etc.

Mamalava—A hard white wood, from which planks and shingles are made.

Mamala—A hard and heavy wood, of a deep redish purple color, capable of a high polish, and is impervious to the attack of the white ant. It has a juice so strong as to cause bleeding of the nose of the person sawing it. The natives make medicinal extracts from it.

Manaui—A valuable tree, from the fact that its juice will preserve iron from rust, and the bark yields a good substitute for turpentine.

Taputoa—A hard white wood, used for paddles, etc.

Toi—Grows to large size and height; toward the heart the wood is blood-red, and the lighter parts are beautifully waved like satin wood; it takes a high polish. The supply is unlimited; it is used in house-building, is valuable for furniture.

Tutu—A white, soft wood; it is indestructible in salt water, but rots quickly in fresh; it bears a fruit which is used to poison fish.

Tetau—A heavy, dark red wood with a grain superior to walnut; it is valuable for furniture, and is used in boat-building. It has a fruit the oil of which the natives use to cure rheumatism.

Maali—A hard red wood, valuable for ship-building; a sap exudes several times a year which has a strong, sweet fragrance that lasts forever.

Tilofiloa—A heavy, hard, white wood, with solid grain, from which spear prongs are made.

Amai—Wood of close texture, of dark brown color, susceptible of high polish, and valuable for furniture.

Milo—Resembles rosewood, and valuable for the same purpose.

Laulilii—A white hard wood, from which spears are made.

U'a—The mulberry, from the bark of which tapa is made.

Tou—A low, wide-spreading tree; its wood resembles rosewood in color and grain, but is not so hard; a beautiful furniture wood; wooden drums are made from it that produce a mellow and sonorous sound.

O'a—The banyan.

Lafo—This is a valuable reed that grows abundantly in the marshes 20 to 30 feet long, and is used for thatching, baskets, etc.

INDUSTRIES AND COMMERCE.

As the natives are proverbially lazy owing to the profuseness of nature in supplying their food and their wants being simple, their industries are not many or general, and such of her products as are prepared for trade or personal use amount to but a small percentage of what is possible were the whole population engaged in some industry, to say nothing of the extensive production possible on the great areas of fertile and untilled land.

Copra is the leading product, the native groves and the plantations making about 3000 tons per annum. The bulk of this is produced by the natives but it is only one third of what might be obtained from the present trees owing to the reckless consumption by the natives at their homes and at their feasts; the considerable amount used to make oil for their bodies and hair; the reckless feeding to pigs and chickens, and the thousands that rot away from sheer indolence to utilize them. The labor in preparing copra is not great. The nut has to be husked, cracked open, the meat cut out with a knife into small pieces, dried four days in the sun and is then ready for market. It must not be allowed to get wet while drying for it will then rot. A great deal of this copra is brought in small quantities to Apia by the natives to sell, but the bulk of it is collected at the copra trading stations numerously located over the islands by the German firm and the Auckland firm of W. McArthur & Co. The price of copra fluctuates considerably in the foreign markets from £12 to £22. It is ruling at £14 6s. now. The price paid to the natives varies accordingly, from 1½d. and 2d. in cash or 2d. and 2½d. in trade and there is lively competition to obtain it. Other merchants who collect copra usually sell to the large exporters at ¼d. advance on the price paid to natives. The principal foreign markets for copra are Liverpool Marseilles and Hamburg. Occasional cargoes are sent to San Francisco and Valparaiso. The oil expressed from the copra is used in various ways. Its more important uses are in the manufacture of soaps, candles and hair oils, and an excellent salad oil is made from it which goes to the consumer as No. I olive oil. The refuse is made into oil cake for stock feed or used as a fertilizer.

Cotton comes next in value as an export but is raised exclusively on the German plantations. It is an excellent and valuable quality of South Sea Island cotton having a long staple. Last year's export was about 2,000,000 lbs. The area of cultivation is being continually extended, and experiments made at different elevations.

Coffee is also cultivated exclusively on the German plantations, at an elevation of about 1000 feet. Last year's crop was the first, producing 56,000 lbs. The crop averaged 1,000 lbs. per acre. The coffee is an excellent quality and is sold in Apia at 25 cents a pound, but the bulk of it is exported to Germany where it is in demand at the same figure.

Bananas grow spontaneously everywhere, but the cultivation for market is increasing. Each month there are large shipments to Sydney by the direct steamer. The shipments vary from 1000 to 5000 bunches. The price paid to natives by the traders is usually a shilling per bunch, though at certain seasons only six-pence is paid in cash or a shilling in trade. The freight to Sydney is a shilling per bunch—expense of handling about six pence. The price realized in Sydney is usually two shillings to two and six-pence per bunch; but in the season when the Queensland bananas come into market the price falls to one shilling and six-pence. The bananas shipped are the same as our China banana, but not as large or good a fruit and it is forwarded without covering and thrown into a heap without the care for each bunch as our shippers have.

Kava is not cultivated but grows abundantly, and is gathered in large quantities. After drying, the natives sell what they do not use to the copra stations or to the Apia merchants at from 8 cents to 12 cents per lb. The dealers resell in quantity at from 15 to 10 cents per lb. Though every family in Samoa consumes its kava, the supply is more than the demand and a portion is exported to Tahiti, Fiji, and elsewhere. A piece of kava is always extended to a visitor as a token of welcome. The natives are the mildest kava drinkers in the Pacific. It is pounded into shreds or grated, mixed with water and strained, its strength diluted making a mild and pleasant drink. Taken in moderation it is said to purify the blood, and old men take a bowl of it every morning to prolong vigor and life. They are never intoxicated with it.

Tobacco is cultivated by the natives in considerable quantities. They have a method of curing and pressing it and wrap it up in reels of about 3 lbs. each which retails all over the country at one dollar. It quantity it sells at 75 cents. It is a rank and strong tobacco but Samoans gives it the preference. The production is in excess of the consumption and small quantities are exported.

Yams grow wild and are also cultivated, and grow to a large size. They can be bought in any quantity at 1½ to 2 cts. per pound.

Taro mostly grows wild, both the dry land and wet taro. A good deal is cultivated and sold at $1.00 per 40 heads.

Oranges and limes grow wild in profuse abundance and are occasionally exported in quantity to Sydney.

Fine mats are the choicest production of Samoan industry and to them the most valuable. They are called Ie Toga because the Tongans in their ancient conquest of Samoa taught the Samoans how and forced them to make these mats. They are made from the leaf of a species of dwarf pandanus which grows about six feet high and is found in great abundance all over the islands. The leaf is dried, scraped thin and slit into thin strips from which the mat is braided. A fringe of braid surrounds the mat with a border of red feathers on its edge. It takes years to braid a single mat. They are of a straw or cream color, very flexible and light, and will last for generations. They vary in value according to size, quality, and its long line of distinguished possessors, from $20 to $300. To a

Samoan they are of more value than gold or silver, and they will never part with them for money except in necessity. They are used for gala costumes: they are a bride's dowry, and are the principal presents given in their numerous ceremonies. They also are a sort of currency used in trades of land or property.

Another species of mat called *Ie Sina* is from the bark of the dwarf Hibiscus (Fau), which is extensively spread over the islands. They rank next to the other mats in value as presents, and can be bought at from $6 to $10, according to size or whiteness of the material. The underside is a neat braid, the other side shaggy like a sheepskin. Both of these materials could be collected in great abundance, and might form a valuable export.

Other mats of coarser quality are also made from the leaf of the common pandanus and the cocoanut, which are also used to cover the floors of houses and for beds. They can be bought very cheap. All of these mats when soiled are cleaned with the juice of the wild orange.

Tapas or siapos as they are usually called are being continually and numerously manufactured by families all over the islands. The method of manufacture is similar to the Hawaiian and the quality about the same, but the Samoans are not as expert as the Hawaiian in dyeing or as tasty in their designs. They are made in all sizes from 4 feet square to 300 feet long by 8 or 10 feet wide. They are valued as presents and for use as clothing or partition curtains, but are freely offered for sale cheap. An ordinary size 8x8 is worth $1.50 or $2.00.

Baskets and Fans.—Very pretty little baskets, neatly braided in black and white, from the pandanus and banana leaf in various shapes and sizes are peddled about in great quantities at a shilling apiece; a larger sort of basket, made of a twisted braid of hala leaf is sold for 50c. and $1. Fans made of the rib of the cocoanut-leaf are numerously peddled about also for a shilling, and they are neat and serviceable.

Cinnet is a fine cordage made from the fibre of a cocoanut husk. It is very strong and durable, and is used in building their houses, binding together the planks of large canoes, and all the other numerous purposes of tying and binding. It is usually made by the old men, who occupy themselves with it at home or at the village house, where they meet daily to gossip and discuss affairs. It is rolled up neatly in various shapes, and is sold at 25 cents per pound.

Coral and Shells.—Between the reef and the shore are vast beds of coral in every form and variety, and as one sails over it it looks like a beautiful submarine garden with exquisite and fantastic growths, amid which innumerable little fishes of red and blue and green dart about, giving it life and color. Near

Apia the natives gather it in great quantities, and drive quite a trade with the steamers and other vessels visiting the port. Most of the specimens are very pretty, and the prices asked are moderate. Women and girls come into Apia from every direction with a great variety of pretty shells for sale, but the prices asked are rather high. The most numerous shell they have is the *tupè alili*, a pretty green-eye stone of a shell-fish, which is in all sizes. They can be made up into pretty jewelry ornaments or used for many other decorative purposes.

Canoes.—The natives are very expert in the manufacture of canoes, and their models are very pretty, with graceful curves and outlines. The woods from which they are made are numerous. New ones are being continually made, and any number can be bought at from $6 to $20, according to size.

House-building is an art by itself, and engages a distinct class of men. A Samoan house is like a great bee-hive covered with thatch. The floor is built of small pebbles, elevated about one to one-and-a-half feet from the ground. The dome of the roof rests on a series of posts about four feet high, arranged circular or oblong, with two or three centre posts reaching to the apex. The interior of the roof is a graceful combination of round joists forming regular curves, and inlaid by a network of smaller prices of about an inch diameter. A first-class house costs from $150 to $200.

It is impossible to obtain an accurate estimate of the total value of imports and exports, there being no official entries made as the commerce is entirely free, and such records as are kept in the Consulates are not complete. The German firm naturally decline to give any intimation of the amount of their business. By careful inquiry, however, I will venture to offer the following approximation: Imports about $400,000, of which about one-third is from the United States, one-third from England and Sydney, and one-third or less from Germany; exports of products, $250,000, the bulk of which is to Germany. Apia is the most important distributing station in the South Pacific, and about one-third of the foreign imports is re-exported to the numerous island stations. More than half of all the carrying tonnage is German.

The Samoans will not work, so it is necessary for the plantations to import labor, and a systematic labor immigration is conducted, recruits being obtained from New Hebrides and other islands of black people.

LANDS.

A considerable portion of the choicest lands has come into the possession of the Germans mostly by legitimate purchase, but considerable by very questionable methods, which will probably not stand the light of investigation by a Court. Over one-half of Upolu is claimed by them, besides some thousands of acres on Savaii. The Polynesia Land Company has also extensive claims. They bought lands and paid a portion down, the balance to be paid after survey; but such long time elapsed a good portion has been re-sold by the natives to the Germans, and will therefore have to be adjudicated upon. There is one choice tract of 25,000 acres back of Apia which is still the undisputed property of the Polynesia Land Company. But who is the successor of the company is a disputed question. The affairs of the company have been through so many complications and transfer it will be a difficult question to determine. A certain Mr. Sherwood has the claims recorded in his own name at the British Consulate. There are other private land claims which seem to remain in abeyance, but, with a land court established, they will probably turn up for adjudication. Beside all these claims, and the lands owned under good title, there still remain large tracts of rich lands on the coast and in the interior owned by natives which, with the advent of capital and good government, would soon come into the market. The Germans recognizing the value of these lands are continuously buying up lots here and there at 25 cents to $1 per acre.

Among the Samoans the succession of title is based on customs similar to the laws of descent of civilized countries. Lands are the common property of a family, except when some special price has been particularly given to one member of the family. Each family has its recognized head by regular descent or by election, who is called the *pule* of the lands. The head of the family has the right to sell, with the consent of the family, and is expected to divide the proceeds. In some districts the consent and approval of the head chief has to be obtained. From one to half a dozen households constitutes a family, and they are continually traveling and moving on *malaga'o* (visits), and it is for this reason that so many disputes arise and fraudulent sales are made. In their wars, when one district conquers another they have no respect for the rights of families, but will sometimes confiscate and sell the lands as spoils of war. The natives do not place much value upon lands, and when it passes through complications without recorded evidence of title, and the families become divided in quarrels or wars it becomes a laborious task to investigate and determine the title.

(*To be continued.*)