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## THE NATIONAL PLANT OF THE CHINESE.

The uses of the bamboo, says Dr. S. W. Williams (author of "The Middle Kingdom"), are so numerous as to entitle this grass to be called the national plant. It grows naturally throughout the country nearly to the latitude of Pekin, diminishing in size and strength as one goes northward. The varieties induced during the long period of its culture are numerous, and a native writer on its propagation observes at the outset of his treatise that he could not undertake so much as to name them all, and would therefore confine himself to a consideration of sixty three of the principal. Some of them are like trees, forty or fifty feet high, with culms eight inches in diameter at the root; others resemble pipestems through their length, graceful and slender as a magician's wand; while one kind presents a black, and another has a bright yellow skin. This plant may well be called useful, for it is applied by the Chinese to such a vast variety of purposes that they are puzzled to get along without it when they emigrate where it does not grow. The tender but tasteless shoots are cut for food, either boiled, pickled, or comfited, as the customer wishes. The seeds, too, furnish a farina suitable for cakes, and the Chinese have a proverb that the bamboo flowers chiefly in years of famine. The gnarled roots are carved into fantastic images of men, birds, monkeys, or monstrous perversions of animated nature; cut into lantern handles or canes, known in commerce as "whangees;" or turned by the lathe into oval sticks for worshipers to divine whether the gods will hear or refuse their petitions.

The tapering culms are used for all purposes to which poles can be applied in carrying, supporting, propelling, and measuring, by the porter, the boatman, and the carpenter in all cases where lightness, strength, and length are requisites. The joists of houses and the ribs of sails, the shafts of spears and the wattles of hurdles, the tubes of aqueducts and the rafters of roofs, the handles of umbrellas and the ribs of fans are all constructed of bamboo. The leaves are sewed upon cords in layers to make rain cloaks, swept into heaps for manure, matted into thatches, and used as wrappers in cooking rice dumplings. Cut into slivers of various sizes, the wood is worked into baskets and trays of every form and fancy, twisted into cables, plaited into awnings over boats, houses, and streets, and woven into mats for the scenery of the theater, the roofs of houses, and the casings of goods. The shavings even are picked into oakum and mixed with those of the rattan, to be stuffed into mattresses. The bamboo furnishes material for the bed and the couch, chop-sticks to use in eating, pipes for smoking, flutes, curtains to hang in the doorway, brooms, screens, stools, coops, stands, sofas, and other articles too numerous to mention, of household necessity and luxury. The mattress to lie on, the chair to sit upon, the table to dine from, the food to eat, and the fuel to cook it with are alike derived from it. The ferule to govern the pupil and the book he studies both originate here. The tapering tubes of the native organ and the dreaded instrument of the lictor, the skewer to pin the hair with, and the hat to screen the head, the paper to write on, the pencil to write with, and the cup to hold the pencils; the rule to measure lengths, the cup to gauge quantities, and the bucket to draw water; the bellows to blow the fire with and the tube to hold the match; the bird cage and the crab net, the life-preserver and the children's buoy, the fishpole and sumpitan, the water-wheel and eaves-trough, sedan, wheelbarrow, and handcart, with scores of machines and utensils, are one and all furnished or completed by this magnificent grass, the graceful beauty of which when growing is comparable to its varied usefulness when cut down.

China could hardly be governed without the constant application of the bamboo, nor could the people carry on their daily pursuits without it. It serves to embellish the garden of the patrician and shade the hamlet of the peasant; it composes the hedge which separates their grounds, assists in constructing tools to work their lands, and feeds the cattle which labor on them. The boatman and weaver find its slender poles indispensable to their trades, while there is nothing the artists paint so well on wares and embroideries. The tabasheer found in the internodes has its uses in native pharmacy, and the silicious cuticle furnishes the engraver a good surface for carving and polishing.

## THE METROPOLITAN MUSEUM OF ART.

The new building of the Metropolitan Museum of Art, in Central Park, New York city, was officially declared open to the public March 30. A large number of prominent citizens were present, including President Hayes and the Secretary of State. In accepting the building from the Park Department, the president of the museum spoke of the encouraging beginning that had been made in art collections, and said that the department devoted to industrial art promised to be soon filled. The industrial art schools had made a good beginning and were proving successful. The main address of the occasion was delivered by Joseph H. Choate, on the history and future plans of the museum. Mr. Choate said that the aim of the trustees was not to establish a mere cabinet of curiosities which should serve to kill time for the idle, but gradually to gather together a more or less complete collection of objects illustrative of the history of art in all its branches, from the earliest beginnings to the present time, which should serve not only for the instruction and entertainment of the people, but should also show to the students and artisans of every branch of industry in the high and acknowledged standards of form and of color, what the past had accomplished for them to imitate and excel. It was also a prominent feature of the plan, in which some progress has already been made, to establish a Museum of Industrial Art, as distinct from the beautiful in art, for the direct and practical instruction of artisans, showing the whole progress of development from the raw material, through every artistic process to the most highly wrought product of which art is capable.

The building now open forms one-twelfth of the plan of the grand structure proposed for the museum.

## AIDS FOR THE DEAF.

Dr. C. H. Thomas, of Philadelphia, has been making a careful study of audiphones, dentiphones, and other devices for helping the deaf to hear. As stated in a lecture before the Philadelphia County Medical Society, since published in the *Medical Times*, the objects sought in his investigations were:

(1) To demonstrate the principles upon which their action is founded; (2) to determine the practical value and range of use of these instruments; (3) to devise other and more convenient and less conspicuous forms of mechanism which might be substituted for them; (4) to improve the quality and increase the volume of the sound conveyed; (5) to discover new physiological and pathological facts relating to the functions of vocalization and hearing; and (6) to throw open to professional, and so to public, use the results gained, thus supplying data for further investigation and invention.

It appeared that both the audiphone and dentiphone depend for their action upon the principle of acoustics that solids—in this case in the form of thin plates—vibrate in unison with the sound waves produced in the air near them. In these instruments the vibrations are of sufficient force to be audible when conveyed to the internal ear through the medium of the teeth and cranial bones, independently of the ordinary channel of hearing—the transmission being direct in the audiphone and indirect through the conducting string in the dentiphone. In the audiphone not tension but the arched form is the condition essential to its proper action, for this form is that best adapted to impart the impact of sound waves against its convexity, which is then expended as thrust of the arch against the teeth, these forming one of its abutments.

To do away with conspicuousness and inconvenience of these instruments, Dr. Thomas made one in which the large receiving diaphragm was attached to a curved rod of wood or metal, like a pipe-stem. In this way the diaphragm was supported below the level of the face by the curved stem held firmly between the teeth, allowing the user to have his hands free and his face uncovered. In experimenting with different materials for diaphragms it was found that when substances lacking in resonance were used (such as celluloid and binder's board) flatness of tone resulted. Substances, which were over-resonant or over persistent in their vibrations (as vulcanite and ferrotype metal) yielded ringing or confused sounds. The quality needed is that possessed by good sounding boards, of instantly responding to contiguous sounds and maintaining them during their continuance, and also of instantly ceasing to vibrate upon the cessation of the causative sound. This right sort of elasticity of resonance, that capable of reproducing human voice tones in their purity, is possessed to a high degree by fuller's board (or press-board), which, when treated with shellac varnish and thoroughly dried, has proved not only far better than other paper or cardboards, but is also a great improvement upon the sheet metals or hard rubber, lacking the "reverberations" and "roaring sounds" of the latter, as they are described by different patients upon whom they have been tested. Besides, owing to its greater elasticity, it is less destructible than either these or the thin sheets of wood which otherwise answered the purpose, while its cost is but trivial.

The simplest instrument, one that excels either the audiphone or the dentiphone in the volume of sound transmitted, consists simply of a small rod of hard wood—a convenient size being about two feet long and a quarter of an inch thick—one end of which is placed against the teeth of the speaker, the other resting against or between the teeth of the person hard of hearing. If the speaker now articulates in a natural tone of voice, the vocal vibrations will be transmitted in great volume through the teeth and thence to the ears of the deaf person.

Later observations show that it will also convey the voice distinctly when placed against the forehead or other portions of the skull of the hearer. It will also convey perfectly audible speech from the skull of one to that of the other, or in its absence such sounds may be conveyed by simply bringing the heads themselves in contact. Again, instead of the speaker holding it against his teeth, he may place it against the upper part of his chest, when, upon using his voice, the sound will be conveyed as before, of course independently of the teeth of either person.

That these instruments are of great value in a considerable proportion of cases of deafness, Dr. Thomas thinks there is no reason to doubt, but there is, in his opinion, no just ground for the public belief that with their aid the deaf are enabled to hear as well as those with ordinary hearing. On the contrary, they supply but a very small fraction of normal hearing—much *less* than a *hundredth part.* The difference between normal hearing and that derived through these means is hardly less marked than that between sunlight and candle-light; nevertheless, this very small fraction is a priceless value in many cases, for to those who practically hear nothing without them, who sit in acoustic darkness, the gain is all the difference between nothing and something—scarcely less than infinity.

In view of certain strongly expressed statements which have obtained currency, the results to be derived from the use of the audiphone in deaf-mutism are likely to prove very disappointing. Repeated tests show that those who are able to hear with the aid of the audiphone hear *their own voices* perfectly without it; while those who are unable to hear their own voices without it can hear no other voice with it.

## SOME ELECTRICAL MEASUREMENTS OF ONE OF MR. EDISON'S HORSESHOE LAMPS.

BY HENRY MORTON, PH.D., ALFRED M. MAYER, PH.D., AND B. F. THOMAS, A.M., AT THE STEVENS INSTITUTE OF TECHNOLOGY.

Much has been written and said within the last few months on the subject of Mr. Edison's new horseshoe lamps, and with all the writing and saying there has been wonderfully little produced in the way of precise and reliable statement concerning the simple primary facts, a knowledge of which would give the means of estimating both the scientific and commercial status of this widely discussed invention.

It was, therefore, with great pleasure that the present writers found themselves, through the kindness of the SCIENTIFIC AMERICAN, placed in possession of one of these horseshoe lamps of recent construction.

To satisfy themselves as to the real facts of the case they soon made a series of careful measurements and determinations, and as the results of these are likely to interest others, they now put them in print for general benefit.

A further examination of other lamps would have been made at the same time had opportunity offered; but as a communication on this subject addressed to Mr. Edison did not evoke a reply, they are obliged to content themselves with the one lamp as a subject of experiment.

They would, however, here remark that the behavior of this lamp, under the tests, and the agreement of its results with information otherwise obtained, convince them that it is at least a fair specimen of the lamps of this form so far produced at Menlo Park.

The first object, on receiving the lamp, was to determine roughly what amount and character of electric current would be needed to operate it efficiently. With this view a number of cells of a small Grove's battery were set up, having each an active zinc surface of twenty square inches and a platinum surface of eighteen square inches.

The lamp being placed in the situation usually occupied by the standard burner in a Sugg's photometer, the battery was, cell by cell, thrown into circuit.

When ten cells had been introduced the horseshoe showed a dull red, with fifteen cells a bright red, with thirty-four cells the light of 1 candle was given, with forty cells the light of 4½ candles, and with forty-five cells the light of 9⅕ candles, and with forty-eight cells 16 candles.

Having thus determined what amount of electric current would be required for experiments, arrangements were made to measure accurately the resistance of horseshoe while in actual use and emitting different amounts of light. The resistance of this carbon thread at the ordinary temperature had been already determined as 123 ohms in the usual way, but it was presumed, as had been shown by Matthiessen (*Phil. Mag.*, xvi., 1858, pp. 220, 221), that this resistance would diminish with rise of temperature.

To measure the resistance under these circumstances the apparatus was arranged as follows: The current from the battery was divided into two branches, which traversed, in opposite directions, the two equal coils of a differential galvanometer. One branch then traversed the lamp, while the other passed through a set of adjustable resistances composed of German-silver wires stretched in the free air of the laboratory, to avoid heating. (Careful tests of these resistances showed that no sensible heating occurred under these circumstances.)

Matters being thus arranged, the resistances were adjusted until the galvanometer showed no deflection when the candle power of the lamp was taken repeatedly in the photometer, and the amount of resistance was noted.

These measurements were several times repeated, shifting the coils of the galvanometer and reversing the direction of the current.

The results so obtained were as follows:

| Resistances. | Condition of Loop. |
|---|---|
| 123 ohms | Cold. |
| 94 " | Orange light. |
| 83·7 " | $\frac{9}{10}$ candle. |
| 79·8 " | 5 " |
| 75 " | 18 " |

The photometric measurement was in all these cases taken with the carbon loop at right angles to the axis of the photometer, which was, of course, much in favor of the electric lamp. On turning the lamp round so as to bring the carbon loop with its plane parallel with the axis of the photometer, *i. e.*, the edge of the loop turned toward the photometer disk, the light was greatly diminished, so that it was reduced to almost one-third of what it was with the loop sideways to the photometer disk.

Having thus determined the resistance of the lamp when in actual use, it was next desirable to measure the quantity of the current flowing under the same conditions.

To do this the current from fifty cells of battery was passed through a tangent galvanometer as a mere check or indicator of variations, and then through a copper voltameter, *i. e.*, a jar containing solution of cupric sulphates with copper electrodes immersed, and then through the lamp, placed in the photometer.

Under these conditions it was found that during an hour the light gradually varied from about 16 candles at the beginning to about 14 candles at the end, making an average of about 15 candles, measured with side loop of toward disk.

The galvanometer during this time only showed a fall of half a degree in the deflection of the needle.

Carefully drying and weighing the copper electrodes, it was found that one had lost 1·0624 grammes.

Now, it is well known that a current of one weber takes up 0·00326 gramme of copper per second, which would make 1·1736 grammes in an hour; therefore the current in the present case must have been on the average $\frac{1 \cdot 0624}{1.1736} = 0 \cdot 905$ webers, or a little less than one weber.

Having thus obtained the resistance of the lamp when emitting a light of 15 candles, namely, 76 ohms, and the amount of current passing under the same conditions, namely, 0·905 weber, we have all the experimental data required for the determination of the energy transformed or expended in the lamp, expressed in foot pounds. For this we multiply together the square of the current, the resistance, the constant 0·737335 (which expresses the fraction of a foot pound involved in a current of one weber traversing a resistance of one ohm for one second), and the number of seconds in a minute. Thus, in the present case, we have $0 \cdot 905^2 = 0 \cdot 8125$, and $0 \cdot 8125 \times 76 \times 0 \cdot 737335 \times 60 = 2753 \cdot 76$ foot pounds.

Dividing these foot pounds per minute by the number of foot pounds per minute in a horse power, that is, 33,000, we have 0·08, that is, about eight one-hundredths or one-twelfth of a horse power as the energy expended in each lamp.

It would thus appear that with such lamps as this, one horse power of energy in the current would operate 12 lamps of the same resistance with an average candle power of 10 candles each,* or 120 candles in the aggregate.

Assuming that a Siemens or Brush machine were employed to generate the electric current, such a current would be obtained, as has been shown by numerous experiments, with a loss of about 40 per cent of the mechanical energy applied to the driving pulley of the machine. To operate these 12 lamps, therefore, we should have to apply more than one horse power to the pulley of the machine, so that when this loss in transformation had been encountered there should be one horse power of electric energy produced. This would call for 1⅔ horse power applied to the pulley of the dynamo-electric machine, by the steam engine.

To produce one horse power in a steam engine of the best construction about three pounds of coal per hour must be burned, and therefore for 1⅔ horse power 5 lb. of coal must be burned.

On the other hand one pound of gas coal will produce 5 cubic feet of gas, and will leave, besides, a large part of its weight in coke, to say nothing of other "residuals," which will represent practically about the difference in value between "steam making" and "gas making coal," so that it will not be unfair to take 5 lb. of gas coal as the equivalent of 5 lb. of steam coal.

These 5 lb. of gas coal will then yield 25 cubic feet of gas, which, if burned in five gas burners of the best construction, will give from 20 to 22 candles each, or 100 to 110 candles in the aggregate.

We have, then, the twelve Edison lamps producing 120 candles and the five gas burners producing 100 to 110 candles, with an equivalent expenditure of fuel.

If each apparatus and system could be worked with equal facility and economy, this would of course show *something* in favor of the electric light; but when in fact everything in this regard is against the electric light, which demands vastly more machinery, and that of a more delicate kind, requires more skillful management, shows more liability to disarrangement and waste, and presents an utter lack of the storage capacity which secures such a vast efficiency, convenience, and economy in gas, then we see that this relatively trifling economy disappears or ceases to have any controlling importance in the practical relations of the subject.

* The candle power being 15 candles in the best position, and 5 candles at right angles to this, the average or general illuminating power of the lamp is 10 candles.

## THE AMERICAN FISH CULTURAL ASSOCIATION.

The ninth annual meeting of the American Fish Cultural Association began in this city March 30. A large number of gentlemen interested in fish and fishing were present. The President, Mr. R. B. Roosevelt, read an interesting paper on hybrids. Mr. Seth Green contributed an account of his experience with California mountain trout, brook trout, and black bass at the State hatchery, with remarks on cray-fish and frogs.

Mr. Hugh D. McGovern submitted a short paper on the discovery made by him of a curious habit of eels. At the Brooklyn waterworks, among the wet moss growing on the crown of an arch over a waterway, 12 inches above the surface of the water, he found thousands of small eels, who seemed to live there, clinging to the moss as flies cling to the ceiling. The fact was important, as showing how this fish could move from water to water. To reach the moss these eels must have climbed up the 12 inches of wet wall above the surface of the water.

Mr. Livingston Stone, U. S. Assistant Commissioner of Fisheries, followed with an important paper on the transportation of live fish. Mr. James Annin gave an illustration of trout stripping in artificial propagation, using a number of male and female trout from his ponds on Long Island. Mr. Charles Hallock gave a description of Labrador fishing, and Mr G. Lamphear read a short but valuable paper comparing the statistics of Fulton Fish Market for 1878 and 1879. His figures showed that 34,276,666 pounds of fish were sold in Fulton Market during the year 1879-'80, an increase of 646,700 pounds over the previous year. In addition, 1,509,561 mackerel had been sold and 291,845 shad.

The next day Prof. Brooks, of Johns Hopkins University, described the propagation of the oyster; and Prof. Atwater, of Wesleyan College, read a paper on the nutritive qualities of various kinds of fish. Prof. Brooks believes that the oysters of the Chesapeake do not breed in the same way as European oysters do; that the sexes are separate; and that to propagate oysters artificially the males and females should be chopped up together and thrown into the water, so as to thoroughly mix the eggs and milt.

In this way, he thinks, the oyster might be propagated with profit, using for the purpose small ponds. All this learned trifling will be very amusing to the practical oystermen of Connecticut, who, for a score of years, have successfully propagated oysters by the square mile. Their trouble is not to get an abundance of young oysters. At certain easily recognized times the Sound waters swarm with them, ready to attach themselves to any clean "stools" presented to them. The real trouble is to defend the oyster farmer's acres of partially grown oysters from the swarms of star-fish and other marine vermin which prey upon them; for which defensive work steam dredging seems to be the only economical and certain resource.

## PHOTO-ENGRAVING.

In general terms the process of producing engravings or types for printing by photography, consists, first, in making a sharp negative of the picture to be engraved; second, in the photographic printing of a sheet of sensitized gelatine by means of the negative; third, the development of the printed lines upon the surface of the gelatine by water; and fourth, the casting of a copy of the developed gelatine sheet in metal, the metal so produced being used for printing on the press in the ordinary manner. All this is very simple, and in the hands of experienced and skilled persons very beautiful examples of printing plates, having all the fineness and artistic effect of superior hand engraved work, may be produced.

Among the earliest and most extensive efforts to introduce this process commercially were those of Mr. John C. Moss, of this city, to whose persevering labors the public is chiefly indebted for the successful establishment of the new industry in this country.

Mr. Moss has finally concluded to give the public the benefits of all his latest improvements in this line, by the organization of a new corporation known as "The Moss Engraving Company," whose first announcement will be found in our advertising columns. Every description of engraving and printing plates is done in a superior manner by the company promptly on very moderate terms. The Moss process has been used on the SCIENTIFIC AMERICAN, especially on our SUPPLEMENT, for several years past, and we therefore speak from experimental knowledge when we say that it is good and reliable. The motto of Mr. Moss's company is "The best work at low prices, always on time." In all our past experience with Mr. Moss, although we have given him many perplexing jobs, we have never known him to fail in carrying out the above motto. The Moss Engraving Company has a large and splendid establishment at 435 Pearl St., New York, which is fitted up in every department with the latest and best appliances for the execution of good work. It deserves and will doubtless command an extensive patronage.

## THE NEW YORK EXHIBITION OF 1883.

A bill to provide for celebrating the one hundredth anniversary of the treaty of peace and the recognition of American independence by holding an International Exhibition of arts, manufactures, etc., in New York, in 1883, passed the Senate March 31. It incorporates the United States International Exhibition, composed of well known New York gentlemen, whose official functions are to continue until the close of the Exhibition. It will be their duty to fix the date of the Exhibition, make the needed preparations for it on a site within the corporate limits of the city of New York, and to superintend the Exhibition during its progress. The bill provides further that the corporation shall cease to exist on or before January 1, 1885. Congress may at any time alter or repeal the act, and the United States are not to be liable for any of the acts or representations of the promoters of the enterprise. Not less than $1,000,000 must be subscribed, and not less than 10 per centum thereof must be paid in before the corporation may do any corporate act other than organize, and no part of the capital stock or assets is to be withdrawn, refunded, or divided among the stockholders until all the debts are fully discharged.

### Glucose Manufacture.

There appears to be quite a furor in the West in connection with the manufacture of glucose from corn. A large number of factories are being set up; one at Chicago, it is said, will have a capacity of 20,000 bushels a day. A bushel of corn produces 30 pounds of glucose (grape sugar) or 3 gallons of sirup. The sugar costs 2 cents a pound, the corn selling at 40 cents a bushel.