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A FIELD FOR INVENTION.

With the utilization of every new natural product there is required a more or less extensive group of new machines and implements. It is not surprising, therefore, that with the increasing attention paid to the American agave as a fiber plant there should come a demand for new implements and appliances to be used in securing and cleaning the fiber.

The plant (*Agave americana*) is described as a member of the amaryllis family. It is put to a great variety of uses by the natives of Southern Mexico and Yucatan. A gentleman commercially interested in the development of this plant says that a coarse thread has long been made of the fiber. The disagreeable gummy substance which forms the bulk of the thick leaves has peculiar saponaceous properties, which has caused the agave to be known sometimes as the soap plant. When the leaf is split longitudinally the surface of the hollow center is found to be so thickly covered with fine particles of silica that it makes an excellent hone for sharpening knives, razors, and other edged tools. There are quite a number of varieties of the agave. In arid soils and on the uplands its leaves, in a cluster around a stalk which reaches but a few inches above the ground, are often not more than a foot or two feet long, very thick, and six to eight inches broad at the base. Other varieties are known as Bromelia, Henequin, silk grass, Ixtle. On the lowlands, especially in Yucatan, Honduras, and Nicaragua, where the pita grows most luxuriantly, the leaves are narrow and thin, containing a smaller amount of gum and sap, and are sometimes sixteen feet long, the average length being ten feet. The leaves continue green and increase in length during nearly the entire life of the plant, which varies from ten to seventy years. When the plant approaches maturity a flower stalk shoots up from the center of the leaf cluster to a height of about thirty feet. The plant then flowers and dies. Experiments have shown that the fiber of the finest varieties is so finely divisible that it can be advantageously woven with silk. It bleaches without loss of strength, and takes dyes as perfectly as any fiber known. It has also been successfully woven with cotton and wool. The uses to which the natives have put the fiber are the manufacture of bowstrings, nets, ropes, mats, sacking, fish-lines, hammocks, and a few coarse garments. They obtain the fiber by the very primitive method of gathering the leaves and pounding it out between stones and "whipping" it to cleanse it. Yet prepared in this rough way the product possesses a strength and durability much greater than manila hemp. When combed out with a comb or hackles it has been pronounced equal to the best Russian flax. From the different varieties of this plant fibers of all the different grades can be obtained from Mexico and Central America sufficient to supply the whole world. Exports from Yucatan to Europe have been found very profitable, although the quantity exported is yet small. An American company has recently established a mill with machinery for preparing the fiber not far from Vera Cruz, but the yellow fever which has prevailed at that port has prevented the company from securing the necessary labor and work has been unnecessarily delayed.

Another company has been formed for the development of this and other fiber plants in Honduras, having secured for this purpose a vast tract of country on the Caribbean coast. The Panama *Star and Herald* of recent date says:

"A sample of 'pita' (*Bromelia febrista*) was lately sent from Belize to New Orleans. Experiments prove it to possess an exceeding strong and valuable fiber. The sample, which was of a yellowish tint, was bleached by the Roberts Kendal process to a snowy whiteness, and now presents the appearance of fine and delicate white silk. As this valuable fiber can now be extracted from its pulpy covering and bleached perfectly white without loss of material, and at the same time very expeditiously, it bids fair to become an important article of commerce between the Central American States and the United States. The production of this staple is unlimited in Central America, and its cultivation should be largely encouraged."

Special efforts are being made to substitute the cultivation of this plant in the French island of Mauritius, in place of sugar and other crops which have failed. A planter appeals to the Paris correspondent of the *World* to set the problem of inventing a machine for preparing the fiber before our "clever American inventors." He says: "The man who does that will not only powerfully contribute to the prosperity of our little island, but—which is far better to a practical mind—he will at the same time most certainly make his own fortune."

The pita or agave fiber brings in London an average price of $150 a ton.

THE MORAL INFLUENCE OF THE TELEGRAPH.

"One touch of nature makes the whole world kin."

Men have accepted this saying in a broader sense than Shakespeare dreamed. But for a world-wide manifestation of its truth, for a signal demonstration of the kinship of humanity, men have had to wait until science and invention had brought all nations into something like instant communication. It was the touch of the telegraph key, a favorable opportunity being presented, that welded human sympathy and made possible its manifestation in a common, universal, simultaneous heart throb.

We have just seen the civilized world gathered as one family around a common sick bed, hope and fear alternately fluctuating in unison the world over as hopeful or alarming bulletins passed with electric pulsations over the continents and under the seas. And at last, on the same day, the nations stand in sympathethic mourning: a spectacle unparalled in history; a spectacle impossible on so grand a scale before, and indicative of a day when science shall have so blended, interwoven, and unified human thoughts and interests that the feeling of universal kinship shall be, not a spasmodic outburst of occasional emotion, but constant and controlling, the usual, everyday, abiding feeling of all men toward all men.

THE LESSON OF MR. GARFIELD'S YOUTH.

Nothing that Mr. Garfield ever did will mark so grand an issue, or contribute so much to emphasize the new era upon which humanity has entered, as his dying. It was everything that he did and attempted in life, however, and especially the manner of his doing and attempting, that made it possible for his death to be one of the notable deaths of history.

After all, there is nothing that the world esteems so highly as broad, forceful, generous, genuine manliness; and it was because Mr. Garfield had acquitted himself nobly as a man in his long and arduous struggle with life and death that the best men and women of all nations lamented the untimely ending of his career. It is true that the exigencies of political life had resulted in his achievement of one of the most conspicuous and honorable positions among men; but neither that nor the atrocity of the crime which cost him his life could alone have awakened such national and international sympathy and interest as we have just witnessed. It was the manliness of the man, not the dignity of his station, that the world regarded.

It is a question for the rising generation to consider: How and under what influences the manliness of Mr. Garfield was developed and demonstrated.

Nature's first and best gift to man he had at birth—a strong body, well set up, and endowed with vigorous and healthy instincts. Thus, in the highest sense, he was well born. Beyond this his early prospects were certainly not brilliant. His early home was a rude, single-roomed log house in the wilderness. Orphaned in his second year by the death of his father, the poverty he was born to was intensified and saddened by the lack of a father's care and guidance. For fourteen years the log house was his home, and hard work his chief educator. The family circumstances improved slowly, and the older boys built for their mother a small frame house with three rooms on the ground and two under the roof. Here was young Garfield's home for two or three years more, during which he earned something at odd jobs among the neighboring farmers.

At this time his ambition was to be a sailor on the lake. His ambition was not gratified, and he hired himself to a cousin at ten dollars a month to drive the horses of a canal boat. He was now seventeen years old, an age at which most boys regard their education complete or hopeless of attainment. His, so far as books went, had not begun.

At eighteen a fit of sickness kept him in bed for months. To divert him from his intention to be a sailor his mother persuaded him to begin to prepare himself to be a country school teacher. Then, if he still desired to, he could sail summers and teach winters, and so be earning something all the time. He had no money, but by working with a carpenter at odd hours and Saturdays he earned enough to buy books and pay his board. In the winter he taught a district school. At twenty he pluckily decided to prepare for college, counting that he could work his way through in ten or twelve years.

At the age of twenty-three he was ready to go to college, and had saved enough money while teaching to pay his way for the first year. By borrowing money on a policy of insurance on his life he was able to complete the rest of his college course without the anticipated delays, graduating at the age of twenty five. For the next five years he taught, reading law meantime, and then entered upon political life in the Ohio Legislature. In 1861 he was admitted to the bar, and in the winter of the same year, in response to the call for volunteers, he abandoned his legal plans and entered the army.

By this time he had developed those traits of character and a capacity for painstaking effort and hard work which made his promotion comparatively rapid. In 1863, at the age of thirty-two, he resigned a major-general's commission for a seat in the U. S. House of Representatives upon the urgent solicitations of President Lincoln. After seventeen years of diligent service in the House he was chosen to represent his State in the Senate, but before taking his seat he was elected President of the United States.

It is impossible here to touch upon those details of character and circumstance which fittingly illustrate the nature, severity, and grand success of the struggle upward to be seen in the life we have so baldly outlined. The lessons to be learned from such a life cannot be too strongly commended to the young, whether born to poverty or wealth.

The early life of poverty and hard work which young Garfield inherited undoubtedly developed much of the force and manliness which he displayed in after life, and saved him from many of the hinderances and temptations incident to inherited riches and social position; but it must not be forgotten that the vigorous body and passionate nature, which he disciplined and made the basis of a pure and lovable manhood, carried and involved moral hazards not less than those of wealth.

He overcame the disadvantages of early surroundings, as thousands of other young men have, simply because he willed to and was willing to pay the price of personal and social advancement in hard and patient effort, integrity of purpose, and a readiness to do his best in everything that might fall to him to do. He made opportunities to work where he found none open, and when responsibilities were laid upon him by his townsmen or countrymen he met them bravely and studied hard to fit himself for the duties to be performed. Above all, he sought to prove himself in all things worthy of his own self-respect. There was one man, he said, whose good opinion he desired before all others, for that man he had to eat with, and work with, and sleep with; his name was James Garfield.

There is not a young mechanic who reads these lines, however humble his position, however scanty his opportunities, who cannot rise in position, knowledge, and personal worth by the same means. He may not gain great learning, great wealth, or fame by the effort, but he cannot fail to gain what is worth more than all these in themselves—a higher, truer, and more enjoyable manhood.

The failures of some men are grander than the successes of others. And while Mr. Garfield's life, tried even by conventional standards, was a splendid success in the end, it should not be forgotten that during most of his life sudden death would have found him in the ranks of the worthily inconspicuous, with those "who failed on earth great men to be, though better than the men who wore the crown."

It was a sincere, purposeful, kindly, and laborious life that made it possible for the close of his life to be signally conspicuous and his memory revered. Any youth who will can accomplish the life, though kind Fortune may spare him the pain and the glory of so tragic a termination of it.

THE HOLY WELL AT MECCA.

When Mohammed captured Mecca, which had been regarded for ages by his countrymen as a place of peculiar sanctity, he interfered with the worship of the Black Stone (probably a meteorite) which the angels had brought from heaven, and of the Zemzem, or Holy Well of Hagar, only so far as to suppress the ancient polytheistic rites. This well is close beside the Caaba or Square House, the chief sanctuary of the Mohammedan world.

The princes of Islam maintain at Mecca keepers of the Holy Well, who annually supply them with water to be used on great occasions and in great emergencies, as when stricken with disease. Every pilgrim to Mecca—and thousands come thither from all countries—visits the well and is purified by drinking the water or pouring it over his person, or both. The water is described as unpleasant in taste and cathartic in effect—qualities which are now to be accounted for without recourse to miracle.

With Occidental irreverence the British Consul-General at Jeddah has sent a bottle of the water to the Royal College of Chemistry at South Kensington to be analyzed. Dr. E. Frankland, in his report of the analysis, says that the water is of the most abominable character. "In fact, it is sewage more than seven times as concentrated as London sewage, and it contains no less than 579 grains of solid matters per gallon. Knowing the composition of this water, and the mode of propagation of Asiatic cholera by excrementitious matters, it is not to be wondered at that outbreaks of this disease should often occur among pilgrims to Mecca, while it would scarcely be possible to provide a more effective means for the distribution of cholera poison throughout Mohammedan countries."

It would be interesting to know the composition of the waters of other holy wells of which Islam has by no means the monopoly.

STEAM BOILER NOTES.

A foreign correspondent wishes to know why locomotive boilers work satisfactorily with so much less steam room per horse power than is usually found in marine boilers. He cites good English practice to show that fully three-fourths of a cubic foot of steam room is allowed per indicated horse power in marine boilers, while only one-eighth to one-twelfth of a cubic foot is allowed in locomotive boilers, and asks, To what shall the steam room be proportioned, if not to the indicated horse power? The answer to the first part of the inquiry is, the greater pressure relatively to the power developed in the locomotive. But the subject does not seem to admit of such categorical treatment as our correspondent seems to indicate by the tone of the query. Perhaps an empirical rule might be made from a sufficient number of experiments, embracing most of the conditions of modern practice, but the factors of the problem include everything that affects the rate of evaporation and the free escape of the steam from the surface of the boiler water and the steam pressure.

The efficiency of the heating surfaces, the ratio of grate to heating surface, the rate of combustion, the circulation of the water, the quantity of water and its depth upon a unit of heating surface, the surface area from which the steam escapes into the steam space, the pressure upon that surface relatively to the power developed by the engine; and inasmuch as the number and volume of the cylinder charges for cut-off engines are determined, in some degree, by the grade of expansion for a given power, the point of cutting off enters with the other numerous factors into the problem.

An illustration in point is of a small winding engine the boiler for which was, for special reasons, made small and upright, and intended to work at about one hundred and fifty pounds of steam, but it was thought best to test the machinery at a lower pressure than the design contemplated; so, in order to get full speed, it was adjusted to work steam nearly full stroke of the piston. The foaming and priming of the water was, however, so bad as to prevent the use of the engines under these conditions; but at the higher pressure, and with a correspondingly high grade of expansion, there was no further trouble from foaming. It will probably occur to the inquirer that locomotives are worked at all grades of expansion and at considerable variations of pressure, but a little thought will lead to a correct appreciation of the difference in causes that produce priming in different types of boilers.

As a general proposition, it may be said that, other things being equal, high-pressure boilers require less steam room per unit of power than low-pressure ones.

The explosion of the boiler in Card & Co.'s sawmill, near Monroe, Jasper County, Iowa, resulted in the instant death of E. N. Garnant and the fatal injury of M. L. Card, on the 17th of September.

The locomotive of a freight train between Chetopa, Kansas, and Parsons, on the Missouri Pacific road, exploded September 21, wrecking the engine and a dozen cars, killing Geo. Adams, engineer; Simon Bailey, fireman; John Denny, and a man named O'Neil. One of the victims was blown two hundred yards and terribly mangled. Bailey's head was blown off and could not be found.

A boiler explosion occurred at the mines of the Dunbar Furnace Company, Dunbar, Fayette county, Pa., on the 16th of September. James McDonald, fireman, was fatally, and George McAnally dangerously injured, and several others were slightly hurt.

The boiler of a thrashing machine exploded at Thurlow, Ont., Friday night, September 23, killing Andrew Lloyd, Messrs. Malcolm and Anson, and Miss Caldwell, and seriously injuring three others.

The method of feeding water to steam boilers has fully kept pace with other improvements in steam engineering. The plan of serving cold water to locomotive boilers, which prevailed only a few years ago, is now a thing of the past, greatly to the advantage of the boilers. The injector in its early days was not understood, was not reliable, and it was therefore shunned by careful engineers as a boiler feeder. The difficulty has now been fully met and overcome by the Korting Double Tube Injectors, which are shown in full lines at the American Institute Exhibition. They are made to work at all pressures, and to *lift* hot or cold water and deliver it at the rate of from 80 to 4,000 gallons per hour. They are compact, self contained, and easily set up by any steam fitter, and they will start readily, operated by a single handle, without any adjustment for variations in steam pressure. The boilers of the Institute are being fed with one of them, which any one, no matter how inexperienced, can learn to put in motion and regulate while "you wait."

These fine goods, with a line of Straightway check valves are shown by A. Aller, of 109 Liberty street, New York.

Exhibition of Smoke-preventing Apparatus.

The Department of State at Washington is in receipt of a communication from the British Legation, relative to the exhibition to be held in London of apparatus of all kinds devised to prevent smoke and to consume smokeless as well as other kinds of fuel. The exhibition will be open from October 24 to 26 inclusive, and the Department has been further informed by the British Charge d'Affairs at Washington that the committee has decided to consider favorably all applications from foreign exhibitors throughout the whole of September, and they will, as far as possible, reserve space for late exhibits, so that none may be excluded.

American Awards at the Geographical Exhibition in Venice.

The following awards were made to the American Section of the Geographical Congress:

Group First.—A letter of distinction to the engineering department for topographic and hydrographic surveys of the Northern lakes, the St. Lawrence and Mississippi river internal improvements, maps of battle fields, and other geographical works; also a letter of distinction for the geographical surveys in charge of Captain Wheeler for accuracy in topographical surveys west of the one hundredth meridian.

Group Second.—A letter of distinction for the best model of the Gulf of Mexico and for the sea soundings of Commander Sigsby and other officers of the navy; also a letter of distinction for the report of Commander Green on international longitudes, hydrographical charts, American ephemerides, a publication on the solar eclipse of 1878, and other papers by naval observers; a diploma of honor of the first class for a list of lighthouses, bound sets of charts, and other publications; a letter of distinction to the engineers of the Department of Geological Natural History and for the examination for Clarence King's exploration along the fortieth parallel; also a letter of distinction for Captain Wheeler's geographical surveys and works on natural history west of the Mississippi; a similar letter to the Signal Service Department and Weather Bureau for an extended series of tidal weather maps.

Group Sixth.—A letter of distinction to the Post Office Department for a series of announcements and other publications; a diploma of honor of the second class to the Agricultural Commission, and for reports on forestry by Professor Hough; honorable mention is made of the statistics of the Treasury Department for their quarterly and other reports.

Group Eighth.—A letter of distinction to the Engineer Department for Captain Wesscher's exploration and survey west of the Mississippi.

ELECTRO-METALLURGY.

ELECTROTYPY.

In taking impressions or moulds of *under-cut* or highly-wrought work it is necessary to use a flexible substance to admit of separating the mould and model without injury to either. For these purposes gelatine—or gelatine and glue or sirup—and gutta percha are employed. Glue (of the finest quality) or gelatin is softened by soaking over night in cold water, then removed from the water and dissolved by aid of heat in a quantity of pure glycerine equal to the dry glue taken. This mixture is kept over the water bath for several hours, and is then ready to pour over the warm, well-oiled model. After standing for several hours, or until thoroughly cooled, it may be removed from the model by careful manipulation. When removed it is dipped repeatedly in a solution of one ounce chromic acid in a quart of water, each time being exposed to strong sunlight (every part), which renders the surface waterproof and non-absorbent. When dry the surface may be metallized, and a strong current with a large anode used at first in the bath. With such work much care is necessary to exclude air bubbles from the deep-wrought portions.

In using gutta percha the moulding operation is conducted either by press, by hand, or in a stove.

By hand.—After purification in boiling water, plates of various thicknesses or lumps are formed.

A quantity sufficient for the intended mould is cut and put into cold water, which is gradually heated until the gutta percha is soft enough to be kneaded like dough. After having pulled the gutta percha in every direction the edges are turned in so as to form a kind of half ball, the smooth convex side is applied to the middle of the model, then it is spread over and forced to penetrate the details of the object. The kneading is continued as long as the material remains sufficiently soft, when it is allowed to cool somewhat. While at a temperature of about 80° Fah. it is separated from the model and dipped into cold water to harden, and may then be handled without danger of impairing its accuracy.

With some models it is preferable to heat the gutta percha in a copper dish with constant stirring until it becomes a semi-fluid paste. This is poured over the pattern previously placed in an iron ring. After a few minutes it may be kneaded in with wet or oiled fingers until it scarcely yields to pressure. In removing the mould from the pattern all useless parts, especially those which have passed under the pattern and bind it, must be first removed. Then the proper position and shape of the covered pattern must be ascertained so as not to break the model or tear the gutta percha.

For moulding by sinking or kneading the following composition is preferable to pure gutta percha: Gutta percha, 2 parts; linseed oil, 1 part. Heat the oil in a copper vessel to about 212° Fah., then gradually stir in the gutta percha cut fine. When the whole is in a pasty form and begins to swell up with the production of thick fumes, throw the contents of the kettle into a large volume of cold water, where, without loss of time, the paste must be kneaded, and, while still hot, rolled upon a slab of marble and passed between mediumly warm rollers.

Gutta percha may be used an indefinite length of time.

In moulding by press.—After the object has been coated with plumbago or tallow it is put square and firm upon the table of a screw press, and surrounded with a frame or ring of iron a little higher than the most raised portions of the model. A piece of gutta percha at least the thickness of the pattern is cut so as to fit the ring or frame of iron, and then heated on one of its faces only before a bright fire. When about two-thirds of its thickness has been softened it is placed, soft portion downward, in the iron ring or frame, and the whole covered with a block of metal exactly fitting. It is put under light pressure at first, the force being increased as the gutta percha becomes harder or more resisting.

Stone moulding is resorted to with models the brittleness of which renders them liable to injury when pressure is applied —plaster of Paris, alabaster, marble, etc. The object is placed upon a plate of iron or earthenware, a ball of gutta percha is placed on the middle of the object, and the whole is set in an oven where the temperature is just sufficient to melt the gutta percha, which, as it softens, penetrates all the details; when it has sunk completely it is removed from the oven and allowed to cool off until it retains just enough elasticity to be separated from the pattern.

Gutta percha is entirely insoluble in water, weak acids, or acid salts. When moulded it is prepared for the deposition of metal by being coated with a film of graphite or bronze powder.

Grass Fired by a Meteorite.

A fire ball was seen to fall at Springfield, Ill, about 10 o'clock of the night of September 21. It resembled in appearance an electric light, and it fell with a rushing sound like that of a sky rocket. The dry grass was set on fire where it struck, and the grass burned to a wooden sidewalk connecting with fences and wooden buildings, before the fire could be extinguished with water.