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ACCURATE WORKMANSHIP.

It has been truly said that no work of human hands is perfect, and that though we may strive to our utmost to secure entire accuracy in workmanship, it will be forever beyond our reach. On the other hand it has often been asserted that the works of Nature are perfect, that they are far superior in every respect to human handiwork, and upon this assumption many a moral homily has been based.

That this proposition has been so generally accepted, affords a forcible instance of the readiness of mankind to accept as truth whatever is presented to them as a generalization. Formulate an idea and lay it down as a proposition, and nine out of ten will accept it as true, because five of the nine will lack the power to detect its falsity, and the remaining four will have too much indisposition to the mental labor involved in logical reasoning, to test whether the proposition be correct or otherwise. About four tenths of the human race are mentally lazy, five tenths are so credulous as to accept anything as a principle which is clothed in the garb of a generalization, and certainly not more than one tenth think for themselves.

Only in one sense are the works of nature more perfect than the works of man. In their adaptation of complicated means to ends, they are for the most part unquestionably above any human production. Yet even on this point there is much illogical inference. We once heard a Professor of Anatomy, in lecturing on the hand, speak of its complicated structure and its marvellous machinery, as one of the greatest evidences of a beneficent design pervading creation. Five minutes later he spoke of the carpal bones and their investing ligaments as being peculiarly liable, on account of their structure, to obstinate and deep seated inflammation when injured; but he did not adduce this as an evidence of a beneficent design. Yet surely there is as much reason to believe that all the effects of a peculiar construction are designed as that one of them is.

But turning our attention to the mechanics of nature, we find that, so far as perfection in form is concerned, human work may stand well in a comparison. It has been said that the types of all the forms employed in the arts are found in Nature; but if we admit this, we shall find on examination that these types are in the majority of instances extremely imperfect. Nowhere in Nature is found a perfect sphere, a perfect cube, a perfect square or prism. We look in vain for perfect cylinders, for absolutely straight stems of trees, for filaments perfectly uniform in size throughout. No individual of any species exactly resembles any other, and even the elementary parts of animal and vegetable structures differ from each other. The anatomist might dissect a thousand subjects without finding two femoral bones that would not differ in some way; and even in the same body the corresponding parts on opposite sides are often found to be somewhat different. So much for the uniformity and mechanical accuracy of natural things. If man's mechanical productions are not perfect, they excel in the particulars named.

There are many practical difficulties in securing accuracy in construction, but we shall find that they may be placed in two categories. The first category includes our own imperfections. These are nature's imperfections. Our vision is so limited that, in very fine work, we must supplement it by the magnifying glass and the microscope. The command of mind over muscle is so far from absolute that, even when the former has been trained to command and the latter to obey through long years of practice, the control of the one and the obedience of the other are still defective. Eye and ear and touch, all tell us falsehoods and never more than approximate to truth.

The second category is found in the lack of rigidity in the materials which we use. Even the diamond, the hardest substance known to man, is elastic and changes its size with every variation of temperature. Nothing we can touch is precisely alike under any two different sets of circumstances. Some things change by absorbing or losing moisture. Others when once changed never resume their original form. So mobile is matter, that a toy cart drawn by a baby hand over a stone floor will generate vibrations the waves of which flow along through the granite, through the legs of the most solid workbench, and set the particles of the material in hand dancing to an entirely new step. All matter throughout the universe, though some of it may seem to the superficial eye to be at rest, is in constant agitation. While the large masses are whirling through space with inconceivable velocity, the smaller masses—molecules—are each moving through what may be—for all we know—even wider orbits in proportion to their size, than those of the sun, moon and stars. The slightest external change is followed by a change in their movements. A man goes on board an ocean steamer with a shingle nail in his pocket, and instantly the compass needle in the binnacle feels the fact, and varies somewhat in its indications. Change, change, is written upon each and every atom of the universe. Nothing shall be constant, nothing shall be uniform. The combined intelligence of mankind cannot command a force strong enough to chain one infinitesimal atom. Endless variety—nothing stable—this is a fiat from which we vainly strive to escape, and to which we cannot find one solitary exception.

HIGH AND LOW STEAM.

An error prevails somewhat extensively among steam users who have not studied the theoretical principles of steam generation, which we propose briefly to correct. It is erroneously supposed that high steam contains much more heat than low steam, and that on this account it will be more efficient in heating buildings and driving engines. We would say to those who entertain this notion that a pound of steam at any pressure contains practically a constant number of heat units. In other words, a pound of steam at either low or high pressure will raise the temperature of a given quantity of water the same number of degrees. This has been thoroughly proved by experiment, the variations from the law being too small for notice in common practice.

It is only the sensible heat of steam which is measured by the thermometer, (the temperature), that increases under pressure, and this increases only as the latent heat diminishes so that the sum of the two is always a constant.

These being facts, it is certainly folly to incur the greater danger of high steam for heating buildings. The low steam will, pound for pound, both in evaporation and consumption, heat just as many cubic feet of air space as high steam.

But although the theoretical working power of steam is measured by the heat it contains, in practice there is a gain in using high steam for propelling engines. Steam generated under pressure is capable of expanding more than low steam, and as this expansive power can be made to perform work, there is a practical economy in using as high pressures as safety will admit; not that the steam contains the power to do more work, but that we can utilize a larger portion—a small proportion at best—of its working capacity. It follows that it takes no more fuel to produce a pound of high steam than a pound of low steam. There is, however, with high temperatures resulting from increased pressure, a greater loss through radiation, to make up for which more fuel will be consumed.

It may be asked: If these things be so, why, in testing the evaporative power of boilers, is it recommended to evaporate under atmospheric pressure? Why will not one pressure do as well as another, provided the proper allowance for radiation is made? We answer that it will make no difference at what pressure we make the test, provided we can keep the pressure uniform. There is usually more or less difficulty in maintaining a constant high pressure, while, with free discharge of steam, there is none in maintaining the atmospheric pressure. It is only for convenience sake that atmospheric pressure is considered by some as more desirable.

In conclusion, we would say that the heat which passes from boilers in the steam generated is the true measure of their working capacity. The heat which passes out in water mechanically suspended does no work. It is only then when the true proportion of the mechanically suspended water is determined that the working capacity of boilers is properly tested.

THE LATE JAMES FISK, JR.

The man whose name heads this paragraph achieved, in a very short time, a prominence in the railway and financial world that has given an interest to the circumstances of his death which his personal merits and character would never have elicited from the public. Our columns are no place for condoning the faults of the deceased by expatiating on his amiability and generosity, nor for homiletics on the scandalous and flagitious vices of which he and, we regret to say, his popularity were very largely composed. Cowardly and wanton assassination has cut him off in the midst of all his notoriety, wealth and pleasures; and New York, amidst the many black deeds that have been committed within her borders, has no greater stain upon her reputation than the murder which has just been committed.

It is difficult to account for the continued existence, in our midst, of so large a number of persons ready to commit the darkest and most violent crimes upon little or no provocation. The absurd and cowardly habit of carrying concealed weapons has much to answer for in this particular, and the great quantity of intoxicating liquors consumed by a large portion of our population is the chief cause for their production and use on the slightest pretext. But the bravado of the murderer obtains its principal stimulus from the fact that the law is full of uncertainties, that political influence and money have a protective power even under the shadow of the gallows, that, against the most adverse circumstances, a long delay is sure to be accorded to the guilty, and that thus the world may cease to take an interest in the matter, as we have often seen occur in our rapidly changing and effervescent state of public opinion. We are justified in these statements by the events which followed the crime of Foster, who murdered Mr. Putnam on the latter's alighting from a street car. The popular indignation against the dastardly perpetrator of this outrage was very great, and inquest, trial, and condemnation followed its committal with a promptitude which is an integral part of the majesty of the law, and the chief means of prevention of crime. But before the day of execution arrived, the culprit was reprieved by one of the hole-and-corner legal processes which discredit the whole American nation and people; and before long the murderer, the object of as righteous an indignation as ever animated the public mind, will probably be let loose to prey once more on society. It is by such precedents as that of Foster that crimes like that of Stokes are created and encouraged; and it may require the commission of a few dozen more outrageous villanies to get the popular sentiment on this subject into a condition more permanent and beneficial than a mere temporary frenzy.

It is quite time that some trustworthy system of administration of the laws was introduced into our social affairs. At present, with a vehement outburst of indignation at the time of the crime, followed by utter indifference to the sequel, and with political intrigue, corrupt judges, and monetary influence as complications, the process of the law is less certain and less logical than are the freaks of a gambler's fortune. If the wicked act which we now deplore does something to awaken the people, these lines will not have been written, and James Fisk, Jr., will not have died, entirely in vain.

TEACH THE CHILDREN TO DRAW.

Teach a child first to read; not merely to speak words in the order in which they occur, but to read understandingly, slowly, and carefully for ideas. Next teach him how to use numbers in arithmetical calculations, and show him that in all the business of life, in all its study, in all its science, the statement of facts in figures is the most important element. Then teach him to draw. You may stop your teaching right there, if you will, and rest confident that, if the boy thus taught has any disposition to mental acquisition, he will find a way to make it. Not that further good teaching will not greatly assist his progress, but that the acquirements named form a solid foundation upon which he *may* and, if his tastes are for learning, *will* build a noble superstructure.

The fundamental value of the two first elements of education named are generally appreciated by educators in this country; the third is only beginning to be appreciated. In the Boston public schools, drawing is now to be made a part of the course of study. The teachers are, we are told, to be taught how to teach drawing, at least such of them as have not the requisite knowledge. This accomplishment should be a part of every teacher's legal qualifications for employment in a public school, not merely because it enables him to give lessons in drawing, but because in the present age the power to draw rapidly and well is a means for the expression of ideas scarcely inferior to language; nay, without which it is impossible to convey certain ideas at all, in the absence of the objects delineated by the skilled pencil of the draftsman.

We cannot carry with us in our pockets geological and mineralogical cabinets, collections of shells and plants, museums of machinery and galleries of art. The power to represent such things as we cannot have at hand in talking about them has become essential to every one who aspires to anything like eminence in science or the arts. Even in walks of life not intimately connected with science and art, (daily becoming fewer) the power to draw is one that often saves time and money.

We speak, of course, more particularly of free hand drawing. Mechanical or geometrical drawing, as it is called, pertains to certain branches of business which will engage only a few out of the many youths now in American schools. A knowledge of it and skill in it can easily be acquired after the other, and will be attained by those who find it necessary to their callings.

No study so interests the young as free hand drawing. It does not weary as do studies which exercise the mind without practising the hand; and if the pupil is put to it in early youth, it cultivates a habit of keen and thorough observation which of all things is the most important discipline to which a young mind can be subjected.

The fault of superficial observation will scarcely ever be found in a pupil who has been taught to sketch from nature. Perhaps no greater or more universal fault than this can be met with in the men and women of America. As a rule, things are glanced at, not seen. In all matters except accounts, we are as a people inaccurate. Hasty, careless, we plunge along headlong, and things pass by us in a confused stream, as do the near objects we view from the windows of an express railway train.

Now while we advocate rapidity in all matters of mere motion, and never yet traveled a hundred miles by a quick train without wishing we could do it quicker, we know that we defeat one of the main objects of life when we attempt to force our minds beyond their normal pace. Let us refuse to look at things at all, rather than to waste time by a half look.

We believe the fault in American character would be greatly remedied by a system of general instruction in free hand drawing, and that the effects upon progress of the discipline thus obtained would be felt most favorably in all the other departments of study pursued in our schools. It appears somewhat astonishing that this fact, proved by years of experience in Europe, should have remained so long unrecognized by American educators.

THE STUDY OF BOTANY.

The study of botany has claims to far more general favor than it receives. No science can be pursued with greater facility, without the aid of a living teacher. It requires but an inexpensive apparatus. A good magnifying glass, small pincers, a press for preparing specimens, a tin box for collecting plants, a pocket knife and a good text book are all that are needed. Any section of country affords ample scope for filling a herbarium, which, by exchanges, can be made as complete as desired. Specimens are easily preserved, and when well cared for, always afford great pleasure in their exhibition.

The advantages of the study are, besides the pleasure derived from any healthy mental occupation, the healthful exercise of body in searching for specimens, the cultivation of the finer tastes, and the vast fund of useful information to be obtained. The dependence of mankind upon vegetable products, for supplies of food and clothing and articles of luxury, is greater than upon either the animal or mineral kingdoms. The animals that give us labor, or from which we obtain food, derive their sustenance from vegetables, and thus indirectly plants are made to contribute to the direct demands made upon them for the sustenance of the human family. A large number of the medicines that we rely upon to cure "the ills that flesh is heir to" are of vegetable origin. We adorn our homes by surrounding them with beautiful flowers, and even the resting places of the departed are made attractive by the sweet scents and exquisite colors of the floral realm.

It is pleasant enough to inhale the fragrance and to feast the eye upon the softly shaded tints of beautiful flowers, but there is all the difference, in the pleasure ordinarily derived from this source and that afforded through the intelligent inspection of flowers by the skilled botanist, that exists in the degrees of delight, derived by cultivated and uncultivated ears from music. To the botanist, there is far more in flowers and foliage than mere color and odor. There are delicate structures, each of which has a definite purpose and meaning. There are beautiful analogies, properties hidden from the common eye, and nice relations which form a basis of classification. All of these things are delights to the minds that comprehend them.

But there is practical profit in the study, as well as unfailing pleasure. Every intelligent farmer ought to know something of botany. By it he often can tell when his land is in danger of being seeded with troublesome weeds, and can exterminate them before they overrun the soil.

We once lived in a rural neighborhood where the practising physician was a proficient in botany. He had doubtless saved the farmers of the county in which he resided thousands of dollars by his gratuitous hints. We once heard him give warning to a farmer, pointing to a conspicuous plant that reared its head above the fine green of a luxuriant meadow. "Pull up by the roots every weed of that kind that you see on your farm." There were few, and it would have cost little to obey the good doctor's injunction. It was disregarded, and three or four years later the farm was literally seeded with a plant till then scarcely known to any farmer in the region.

But little need be said by way of instruction to those who may be induced by our remarks to undertake the study of botany. The driest part of the study, as sometimes taught, is the terminology and nomenclature. Instead of attempting to master all this at once, the better way is for the student to commence with a plant specimen, and endeavor, by means of the analytical method explained in all good text books of botany, to ascertain its name and properties, looking up the necessary definitions as he proceeds. A flower of good size and of simple structure, such as an apple blossom, a butter cup, or sweet briar blossom, should be first undertaken, the many rayed, composite flowers being more difficult. By pursuing this course, the task of learning many definitions is distributed so much as to be almost insensibly accomplished.

The practice of preserving specimens should always be followed. Nearly all text books describe the proper method of doing this, and we need only add to their directions that success in it depends principally upon the patient thoroughness with which the work of laying down the plants in papers for pressing is performed. A plant well pressed is easily mounted so as to look well, while one ill pressed is not worth mounting at all.

Some of the best and most instructive studies in this latitude are found in plants that appear in bloom while the snow has scarcely melted away in the spring. Indeed we have often found anemones and trailing arbutus on the sunny side of a knoll while the snow still rested on the other, and one must start early in the season to find some of the crowfoots in blossom. How many of our young readers will make a beginning next spring?

PURE AIR.

We recently heard a Professor of Chemistry say that the greatest curiosity in his cabinet was a specimen of pure iron. This metal, which is present everywhere, is so difficult to obtain free from impurities, that not half a dozen men on the face of the globe have ever seen it. We are beginning to entertain the same opinion of pure air. Of all the chemical mixtures known to the man of science, we doubt if any gases are so rare as pure and unadulterated air. If it starts right, it soon gets mixed up with organic germs, dust spores, mephitic gas, carbonic oxide, sulphuretted hydrogen, cholera in disguise, and typhoid in odors, until plants wither and animals die, and lamps cease to burn. That this should be the condition of things is not astonishing; on the contrary, the chief surprise is that, with all mankind diligently engaged in filling the waters with pollution and the atmosphere with gases, we are not worse off than we really are.

The habits of the present generation are such as to give rise to more refuse matter and poisonous products than those of previous ages. The fuel we use, the articles we manufacture, and the waste of sewage, combine to create more impurities than were known to our forefathers; and if it were not for the fact that science has given us remedies, nearly in proportion to the increased evil, our population would diminish under the high pressure system which at present prevails. Considering this state of facts, it is not at all astonishing that the attention of Sanitary Commissions, Boards of Health, and Parliamentary Committees is called to the subject, and that we hear of so many reports and propositions to remedy the evil.

The recent illness of the Prince of Wales has occasioned an inquiry into its probable cause, and we see that it is traced to the imperfect sewage of the district of country where this nobleman's party were recently hunting. The disease, from which the Prince appears to have fortunately recovered, is called typhoid, or more properly "night soil fever," and "cess pool fever." Since its rise has been unmistakably traced to disorders of the intestines, the medical faculty have been disposed to give it the name of *enteric* fever; and by this name it appears likely to be henceforth known. The approach of the fever is, in most instances, slow and insidious, and hence the particular occasion on which it was contracted is often overlooked; but all authorities agree that the foul air, proceeding from sewers and cesspools, is the chief cause of this form of disease. By reference to the reports of the Metropolitan Board of Public Works of London, it will be seen that different experiments were made to improve the ventilation of the sewers; but all of them were declared to be too expensive, and no other way could be found than to allow the gases for the future to continue to escape from the middle of the streets. To burn the gases by means of high chimneys would take two hundred and fifty furnaces for the city of London alone, at the cost of two millions of dollars, and a yearly outlay of half a million for fuel, exclusive of the wages of labor. To disinfect the sewers of a large city chemically would be a worse undertaking than pumping out the ocean by Paine's magneto-electric machine. It is evident that both of these schemes are impracticable, and the contamination of the air and water is likely to go on for ever if no better remedy can be found. But this is not all; the present system of sewage acts as a destructive agent in other ways. It not only pollutes the water and gives rise to pestilent fevers, but dilutes a most valuable manure, and destroys it for all useful purposes. We spend fabulous sums of money to destroy the very article which, if properly treated, would be worth millions of dollars.

Now suppose some inhabitant of Mars were to visit our earth. He would naturally be received half way by a self-appointed committee of our first citizens, and, in the course of the inevitable *fêtes*, balls, dinners, and receptions through which he would be obliged to pass, might be shewn through a house "replete with all the modern improvements." The water arrangements, upon which we particularly pride ourselves, would be pointed out, and then would come a sail around the city at low tide, when the mouths of the sewers would be belching forth their greatest stench; and the practical side of the question would be exposed to view, and the chairman would deplore the fact that, in spite of our scientific knowledge, we were unable to abate this nuisance, and he was sorry to inconvenience his noble visitor, and he would about helm and get out of it as fast as possible.

What opinion would this son of Mars form of our boasted civilization? In one place he is shown where we pour the noxious matter in; and where it comes out we deplore our inability to neutralize its deleterious effects. He would probably ask: *Why pour it in at all?* And that would show us at once where the Columbus egg of this difficulty lies, and afford the solution. Why pour it in at all? Why pump water up hill to let it run down? Why spend millions to undo what never ought to be done at all?

It is evident that the building of such works as the Thames embankment, the construction of great chimneys to carry off foul gases, and the immense loss to agriculture, could be avoided if we applied the remedy at the outset, and that would be by using the ounce of prevention and disinfecting all animal matter by dry earth, and never allowing it to pollute our waters.

While our water arrangements appear to us, individually, a great convenience, they are, collectively, the fruitful source of most of our diseases, and ought to be differently regulated.

In spite of all precautions, much impurity would be likely to find its way into the sewers: but the worst evil could be stayed, and disinfecting rendered substantially unnecessary. Pure air is irreconcilably hostile to contagious disease. If we cannot aspire to have it out of doors, it is in vain to look for it in factories, shops, and overcrowded houses.

Nearly all writers on this subject expend all their force and arguments in favor of a complete system of drainage and sewage. We would not gainsay the value of these precautions, but would again repeat that the true remedy is to stop filling the sewers with matter that no power can afterwards cleanse.

"The river Rhine, it is well known,
Doth wash the city of Cologne;
But tell me, nymphs, what power divine
Shall henceforth wash the river Rhine?"

PORTABLE FIRE EXTINGUISHER.

The value of a ready means of extinguishing fires at their very commencement has often been dwelt upon in these columns. We have shown, by facts, figures, and argument, that a large proportion of all the fires which occur could, by such means, be extinguished before extensive damage occurs.

Without making invidious distinctions between the portable fire extinguishing apparatuses now in use, we may well refer to the history of a single one as ample proof of the correctness of our position. We refer to that known as the Babcock Fire Extinguisher, which has made for itself a most honorable record, and is becoming quite extensively introduced. We have not space to enumerate the large number of fires which have been almost immediately extinguished by this machine, but the number is very great. A few words, however, as to the origin of the present form and use of the device, may not be uninteresting.

The original machine was of French origin, and is known as the Carlier and Vignon Machine. To this machine as a starting point, have been added a great number of American improvements. Observing the bulletins of the Northwestern Fire Extinguisher Co., 407 Broadway, New York, announcing the dangerous fires that have been recently controlled at the outset by the use of these portable extinguishers, we have taken pains to investigate its claims upon public favor, and are satisfied that it deserves to rank among the best of modern appliances for saving property.

The machine as now used employs what is known as the Bate and Pinkham mode of charging, by which the liquid acid and the solution of bicarbonate of soda are kept separate until the apparatus is required. By this means there is no gas generated except at the time of using, and consequently no loss of gas or strain upon the cylinder during the intervals. The moment the two materials are allowed to commingle, which is done by simply pulling out the knob of a stem which controls a stopper, a large quantity of carbonic acid gas, in which no fire can live, is generated under great pressure which forces out thoroughly mingled water and gas in a fine, small stream through the nozzle of a small hose, provided with a stopcock to control the flow. Suitable arm straps enable the person using the device to place it upon his back, leaving his hands free to direct the flow from the hose.

A very small portion of the mingled gas and water, a mere film, is sufficient to extinguish a fire that has not been so long in progress as to heat the burning material through and through to the point of ignition. The gas extinguishes the flame, and the water cools the material, a most scientific combination.

It is becoming quite common for merchants and manufacturing establishments to have one of the extinguishers on each floor of their building, ready for immediate use.

It occupies not much more space than a water pail, and no more skill is required to operate it than pouring a bucket of water on an ignited floor.

SCIENTIFIC AND PRACTICAL INFORMATION.

FORTIFYING RAILWAY STATIONS.

Some years since the subject of permanently fortifying important railway stations was discussed by the Prussian Government and abandoned as impracticable. Russia has, however, taken up the project and is putting it into actual practice. The two frontier termini of the Brest and Kiew railways in the direction of Austrian Poland are thus being protected by a citadel and a few outlying forts, probably destined to be the nucleus of a consolidated military fortress in the future.

TEST FOR SILK FABRICS.

The *British Trade Journal* states that Mr. John Spiller, in the course of some investigations made last year, found that hydrochloric acid was an energetic solvent of silk, although it left wool and cotton unacted on, at least for a lengthened period. The practical bearing of this discovery was exemplified by the immersion of several so-called pure silk ribbons and other fabrics in the acid, when the silk was dissolved away, leaving the threads of the adulterating material intact; thus by obtaining a small sample, and immersing it for a few seconds in the hydrochloric acid, or preferably by dropping a little of the acid on the center of the sample, if it be pure silk a hole will be produced; but, if impure, the