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No. 378,

For the Week ending March 31, 1883.

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EDUCATION FOR MECHANICS.

The question of the extent of the benefits of education to the working mechanic is an old one. Many place too high a value upon the utility of learning. To them knowledge seems all powerful; it is a key that unlocks every door. It is among those of lesser culture that this opinion mostly obtains. They overestimate the value of science, while the better educated fall into the opposite error, and undervalue it. As usual, the truth is to be found in the middle. Education of whatever nature exerts a certain influence upon all our actions, but is not responsible for everything. Those who are wanting in it are apt to attribute all their troubles to this deficiency. How often does some inefficient mechanic say that he would have done much better if he had only been educated. He cannot see that his faults are positive and inherent. Those who possess education, finding that their natural faults still impede their progress, come to the conclusion that what they have learned is of little value.

In the case of the mechanic it is not easy to determine just what knowledge is worth. After he has learned his trade mechanically, it is worth his while to go further and read up what has been written about it. While many of the best workmen do not use book knowledge at all, the typical intelligent workman is always a reader. He receives a scientific journal and possesses half a dozen books treating of lathe work and kindred subjects. They describe case-hardening compounds, brazing and welding fluxes, and give hints on lathe management, on cutting angles of tools for different metals, and the like. Every day he may have to go through some of the operations they tell of, yet rarely or never will he leave the beaten track. But although he may not follow them in practice, he always reads them. He does good work in the shop, and reads intelligently at home. If any question comes up with his employer about mechanical points, he will bring him the next day some of his books or papers as authorities, yet his shop work is done on principles learned by hard experience, and not by book theory. His books and his scientific journal do not seem to help him there. Clever as the man may be, he would seem at first sight to lack the faculty of applying his book knowledge. Yet if we go a little deeper into the subject, it may appear that it is because of his excellence as a mechanic that he rejects the book in practice. The hard school of experience has taught him two lessons. One has been a right way of doing things; the other has been the danger of trying to improve on that way. In the apprenticeship of the mechanical arts the work of generations of mechanics is imparted to the learner. The evolution of so many minds and years should be treated with reverence. To institute a genuine and valuable improvement is far from easy.

All this proves the dignity of the position held by the mechanic. He has a knowledge of shop work that is derived, as just stated, from generations of the world's work. His knowledge of this work is, then, of the very best. His acquaintance with different metals, with the treatment of different steels and irons, is perfect. His application of it is an instinct. He will seldom find in his course of reading a justification for leaving the way he is accustomed to. His special branch he knows so well that the books can scarcely improve it. His thorough knowledge of shop work attains to the dignity of a liberal education. It is not to be despised or looked down on because not acquired under the roof of a college.

This is a fair picture of the good mechanic as found in our shops to-day. He reads, but does not often succeed in applying his reading. Yet he will study, and will enjoy studying. It elevates his mind by giving it something besides itself to live upon. Seldom as the direct application of his reading comes into his work, its indirect influence affects every blow of his hammer. His intellectual being is improved by it, and his self-respect increased. His journal and books give it good pabulum. The benefits of education cannot be doubted in his case.

ANALYSIS OF WATER.

Chemistry will unfailingly reveal the elements and their proportions in a compound, and also the inorganic quantities; yet it will be at a loss to show the organic components more than approximately. Tests will only show the presence, not the exact parts, of the latter, and as the process by evaporation and heating the residuum separates the volatile constituents of animalcules and vegetable compounds, their amount cannot be determined with certainty.

It is only after disease germs have been traced to water as their medium of diffusion that the water is subjected to examination. The microscope failing to show them, their existence can only be proved by placing them in conditions favorable to their development. Inorganic ingredients of a hurtful nature can be ascertained, and the proportions which it would be dangerous to exceed are known. Vegetable matter can be closely calculated, but the results that would ensue by changes under certain conditions can only be obtained by a system of *a priori* reasoning. But the germs, the most insidious enemy to health in water, as neither atmospheric nor mechanical action, nor dilution, will eradicate them, cannot be found.

The benefits accruing from the solution of this problem cannot be overestimated; physicists are bending their energies in this direction, and students are entering the field; it is a wide one, and one that, if explored, will yield boundless reward.

SITES FOR WATER SUPPLIES.

The transition from a village to a city is so rapid in this country as to seem to be due to the agency of the "magic lamp," and yet all the privileges and conveniences enjoyed by the old are demanded by the new communities. Undoubtedly among the most important of these, and one to which attention is forcibly drawn as spring opens and building operations are resumed, is that of a perfect supply of water.

In selecting a locality whence to obtain this supply, it would be judicious to insist upon certain conditions which are vital to success. Absolute purity of the source should be the first characteristic. The entire watershed should be carefully examined, and everything avoided that would even be liable to produce corruption. In the case of wells, chemical analysis will take the place of inspection. After having obtained a source now pure, the possibilities of contaminations in the future should be looked to. It is a well known and frequently demonstrated law that security breeds negligence, and in the case of water supplies this is often tested. Imperceptibly the water will become unwholesome, and yet its true character will remained concealed until disease is traced to it, when an examination reveals impurities which have crept in and been steadily increasing.

For many reasons the quantity of the supply should be sufficient, not only for present needs, but to allow for growth and increased consumption. After these comes the next factor, one that is, unhappily, often ranked as first—that of cost. The works should be built economically, but when poor work is liable to risk the whole, the economy is false. Due attention should be paid to so constructing the first system that it could, when the time came, be increased by the expenditure of a moderate percentage of the first cost.

The Great Statue of Liberty.

A singular problem in engineering is presented to the committee which has in charge the construction of the pedestal for the great statue of Liberty in New York harbor. About eighty thousand dollars out of the necessary two hundred and fifty thousand have been raised, but nothing has been done about the work. It is probable that operations would be begun at once with the funds in hand, if it were not that no plans have been made, and no architect or engineer has been engaged to make them, the committee not having been able to find any member of these professions willing to contribute them for nothing, or rather for the "great credit" which, "if properly done," they will "reflect upon the designer and engineer."

As the value of the drawings and superintendence for the pedestal alone, to say nothing of the responsibility of seeing the statue placed safely upon it, would be about twenty-five thousand dollars, we fear that the committee will look long before they find the individuals whom they seek. The task itself, independent of any consideration of proper payment for the time and responsibility involved, is not one that the most skillful engineer would wish to undertake hastily. The statue weighs, complete, only about eighty tons, but presents an immense surface to the wind, and stands, moreover, on a comparatively small base.

Considering that it is not extremely easy to construct a brick chimney of the same height—one hundred and forty-eight feet—weighing ten times as much, of pyramidal form, and standing on the ground, so as to resist the force of a storm, the difficulty of raising and securing the statue, not on the ground, but on the top of a pedestal nearly one hundred and fifty feet high, is apparent. There are no precedents for anything of the kind, and it will hardly do to secure the figure by the rope stays, like those of a derrick, which the incapable engineer would naturally resort to.

The members of the committee seem themselves to have perceived something of the difficulty of the undertaking, and have telegraphed to France for instructions as to the mode of doing the work. We do not generally volunteer advice, but it seems to us that the plan said to be employed by the Japanese for securing their light pagoda towers against the effects of wind, by means of a long weight or pendulum, hung from the top of the tower, and reaching nearly to the floor, might perhaps be employed with good effect for the New York statue.

A very similar device, applied by Sir Christopher Wren, has for two hundred years held up the spire of Salisbury Cathedral, as well as those of one or two other English churches, in which a heavy wooden framework, extending as far downward as the construction of the tower permits, is suspended by strong iron bars from the capstone, free to swing in any direction. The effort of the wind on one side of the spire inclines it until the hanging framework rests against the opposite side, but when the pressure is relieved, the pendulum swings back, bringing the stonework with it into its original place.—*Amer. Architect.*

Electric Tramway.

According to Mr. Trail, the engineer of the Giant's Causeway and Portrush Electric Tramway, the total prime cost will be about £31,000 for six and a half miles of tramway, the cost of buildings, rolling stock, electric plant, engines, law, parliamentary, and engineering expenses. He says also that the electric car is able to ascend a long, continuous hill of about one and a half miles in length, and with a gradient of 1 in 35, drawing a second car behind it, and work as readily and as well at a distance of two miles from the generator as adjacent to it.