How to Make Money Honestly.

Professor R. W. Raymond, in his recent address at the dedication of Pardee Scientific Hall, Easton, Pa., said: Lesoinne, a distinguished French writer, defines metallurgy as "the art of making money in the treatment of metals." This definition may be applied to almost all occupations of life. The practical art of each is not only to achieve certain results, but to do so profitably, to make money in doing so; that is to say, to increase the value of the raw materials, whether wood, or cotton, or ores, or time, or ideas, by the use we make of them and the transformation to which we submit them, so as thereby to really elevate the condition of humanity: to leave the world better than we found it. This is, in its last analysis, the meaning of honestly making money. Men are put into this world with limited powers and with limited time to provide for their own sustenance and comfort, and to improve their condition. A certain portion of these powers and this time is required for the support of life in a greater or less degree of comfort, and more or less multiplied means and avenues of enjoyment, activity, and influence. Whatever their labor produces more than this is represented by wealth, and, for purposes of exchange, by money. To make money honestly is to do something for other men better or cheaper than they can do it for themselves; to save time and labor for them; in a word, to elevate their condition. It is in this sense, greatly as we Americans are supposed to be devoted to making money, that we need to learn how to make more money; how to make our labor fruitful; how to assail more successfully with our few hands the natural obstacles and the natural resources of a mighty continent; how to build up on the area of that continent a prosperous nation, united in varied, fruitful, and harmonious industries, glowing with patriotism and inspired by religion.

In this work we need specially the basis of a more thorough technical education, applying principles of science to the material and economical problems involved. This education is necessary to supply the directing forces for the great agricultural, manufacturing, and engineering improvements of the country. It is also needed as a solvent and remedy for the antagonism between labor and capital. The true protection of labor will be found in its higher education, and in opening to the individual laborer, for himself and for his children, by means of that education, a prospect of indefinite improvement and advancement.

In the realm of metallurgical and engineering operations the difference between theoretical and practical training is, perhaps, still more striking. The student of chemistry in the laboratory cannot be made acquainted with many of the conditions which obtain in chemical and metallurgical operations upon a larger scale. All the chemists of the world failed to comprehend or describe correctly the apparently simple reactions involved in the manufacture of pig iron, until, by the genius and enterprise of such men as Bell, Tanner and Akerman, the blast furnace itself, in the conditions of actual practice, was penetrated and minutely studied. Moreover, in all the experimental inquiries of the laboratory, the question of economy plays no part. It is the art of separating and combining substances which the student follows there, not the art of making money. That education of judgment and decision, of choice of means for ends which the exigencies of daily practice give, cannot be imparted in the school.

In mechanical engineering the same principle is illustrated. The highest department in this art is that of construction, and in this department the highest function is the designing of machinery. Now, the most perfect knowledge of the theory of a machine and its mathematical relations, of the strength of materials, or the economical use of power, will not suffice to qualify a man to design a machine or a system of machines, for the reason that in this work an element must be considered not at all included in theoretical knowledge, namely, the element of economy in the manufacture, as well as in the operation of the machine. A machine, any part of which requires for its manufacture a tool (such, for instance, as a peculiar lathe) which is not already possessed by the manufacturer, and which, after the construction of this one part, would not be necessary or useful for other work—such a machine could not be profitably built. In other words, machines must be so designed, in a large majority of cases, as not to necessitate the construction of other machines to make them; and the planning of machinery, so that it shall be at once economical and durable in operation and simple and cheap in construction, is not merely an important incidental duty; it is absolutely the chief and most difficult duty of the mechanical engineer.

THE PASHIUBA PALM OF BRAZIL.

Among the many wonders of the region of the Amazon river (now being traversed by Professor James Orton, and described by him in the series of letters in the course of publication in our pages), there is none more marvelous than the vegetation, of which the singularity of the species is as remarkable as their prodigous fecundity.

We present herewith an engraving of the *pashiúba* or *paxiúba* palm tree of Brazil (*iriartea exorrhiza*), which certainly "bears off the palm" for eccentricity of growth. The first sight of this tree, says *The Garden*, suggests the idea that some careful hand has been at the trouble of placing round its base a tree guard to protect the stem, somewhat after the manner in which the trees in our parks are railed and fenced in from cattle. A nearer approach, however, discloses the fact that the supposed tree guard is neither more nor less than the roots of the tree itself, which are disposed in this strange fashion. These roots are of the kind known as aerial, and spring from the trunk above the ground, new ones being successively produced from a higher point than the last. They take an oblique or diagonal direction until they reach the ground, into which they descend and root themselves. As fresh ones appear, those underneath decay and die off, leaving the tree supported by a hollow cone of roots, which is sometimes so high that a man may stand in the center, with the stem of the tree, 60 or 70 feet in length, immediately over his head. These roots are densely covered with small, hard, tubercular prickles, and are used by the natives as graters for reducing tho inside of the cocoa nut to a pulpy mass, to be boiled with rice and water. The same peculiar mode of growth is exhibited by *iriartea ventricosa*, and several alllee species.

A Quick Change of Gage.

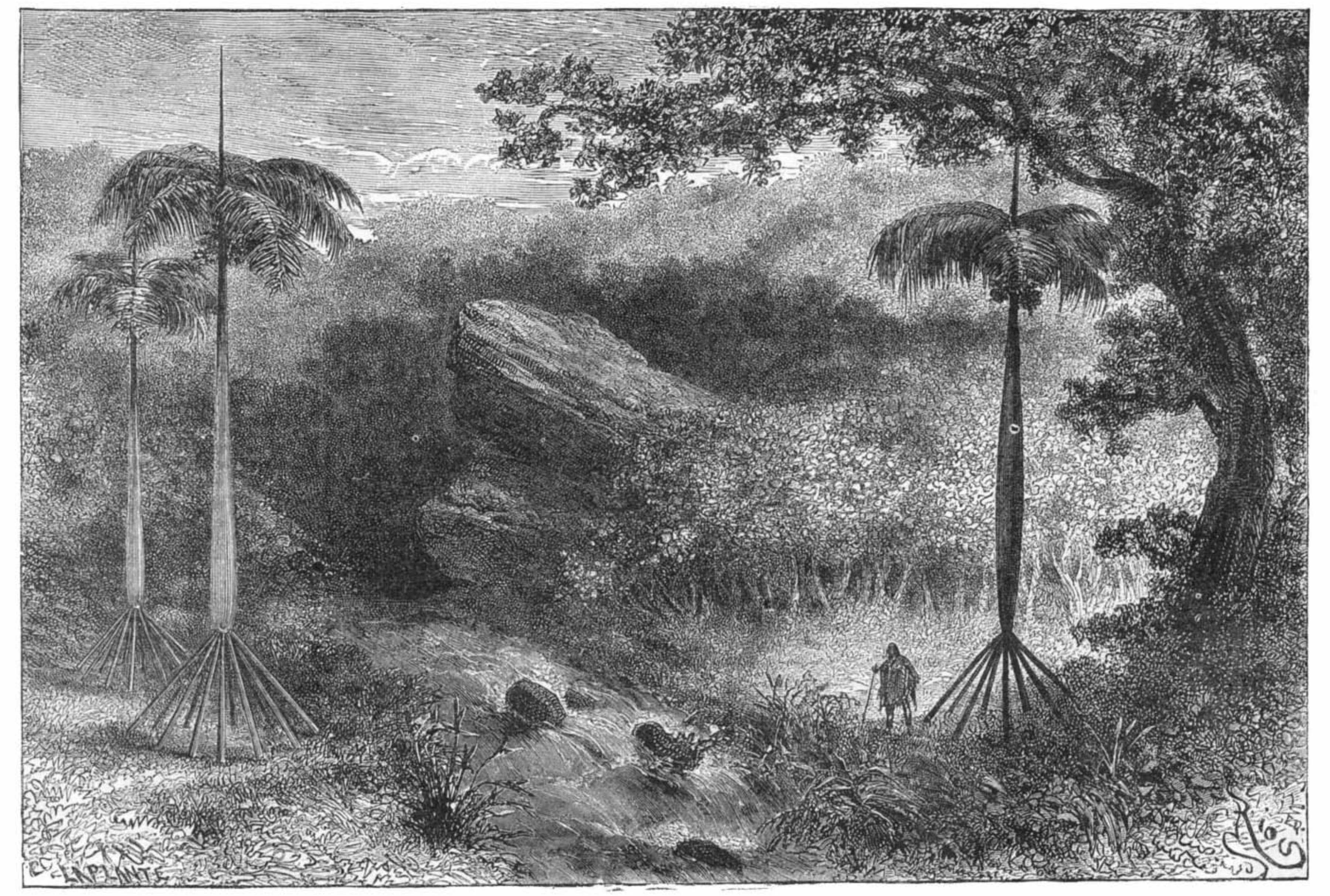
The Grand Trunk Railway Company of Canada have lately been changing the gage of a considerable portion of their lines from 5 feet 6 inches to the standard of 4 feet 8½ inches.

On the main line from Stratford, Ontario, to Montreal, a distance of 421 miles—or, including sidings, 500 miles—1510 men were employed to do the work, the staff thus averaging 3¼ men per mile of main line. The engineer of the Grand Trunk line, Mr. E. P. Hannaford, laid out the work personally by going over the road by hand car, arranging each gang in position, and laying out the details of working. To each 15 miles of main line an overseer was appointed, and these overseers reported progress to the engineer. Each gang of men had their allotted work, and, when they had completed it, reported to their overseer.

After the passing of the last train, it took each overseer from 3½ to 5 hours to narrow his district of 15 miles; so that had the main line been cleared of cars so that all these overseers could have commenced at the same time, a maximum of 6 hours would have completed the work of 500 miles of main line and sidings. As it was, some of the main line was taken possession of on a Friday noon, and the balance, on Saturday at daybreak. The whole was completed and trains running on the afternoon of the second day from commencement.

A Novel and Simple Electric Light.

Dr. Geissler, of Bonn, Germany, whose name is inseparably associated with some of the most beautiful experiments that can be performed by the agency of electricity, makes an electrical vacuum tube that may be lighted without either induction coil or frictional machine. It consists of a tube an inch or so in diameter, filled with air as dry as can be obtained, and hermetically sealed after the introduction of a smaller exhausted tube. If this outward tube be rubbed with a piece of flannel, or any of the furs generally used in exciting the electrophorus, the inner tube will be illumined with flashes of mellow light. The light is faint at first, but gradually becomes brighter and softer. It is momentary in duration: but if the tube be rapidly frictioned, an optical delusion will render it continuous. If the operator have at his disposal a piece of vulcanite, previously excited, he may, after educing signs of electrical excitement within the tube, entirely dispense with the use of his flannel or fur. This will be found to minister very much to his personal ease and comfort. He may continue the experiments, and with enhanced effect, by moving the sheet of vulcanite rapidly up and down at a slight distance from the tube. This beautiful phenomenon is an effect of induction.



THE PASHIUBA PALM OF BRAZIL.