

the veritable coinage of the country, is not to be found in magnificent government establishments, at Philadelphia or New Orleans, but in the humble schoolhouse.

"On the occasion referred to, one of our most sagacious manufacturers declared, not only in accordance with the conclusions of his own reason, but as the result of an actual experiment, that the best cotton mill in New England, if worked by operatives so low in the scale of intelligence as to be unable to read and write, would never yield the proprietor a profit;—that the machinery would be soon worn out, the owner impoverished, and the operatives themselves left penniless. Another witness, for a long time superintendent of many work people, made the following striking remark: 'So confident am I, that production is affected by the intellectual and moral condition of help, that, whenever a mill or room should fail to give the proper amount of work, my first inquiry, after that respecting the condition of the machinery, would be, *as to the character of the help*: and if the deficiency remained any great length of time, I am sure I should find many who had made their marks upon the pay-roll, being unable to write their names; and I should be greatly disappointed, if I did not find, upon enquiry, a portion of them of irregular habits and suspicious character.'

Such I believe to be the experience of both Europe and America, as to the comparative value and profit of the labor of educated and uneducated mechanics, even in the humblest position of the manufacturing operative. And if such be the difference between the taught and untaught workman in cases where little more is required than manual skill in performing the appointed task, what must be the magnitude of the difference in this country, where each labouring mechanic is to so great an extent his own superintendent—where the various trades are for the most part carried on by isolated individuals, or in small shops, rather than in large manufactories, and where the success of each mechanic depends more upon intelligent enterprise than upon mere operative skill? As each agriculturist in Canada should unite in himself the intelligence of the English overseer and the practical skill of the farm laborer; so should each Canadian mechanic combine in his own person the qualifications and skill of the European manufacturing superintendent and operative.

But the advantage of scientific knowledge to the mechanic must appear from the very nature of his employment, apart from the considerations of the accomplishments and pleasures of learning. To instance a few trades that are already practised in this City and Province, and that are extending every year: In the manufacture of the steam engine, for example, (and the same remarks are applicable to the manufacture of other kinds of machinery,) is it not of practical use to the mechanic to know the principles upon which that engine is constructed—to know so much of the science of mechanics as will enable him to understand the reasons of the various mechanical contrivances which his engine exhibits—to know so much of Chemistry as may acquaint him with the nature and properties of steam, of refrigeration and expansion, of the effects of heat and cold; rather than proceeding by rote, as a mechanical imitator, to construct the various parts of the wonderful machine, to put up the cylinder, fit the piston to its place, adjust the parallel motion and adapt the several rods and wheels, the weights and valves, without any knowledge of the principles on which any part of the machinery is framed or put in motion, or how a small quantity of water is converted into an instrument of immense power in the service of man, for driving all kinds of machinery, for propelling ships across the oceans, and carriages over continents? Nor can it be otherwise than advantageous to the coachmaker to understand the principles which determine the proper line of draught, the advantage and disadvantage of the several sorts of springs, and the size and construction of the axles and wheels; while the architect and engineer, the ship-builder and carpenter, the mason and bricklayer, the millwright and machinist, cannot fail to be essentially benefited by a knowledge of the principles of *mechanics* and *dynamics*, and the departments of *hydrostatics* and *hydraulics*, of *electricity* and *pneumatics*, as well as of the elements of the mathematical sciences. Not to enter into details on a point so obvious, I may remark in the words of an acute practical philosopher—

"To how many kinds of workmen must a knowledge of mechanical philosophy be useful? To how many others does chemistry prove almost necessary? Every one must perceive at a glance, that to engineers, watchmakers, instrument-makers, bleachers and dyers, those sciences are most useful, if not necessary. But carpenters and masons are surely likely to do their work better for knowing how to measure, which practical mathematics teaches them, and how to estimate the strength of timber, of walls, and of arches, which they learn from practical mechanics; and they who work in various metals are certain

to be more skilful in their trades for knowing the nature of these substances, and their relations to both heat and other metals, and to the airs and liquids with which they come in contact. Nor is it enough to say, that philosophers may discover all that is wanted and may invent practical methods, which it is sufficient for the working man to learn by rote, without knowing the principles. He never can work so well if he is ignorant of the principles; and for a plain reason: if he only learns his lesson by rote, the least change of circumstances puts him out. Be the method ever so general, cases will always arise in which it must be varied in order to apply; and if the workman only knows the rule without knowing the reason, he must be at fault the moment he is required to make a new application of it."

And if an appropriate and comprehensive preparatory education contributes to the material interests of the mechanic, will it add less to his *intellectual and social enjoyment*?

Absence of knowledge is absence of the essential condition and materials for rational enjoyment. There is a pleasure—a great pleasure—in the very consciousness of power which knowledge bestows, as well as in the sensible elevation of mind which it imparts, and the emotions and exercises which it awakens. How different are the pleasures of the mere creature of corporeal senses, of sensitive appetites and passions, from a being of developed mental faculties and intellectual tastes and enjoyments? How different is the state of mind connected with the exertion of one's physical powers from the necessity of subsistence and the promptings of intelligence? How different are the enjoyments of the man who knows nothing of the world or its inhabitants beyond the limits of his own horizon, from those of the man whose intellectual eye can travel to other lands and to other ages—can survey the varied aspects of the entire globe—the oceans and rivers, the continents and islands which indent and diversify its surface—the animated beings that people them, and that float in the atmosphere which envelops them—the revolutions of empires, and the history of the human race? How different the enjoyments of the untutored mind which looks up to the firmament as the roof of his earthly dwelling, and the stars as taper lights suspended to glimmer upon the path of the nocturnal traveller, from those of the enlightened mind that sees in the magnificent orbs of heaven so many worlds and suns, that contemplates their magnitudes, their distances, their motions, and the sublime purposes of their creation! How different are the feelings connected with the rote labour of the workman who plods through his task without knowing any more of the reasons of a single step of the process adopted, or of any part of the work executed, than the ox which draws the plough knows of the science of tillage, from those feelings connected with the intelligent labour of the educated workman who understands the philosophy of every process required, and the principles involved in each piece of machinery constructed, from the separation of the cotton seed and the carding of the wool to the printing of the calico and the finishing of the broadcloth, from the felling of the timber to the erection of a palace—from the smelting of the ore to the making of a watch or the construction of a steam engine! And must it not impart a noble and unspeakable pleasure to a mechanic to trace to a few elementary principles and substances all the operations of mechanism, and all the materials on which he is depending in the exercise of his trade; and to contemplate the analogy between the most simple facts that come under his every day observation and various beautiful and sublime phenomena of nature—to be able to reduce the innumerable combinations and modifications of forces which are often so astonishing and which are so indefinitely varied in all descriptions of machinery, to six mechanical powers, regulated by ascertained and immutable laws—to find the endless productions of the vegetable and animal kingdoms consisting of scarcely half-a-dozen simple substances, and some of these invisible gases—to know that the same principle which causes sparks to be emitted by the rubbing of a cat's back, produces the beautiful coruscations of the aurora borealis, the lightnings of heaven, and the sublime phenomena of the thunder storm—to realize the identity between the principle of gravitation which endangers his own safety in the event of his losing his centre of gravity in an elevated position, and that principle which forms the mechanical powers, which gives solid foundations to the mountains, which determines the march of the river, the rush of the cataract, and the boundaries of the ocean, which directs the planets in their