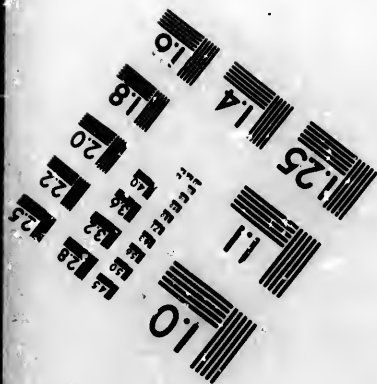
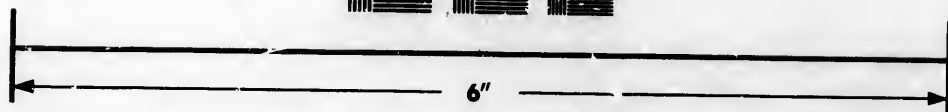
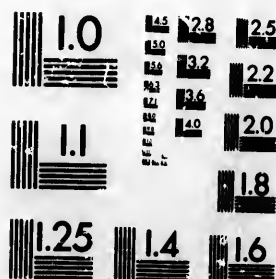


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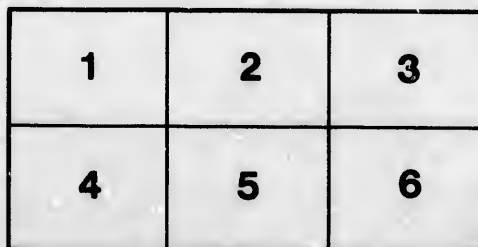
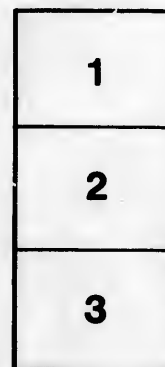
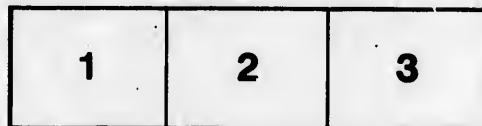
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A LECTURE,

ON THE AIMS AND USEFULNESS OF

MECHANICS' INSTITUTES

DELIVERED ON THE OPENING OF THE

ORILLIA MECHANICS INSTITUTE,

DECEMBER, 1864,

BY JAMES DALLAS, ESQUIRE,

PRESIDENT OF THE INSTITUTE.

~~~~~  
PUBLISHED BY REQUEST.  
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BARRIE :

PRINTED BY D. CREW, AT THE ADVANCE OFFICE, DUNLOP ST.

1865.



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## LECTURE.

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It seems to be very desirable that, at the opening of a new institution, such as the Mechanics' Institute of Orillia, some remarks of a general character should be offered, relative to the design of such an Institution, and the manner in which it ought to be carried out, in order to produce the greatest amount of practical benefit; and this previous to the commencement of a series of lectures on topics fitted to illustrate science, and afford general information.

It would have been gratifying to me, had the task fallen upon one fitted by talents and scientific attainments to have done justice to the greatness of the subject, and its importance to the community.

The question then presents itself, how shall the great purposes of our Institution be best worked out? I would reply, by as many good and valuable lectures as we can obtain, and by the establishment of a Library of choice books. Living in this distant part of a vast country, what encouragement have we in the procuring of lectures? Yes! In this remote spot we possess I believe within ourselves no small amount of talent, and of that high education which unquestionably fits a man for a task of the kind. I have listened on more than one occasion with pleasure to interesting lectures, particularly to those delivered by Dr. Ardagh; but I must be silent in the way of praise; as I believe by doing so, I shall best comply with Dr. Ardagh's wishes. Many however heard those lectures as well

as I did, and will join me in congratulation on the prospect we have of again listening to the eloquent lecturer. We have happily amongst us other gentlemen belonging to the learned professions, whose education and habits of composition will render the task of lecturing comparatively easy; and who, I doubt not, will cheerfully assist us in this way. There is a prospect also of some aid from distant parts of the province.

The intention is, to have those lectures delivered once a fortnight until the end of March, though I do not see myself why there might not be one occasionally during the summer. The winter of course is the season most fitted for the promoting of general knowledge in this way. Our great auxiliary—an indispensable one I think—is the library. I am glad to say, that a few excellent volumes have already been presented to our library; and it would much assist us, were this example to be followed by others. There is no need for particularly specifying the subjects on which we should desire to be furnished with books. Whatever work is calculated to give general information, and to be useful, will be acceptable. I might just say, that works on Science, Mechanics, History, Travels, Biography, Geography, and the higher educational works, are particularly adapted to our purpose.

I shall not attempt to give you a history of the rise and progress of Mechanics' Institutes, and the development of those mighty improvements in their extension and usefulness, which could only be supplied by a person intimately acquainted with the subject. I shall leave this to one, who, I believe, is able to do justice to the task.

I shall just advert to the origin of those Institutions. The designation itself evidently points out the intention of its founders. It was to give that valuable class of men, the Mechanics of Great Britain the means of improving themselves in knowledge, not only of Mechanics as a whole, but also in acquiring those branches of Science which were best fitted to

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elevate their minds, to cultivate their acquaintance with Science, and to afford them general information.

It is now many years, though I remember it well, since Henry Brougham, with a band of co-adjutors, formed the first Mechanics' Institute; and at the same time established the 'Mechanics' Magazine. Alas! how few of those excellent men are left! Brougham—the Philosopher, the Statesman, the Orator, seems alone to survive, to witness the triumphs of those Institutions, of which he was in a great measure the founder.

And here let me pause, to offer my tribute of admiration to that extraordinary man. Possessed of high genius, the profound Philosopher, and great Statesman, he now lives at an advanced age, honored and respected. It is now more than twenty years since I was one day crossing Lake Simcoe on the ice—approaching Thorah Island, I observed, with some wonder, a tree in the centre of the Island which rose to a great height above all the trees by which it was surrounded—a giant among giants. Such is Henry Brougham—a giant among the intellectual giants of England.

Thus were the means afforded to many a generous youth to become acquainted with the higher walks of Science—to grasp at attainments which otherwise he never could have reached.—How must the youth, possessed of genius which had hitherto lain dormant, just from wanting that with which such an institution supplies him, rejoice that his wishes are at last gratified. He wanders with joy through the realms of Science. He beholds the Heavens with a delight he never felt before: Astronomy has enabled him to tell the names of the constellations, and to marshall them in their order; Natural Philosophy has been his instructor, and the works of the Creator stand out before him, with a majesty and grandeur hitherto unknown. Chemistry has exhibited her more than magic powers. The ship which, sails against the wind and tide—the beautiful engine with its attendant train, that thunders through the

American forest—the electric flash, that leaves the Sun far behind it in its progress,—these no longer remain the mysteries which they once were. And so, on and on, and on, he goes in his noble progress, until he attains a name and a place among the great ones of the earth. Is this an imaginary picture that I draw? By no means! One name flashes upon me at this moment. Ferguson the celebrated Astronomer, was a shepherd boy. As he lay on the hill side, watching his flock, his eye was often directed to the starry heavens, or in the sublime language of Addison—

The spacious firmament on high,  
With all the blue ethereal sky,  
And spangled heavens—a shining train—  
Their great Original proclaim.

He traced night after night the position of the constellations, and watched the motions of the planets. Taking a small piece of string, he tied knots upon it, so as to trace the position of the stars and the changes of the planets. His next effort as a boy, was to make a wooden clock, and in this he succeeded, making it to keep time, and show the hours on its dial. By indomitable perseverance he rose to great eminence, and delivered lectures on astronomy in presence of his Sovereign.

Well may we quote the beautiful lines of the poet :

How many a gem of purest ray serene  
The dark unfathomed caves of ocean bear ;  
How many a flower is born to blush unseen,  
And waste its sweetness on the desert air !

There can be no doubt that not a few of the great engineering works of Britain, and perhaps this country, have been executed by men who have raised themselves to eminence, and proved the benefactors of their country by their genius and their untiring perseverance in the paths of Science. Richly, therefore, have those noble minded men, who devoted themselves to the raising the standard of Science among the Mechanics of Great Britain, been rewarded. Thanks to the

free institutions that are our country's pride, and our country's safety: such instances are not rare.

The establishment of Mechanics' Institutes deserves to be marked as one of the great eras in the history of Science, I might say in the history of the World. We know most certainly that the tendency of these Institutions has been to develop the genius, and encourage the perseverance of the Mechanic. We know most certainly that since they were established discoveries and inventions have made a progress unknown during any previous period. It is true, we cannot tell how far those great discoveries and inventions are to be attributed to Mechanics' Institutes. This is a problem which no man can solve. But certainly, when we consider how eminently these Institutions are calculated to spread Science amongst a vast number of people, we may, without presumption, attribute much of the splendid success which has attended Science, during the last half century, to the Mechanics' Institutes.

The original purpose of the founders of the Mechanics' Institutes seemed to have been accomplished, when the system of lectures, and the establishment of libraries were adopted. But such was the general interest taken in the Institutions—the value of the lectures—the spread of general information—that the Mechanics' Institutes were found to be fitted for the promotion of knowledge to a much wider circle than was originally intended, and in this way they became much more extensively useful, and much more objects of general interest.

While we contemplate the more immediate benefit that flow from such Institutions, let us not forget the more remote, but powerful way, in which they act upon a community—upon a nation. The members of those societies are members of the community. You cannot raise the standard of education, of knowledge, of intelligence among them, without powerfully affecting those with whom such members associate; so that in fact, the nation itself may be said in this way to participate in the benefits that spring from these Institutions.

And now, if I am asked, what is the great and distinguishing feature of such Institutions? the short answer would be, the diffusion of Science. The word itself is simply knowledge; but, in the course of time it came to have an understood meaning, and to include within its single designation many departments of great importance. I believe it is not contended that the divisions into which it is arranged can be very plainly or distinctly marked out. If in a popular way, I might be allowed to describe them, I should say, that the word includes Arithmetic, Mathematics, Algebra, and Natural Philosophy; and this latter, the noblest of all the Physical Sciences, comprehends Chemistry, Geology, Mineralogy, Astronomy, and Natural History; and this latter again includes Botany and Zoology, the knowledge of animals; Ornithology, history of Birds; Amphibia, treating of animals belonging both to earth and water; Ichthyology, which treats of Fishes; and Entomology, which treats of Insects.

If such be the list of subjects embraced by the word Science, how hopeless does the task appear of embracing them all? Yet, it is astonishing what intellectual victories some men have achieved on the field of Science! sometimes, indeed, acquired at the expense of health and even of life itself.

But it is most natural that a man should follow such branches as suit best with his own tastes, or accord with pursuits in life which he chiefly intends to follow. "A little learning is a dangerous thing — Drink deep, or taste not of the Pierian Spring," says the poet; and so indeed it is, if we permit it to foster our pride and self conceit. Yet I cannot but think it extremely desirable, that every man should at all times, and in all places, add as much as he can to his stock of general information.

Remember that education bears a far higher and wider scope than is popularly understood. It is well, very well, that all should be taught to read, write, and know how to count.

But after all, these are but the initials of education ; they are only the gates of knowledge. There is a lovely garden, enclosed with a high wall—many and beautiful are the trees which adorn it, and they are covered with golden fruit. There is a door to this beauteous grove, and it requires a key, without which no man can pass. The garden is Science—the key is simply that education which enables one to enter in and pluck the golden fruit.

The statesman, the lawyer, the merchant, the artisan, must each pass through a course ; each one different from the other in detail, yet each requires to be thoroughly educated in order to do justice to his profession. You will see that reading enables a man to acquire knowledge—writing, to communicate it ; while arithmetic is necessary to carry on the business of life, as well as being the foundation of the Physical Sciences. The thoroughly educated man, as we may designate him, is he who, by application to the higher branches of Science, and obtaining a large share of general knowledge, distinguishes himself by those attainments among his fellow men. I have often thought, that although travelling in foreign countries is not designated as a part of education, yet in opening up new sources of knowledge, and in removing prejudices, it is in fact a very high and beneficial kind of training. This may be best appreciated by conversing with those who have travelled.

While it is well known that our beloved Queen is a well educated woman, may I inform you what was the education given to an illustrious lady, cousin to the Queen, whose premature death led to the Throne being filled as it now is. The education of the late Princess Charlotte of Wales consisted of the English, Classical, French, German, and Italian languages ; Arithmetic, Geography, Astronomy, the first six books of Euclid, Algebra, Mechanics, along with the principles of Optics and Perspective, the policy of Governments, and particularly the principles of the Christian religion. What a noble description is this of an educated woman !

To the young most especially are the objects and purposes of Mechanics' Institutes valuable. In them particularly may a foundation be laid for a life distinguished for that devotion to Science, that thirst for knowledge, and that honorable desire to be useful to the world, which has, in so many instances, conferred great and lasting benefit on society.

There is however one danger, not to be lost sight of, and that is a tendency to pride and vanity, which ought never to be the case with the Student of Philosophy. If he acquires more knowledge than falls to the lot of his fellow men, he is brought so much more into an acquaintance with the works of his Creator, and this ought to teach him humility. Is there a more illustrious name in the annals of Science than that of Newton? And yet Newton was remarkable for nothing more than for modesty and humility.

How many wonderful objects and processes do we meet with in our daily walk through life! How many are the various arts and manufactures invented by man! By what process, or series of processes is the wool from the Sheep's back wrought into the warm texture of our clothing! How is the tissue of the tiny worm converted into the rich and beautiful fabrics that adorn a well dressed lady! How is cotton, the production of the earth, converted into a cloth so useful and so generally worn! How does Hemp, a similar production, become a cable for the ship of war, and form the cords by which its sails are spread out to the breeze! By what curious and most ingenious process does the loom present to us figures so varied, so pleasing, so beautiful! Can you conceive of a mass of sand and salt or flint stone, being converted into the beautiful and transparent form of Glass? Can you tell the manner by which a rough ore taken from the bowels of the earth, is made to flow as a liquid, to become hard as adamant, and to receive a polish that vies with the mirror in brightness? How can we account for a mass of charcoal, sulphur, and saltpetre, each so powerless

in itself, rending asunder the solid rock—throwing projectiles of death for miles, and producing a total change in the mode of warfare through the wide extent of a world?

What do you know of that exquisite system of bones and muscle—nerves and sinews—brain and heart—with other of the great organs which compose the human body—a system so marvellous, displaying so powerfully the work of an Almighty hand, as to make us say with the Royal Psalmist, “We are fearfully and wonderfully made”?

Truly has it been said, that man left to himself, is the most helpless of all animals! How many hands have been employed in the forming of the clothes which you wear! And how many inventions of your predecessors are contributing to your present comfort. By knowledge man stands pre-eminently distinguished in the creation. The illustrious Bacon has truly said, “Knowledge is power”! Every object by which you are surrounded is a subject for the exercise of your talents. There is in fact no object in nature that does not, when rightly viewed and properly investigated, lead us to admire, adore, and praise that great Being, who with matchless wisdom, unbounded benevolence, and transcendent greatness, guides, governs, and preserves his creatures. We are led from Nature up to Nature’s God! When we hear the dread Artillery of Heaven—when we are dazzled with the lightning’s flash—when the raging storm sweeps along the sky, and the waves toss their foaming crests on high—how awful appears the Majesty of the Most High; and yet we discover without doubt, that even amidst what appear to be the elements of wrath, there are indeed the elements of mercy, that the whirl-wind and the tempest are but the instruments by which God freshens and purifies the atmosphere around us, so as to produce in man that health and vigor which he requires.

On an occasion like the present, it is necessary to deal with generalities. To enter at any length upon those great divisions into which the subject resolves itself, would be impracticable.

In presenting before you a catalogue of those many branches of knowledge, all delightful and all useful, how difficult is it, in attempting to prove the admirable uses which Science is calculated to promote, to select subjects for illustration. The field is boundless; and all we can do is to tread on the threshold of Science, and select one or two striking instances of what it has done for man.

There are certain remarkable eras in the history of inventions and discoveries, and the 15th Century is very noted in this respect, perhaps more so than any Century since the Creation, extending as they do, with extraordinary power to the present day. We find in that Century the invention of Printing, the Mariner's Compass, and the discovery of America. I shall select as a display of the triumphs of Science one or two of great note.

I go back to a discovery of a most important article, I mean gunpowder. This was either invented or brought into notice by Roger Bacon, a Friar, who in the year 1216 published a Treatise, in which he says: "You may raise thunder and lightning at pleasure, by only taking sulphur, nitre, and charcoal, which singly, have no effect, but mixed together and confined, cause a noise and explosion greater than thunder."

The quality of gunpowder depends on the proportions of the three ingredients.

Common gunpowder consists of 75 parts of saltpetre, 12.5 of charcoal, and 12.5 of saltpetre. We may take into our hands a piece of charcoal, or saltpetre, or sulphur, we may examine them and investigate their properties. We shall find by chemical analysis that a piece of charcoal consists of the same elements as the diamond that sparkles on a lady's forehead.— We shall discover all the articles of decided value to man, according to their several properties; but, we shall wholly fail to detect that prodigious power which, when combined they exert.

Gunpowder is of great value in works of engineering, in removing natural obstructions that stand in the way of improvement. It has given to man, in a greater degree than ever, dominion over the animal creation, and it has given him a vast power in destroying his fellow man. It has created a total revolution in the art of carrying on War. The bow and arrow, and the spear are exchanged for the cannon and the musket; and to what an extent the power to throw missiles, and the unerring aim by which they are discharged, has reached, are well known to the present generation. The rifle and the rifled cannon have in our time been brought almost to perfection. It has been a matter of dispute, whether this invention has been more a blessing or a curse. My impression is, that it has mitigated the sufferings of the wounded, it has inspired Nations with a greater dread of war, from the power of the weapons employed, and it has placed the weak and the strong more on a level, and given the advantage to skill over brute force. Of course, much might be said on both sides.

The great discovery which throws all others into the shade, is the art of printing. The honor of this invention is claimed by Hærlém, Mentz and Strasburg; and to each it belongs in a qualified sense. The origin of it however belongs to Hærlém, where in the year 1430 the first book was printed; and to Lawrence Coster of that city belongs this great discovery.—Coster was walking in a wood near the city, when he cut out several letters on the rind of a beech tree, which to gratify his fancy, being impressed on paper, he printed one or two lines, as a specimen, for his grand children to follow. It is said that Coster's method was to cut out the letters upon a wooden block—Afterwards Guttemburg, John Fust or Faustus and Schœffer greatly improved the art. The first named invented moveable types, and the two latter metal types. Printing in a very short time acquired great perfection; but, it is evident that the art, as we have it, acquired from different hands its recognized excellence. Fust was said to have been an apprentice to Coster,

who bound him to secrecy; but Fust left him, and settled eventually at Mentz. The completion of the discovery is in reality due to Peter Schœffer, who found out the method of casting the letters singly in a matrix. Fust and Schœffer concealed this invention, by an oath of secrecy, till 1462, when by the sacking of Mentz their workmen were dispersed, and the plan divulged.

Printing was practised in Rome in 1467. Next year it was introduced into England by Thomas Bouchier, Archbishop of Canterbury, who sent Turner, Master of the Robes, and W. Caxton, a Merchant, to the Continent to learn the art. They brought to England one Corsellis, an under workman, a press was set up at Oxford, and the first book was printed by Corsellis in 1468. Presses were erected at St. Albans and Westminster. It has been considered that Caxton was the first printer in England, while in reality Corsellis was. The latter used separate types cut out of wood, while Caxton was the first in England who used fusile types. His printing office was in the Abbey of Westminster, where he pursued the business till 1494, when he died at a great age.

The iron press invented by Earl Stanhope, was a great improvement, as it saved a vast amount of labour. It is well known that the power of the steam engine has of late years been applied to printing, as may be seen in the Capital of Upper Canada. It was first used in this way by the *Times* newspaper.

Stereotype printing, which much resembles the original simple mode of printing, was invented in Scotland by Mr. Ged and Mr. Tilloch respectively. A page is set up in the ordinary way with moveable types, and, when found correct, a cast of plaster of Paris is taken from it. Into this cast the metal is poured; and so on with each successive page. Of course no alteration can take place with this method of printing. When once correct, it remains so; and vast numbers of impressions can be

taken from each plate. With works of large circulation, it becomes a great saving in expense.

And, now that I have shortly gone over the history of printing, of all inventions or discoveries, it forms the one of most momentous interest. No event during the rolling of successive ages can for a moment be compared with it! Science, knowledge, civilization, humanity, man's best and highest interests, have commanded its influence, and been powerfully affected by it. As time progresses, so does this noble art command more and more the support and the sympathies of man. How much genius has been encouraged by it! How many great inventions have indirectly sprung from this one invention! Foreign lands and distant tribes have done homage to its power, and many, many are the languages in which it has been used! Powerful for good, it is powerful for evil; and no man can advance the great interests of morality and science better than by the employment of this stupendous engine. The speech of the greatest orator commands the admiration but of a few hundred or a few thousand people; but the Press, by its repeated and large editions, may overspread the land. Politics, of old, were studied and understood by comparatively few. Now, the daily and other newspapers find their way to the hearths and homes of millions, and thereby vastly add to the stock of information, and to the happiness of man. But the Printing Press, like all the blessings bestowed on man, involves a great responsibility on man himself. If it has been the mighty engine to raise man in dignity, in moral greatness, in intellectual vigor, it has proved a vast engine for evil—for pandering to all that is degrading in his nature, and thus lowering him as a moral being. This remark applies equally to the writer and the reader.

If God has been pleased to bestow upon some men great genius and commanding talent, does not the gift itself imply that it shall be rightly used? that it shall be employed to the praise of that glorious Being, and to the good of his fellow men?

If the poet and the philosopher reflected upon a truth so great, and yet so obvious, would not much that has been written have been blotted out? I know of no living man who bears upon him so great, so fearful a responsibility, as that man upon whom God has bestowed those transcendent talents which have enabled him to lead the tastes, enlighten the intellects, and form the morals of a great empire. How easy would it be to name those who might be fairly comprehended under this designation, and whose works have exerted a deleterious influence upon millions of men.

If I have spoken of the responsibility of the writer, let me say something of the responsibility of the reader. It will be very obvious, from what I have already said, what I deem good and profitable reading; and I would now venture to warn the young, in particular, not to indulge in what is called light reading. It is very useless, and often very pernicious. Some works, of course, are worse than others—some, indeed, most poisonous, most pernicious. Every wise parent will prohibit such works, and every wise youth will avoid them. The restoration of Charles the second brought with it a flood of writers noted for their abominable immorality, and the novelists of the earlier part of last century were as vile as could well be. The Poets of the Augustan age of Queen Anne gradually took the place of those I have alluded to, while the Novelists of last century have fallen into merited contempt and oblivion.

I shall close this subject by an extract from an anonymous work I lately met with, but which I have good reason to believe was written by a mechanic :—

“ The invention of the art of Printing was in itself a memorable event, and gave an impulse to the progress of society which will be transmitted to the remotest ages. It has been an instrument of incalculable benefit to man. To it we owe the infinite multiplication of copies of the Word of God, of works of science, and of sacred and elegant literature. To it

" we owe the establishment of elementary schools, and the  
" spread of general information by means of popular treatises,  
" tracts, newspapers, and magazines,—in a word, it has been the  
" grand instrument for raising the mass of the community in  
" every country where it has had free action, from a state of  
" semi-barbarism to one of comparatively high social advance-  
" ment.

" But unhappily this fair side of the picture is set off by deep  
" and dark shadows. Had the new power been always wielded  
" by good and wise men, it could not have failed to prove an  
" unmixed blessing. The Press, however, like every power  
" entrusted to human agency, is liable to be diverted from its  
" proper ends, through the influence of human passion, preju-  
" dice, and the love of gain, and, in fact, this counteracting  
" influence has great sway. So far as the good has preponder-  
" ated, it must be attributed to the mercy of God and the force  
" of truth; and not to any lack of zeal or malignity on the part  
" of the disseminators of error." And again he says: "As a  
" love of reading generally betokens the existence of a certain  
" degree of taste and refinement, and is supposed to confer upon  
" those who indulge it a sort of favorable distinction, it cannot  
" be out of place to observe—especially in reference to the  
" present times, and the subject under consideration—that the  
" value of reading entirely depends upon its quality. If the  
" books selected have a tendency to awaken in the reader's  
" mind a deeper love and reverence to God; to enlarge his  
" sympathies for his fellow man; to excite and invigorate the  
" best faculties of his mind; to bring under his review all that  
" is great, or beautiful, or useful, in the wide fields of science  
" or literature; then reading, whether pursued as a pastime, or,  
" as it might be, for an ultimate object, is worthy to be ranked  
" among the highest of mental exercises. But if, on the other  
" hand, reading be only the refuge of a vacant hour, and the  
" works selected be of a nature to leave the powers of the un-  
" derstanding passive; to mislead the judgment; to sap the

" principles ; to corrupt the heart ; or to influence the imagination ; then reading becomes not only a resource without profit, but its direct tendency will be to develop and foster " the worst propensities of the human mind."

I shall now just glance at one of the most important discoveries of science,—I mean that of glass. Pliny's account of it is, that it was invented in Syria by accident, at the mouth of the river Belus. Certain merchants, being driven there by stress of weather, and being obliged to remain there for some time, made a fire to dress their victuals. Some of the plant Kali being on the spot was burned to ashes, and, accidentally mixing with the sand, vitrification ensued, and the hint was taken and acted upon. It appears to have been very ancient, for Aristophanes mentions it ; and Aristotle, who lived three and a half centuries before the Christian era, proposes two problems concerning it, viz. : why one sees through it ; and why it will not bend. After him the word occurs often enough. It seems to have been first made at Sidon in Syria. It appears to have been first manufactured by the Romans in the reign of Tiberius.— Venice for many years excelled all Europe for its fineness of glasses ; but both the French and English have of late years surpassed them. Lactantius, one of the Fathers of the Church, speaks of glass in the third century ; and Bede says artificers in glass were brought to England in 674. Glass windows were not used till 1180, and were considered very magnificent. Painted glass was introduced in the reign of John ; but the first specimens are of the time of Henry the Third. The manufacture of it was begun in England in 1557. I may state that flint glass is made by melting, in a strong fire, 120 lbs. of white sand, 50 lbs. of red lead, 40 lbs. of pearl ashes, 20 lbs. of nitre, with a small quantity of borax and arsenic. Plate glass is made by pouring the liquid glass upon a table of pot metal or copper, with iron ledges. As it cools an iron roller is passed over it ; afterwards it is annealed and polished.

While we are all familiar with the vast amount of comfort

and convenience we enjoy from the use of glass, we are led to take a far higher view of the discovery in respect to the prodigious influence it has exercised on science. To it we owe those wondrous instruments, the Telescope and the Microscope. The son of a spectacle maker of Middleburg, in Holland, was amusing himself in his father's shop, by holding two glasses between his finger and his thumb, and, varying their distances, perceived the weathercock of the church spire opposite to him much larger than usual, and apparently much nearer, and appearing also to be turned upside down. This wonder excited the amazement of the father—he adjusted two glasses on a board, rendering them moveable at pleasure; and thus was brought about the first rough model of a perspective glass. Gallileo, a philosopher of Tuscany, illustrious in the annals of science, endeavoured to bring the discovery to perfection. He placed his glasses in long organ pipes, and constructed a Telescope.—It was in the year 1610 that Galileo made those discoveries in the heavens which have made his name immortal. He beheld four moons revolving round the planet Jupiter—spots on the face of the sun, and the rotation of that globe round its axis—mountains and valleys in the moon, and numbers of fixed stars where none before were visible. Since that time great have been the improvements in the Telescope, till we come down to the present day, when Lord Rosse appears to have excelled all others in this respect.

The Microscope was invented soon after the Telescope; and this beautiful instrument opens to us a world of wonders. We perceive that every particle of matter has a determined form—that the scales on the skin of a haddock are exquisitely variegated, and like net work, so that no art could imitate it; that the points of prickles in vegetables, when magnified a thousand times, appear as sharp and pointed as to the naked eye; that every particle of dust on the wing of a moth or butterfly is a beautiful and regularly organized feather; that every hair of our head is a hollow tube, with bulbs and roots, and that the

pores of our skin are so numerous and minute that a grain of sand would cover 125,000 of them. We perceive animated beings, in certain liquids, so minute that 50,000 of them would not equal the size of a mite, and yet each is furnished with mouth, eyes, and other organs of animal function.

With what awe, with what wonder ought we to look up to that great artificer who has thus formed the sublime scenery of the heavens, this beautiful earth, the exquisite structure of our own bodies, and at the same time is mindful of a peopled world so minute as to be to the human eye wholly invisible.

I shall now shortly advert to a discovery, so wondrous in its power, so majestic in its results, as to throw almost every invention of man entirely into the shade. I mean the Steam Engine. There was published in 1663, during the reign of Charles the Second, a very curious, and now a very rare book, called the Marquis of Worcester's centenary of inventions. Having read it in my youth, I cannot, at this distance of time, recall the manner in which the noble author treats the subject, nor am I quite sure whether he may be styled the inventor of the plan, or whether for the first time he gave it to the world. At all events, the hint is contained there. It appeared that the force with which steam issues from the spout of a tea-kettle, and raises the lid, while the water is boiling, suggested its power. It was many years after the Marquis wrote, ere an engine driven by steam was invented. The names of Savory and Newcomen are used with reference to the construction of the Steam Engine. There can be no doubt that for years it was a clumsy machine, doing very little, compared with its size. It was reserved for one of the most illustrious names in the records of science—a name whose lustre will for centuries survive the dimming process of time. To James Watt belongs the honor, not, indeed, of discovering, but of improving this great invention, so as nearly to render it that perfect and admirable machine which we now find it to be. He found it a dwarf—he left it a giant

The different kinds of Steam Engines are, the high pressure —formerly considered dangerous for vessels; the low pressure reciprocating engine, where the machinery is kept in motion by a revolving crank; and the rotary engine, where the steam is applied by a rotary motion, without the loss of power by friction.

It may be simply said of the low pressure engine, that it consists of a forcing pump, with its rod fixed to one end of a lever that is worked by the pressure of the atmosphere upon a piston at the other end; a temporary vacuum being made below it by suddenly condensing the steam that had been let into a cylinder in which the piston works, by a jet of cold water thrown into it. A partial vacuum being thus made, the weight of the atmosphere presses down the piston, and raises the other end of the straight lever, loaded with water, when used in a mine; then immediately a hole is uncovered in the bottom of the cylinder, by which a fresh supply of hot steam rushes in from the boiler, which acts as a counter-balance to the atmosphere above the piston, and the weight of the pump rods at the other end of the lever carries that end down, and, of course, raises the piston of the steam cylinder. The orifice for the admission of steam is immediately shut, and the cock opened for injecting the cold water into the cylinder. This condenses it to water, and another vacuum is made below the piston, which is again forced down by the weight of the atmosphere; and thus the work is continued as long as water and fuel are supplied.

With the application of steam to coal mines, to manufactories, and other general purposes, all are familiar. From a report of a Committee of Parliament in 1822, it appears that the first attempt at impelling vessels by steam was made by an Englishman of the name of Hull, who, in 1736, obtained a patent for a steamboat, to be moved by cranks and paddles. It was in 1807 that the invention was brought to practical use by Fulton, an American, who had the advice of Bell, a Scotch engineer. As in the case of printing, a claim has been made both by Fulton

and Bell. The probability is that each profited by the other's views, and that both deserve great honor for their share in the invention. The first steam vessel in Britain was built by Bell, on the Clyde, and named the Comet. It was of twenty-five tons burthen, and four horse power. It is lamentable to reflect that this distinguished man was allowed to die in poverty.

And now, to speak of Railways. As early as 1676 coals were carried from near Newcastle-on-Tyne to the banks of the river, by laying rails of timber straight and parallel, on which cars with four rollers, fitting the rails, and drawn by horses, would convey four or five chaldrons of coals. About a century afterward, an iron railway was constructed at the Sheffield colliery. The first railway resembling those now in use, for goods and passengers, was the Stockton and Darlington railway, completed in 1825.

Several years passed before Steam Locomotive engines were invented. This noble triumph of art was finally achieved by the completion of the Liverpool and Manchester railway, begun in 1826, and opened on the 15th September, 1830. Its construction cost £800,000 sterling. The Duke of Wellington and Sir Robert Peel were present, as was also Mr. Huskisson, who was unfortunately killed by accident on the occasion.

Such is a short sketch of the progress made by this mighty power. Its great improver, Mr. Watt, was a native of Greenock, and died near Birmingham in 1820, having lived to see the fruit of his labors successful to a great extent. To expatiate on this great invention is not needful. Not a daily paper, not a newspaper reach us—scarce a letter is received—that does not remind us of the benefits flowing from the steam engine. Let us behold the City of Manchester or of Glasgow with their vast chimneys—busy, populous, enterprising—what an idea is given of the Manufacturing greatness of Britain. Who can look upon one of those colossal steamers that bear our mails over the broad Atlantic, without being struck with pleasing astonishment.

Even Dr. Lardner, no mean Philosopher, ridiculed the idea of a steamer crossing the Atlantic; and now they proceed almost daily, with the regularity of clockwork. Casting our eye upon a gigantic War Steam Ship—the Warrior for instance—what an idea presents itself of its being the impersonation of power and grandeur—more like a fabled monster of the olden time. And can we behold the dashing, raging engine, with its stupendous train, as it thunders through our forests, without being struck with surprise and admiration?

I shall repeat to you a few lines written as an eulogium on Mr. Watt, by his distinguished friend Francis Jeffrey:

“ Mr. James Watt, the great improver of the Steam Engine, died on the 25th April, 1820, at his seat of Heathfield, near Birmingham, in the 85th year of his age.

“ This name, fortunately, needs no commemoration of ours; for he that bore it survived to see it crowned with undisputed and unenvied honors; and many generations will probably pass away before it shall have gathered all its fame.

“ We have said that Mr. Watt was the great *improver* of the Steam Engine; but, in truth, as to all that is admirable in its structure, or vast in its utility, he should rather be described as its *inventor*. It was by his inventions that its action was regulated; so as to make it capable of being applied to the finest and most delicate manufactures, and its power so increased as to set weight and solidity at defiance. By his admirable contrivances it has become a thing stupendous alike for its force and its flexibility,—for the prodigious power which it can exert, and the ease and precision and ductility with which it can be varied, distributed, and applied. The trunk of an elephant, which can pick up a pin or rend an oak, is as nothing to it. It can engrave a seal, and crush masses of obdurate metal before it,—draw out, without breaking, a thread as fine as gossamer, and lift up a ship of war like a

“ bauble in the air. It can embroider muslin and forge anchors,  
“ —cut steel into ribbands, and impel loaded vessels against the  
“ fury of the winds and waves.

“ It would be difficult to estimate the value of the benefits  
“ which these inventions have conferred upon the country.  
“ There is no branch of industry that has not been indebted to  
“ them ; and in all the most material they have not only wid-  
“ ened most magnificently the field of its exertion, but multi-  
“ plied a thousand fold the amount of its productions. It is our  
“ improved Steam Engine that has fought the battles of Europe,  
“ and exalted and sustained, through the late tremendous con-  
“ test, the political greatness of our land. It is the same great  
“ power which enables us to pay the interest of our debt, and  
“ to maintain the arduous struggle in which we are still engag-  
“ ed, with the skill and capital of countries less oppressed with  
“ taxation. But these are poor and narrow views of its impor-  
“ tance. It has increased indefinitely the mass of human com-  
“ forts and enjoyments, and rendered cheap and accessible, all  
“ over the world, the materials of wealth and prosperity. It  
“ has armed the feeble hand of man, in short, with a power to  
“ which no limits can be assigned ; completed the dominion  
“ of mind over matter, and laid a sure foundation for all those  
“ future miracles of mechanical power which are to aid and re-  
“ ward the labors of after generations. It is to the genius of  
“ one man, too, that all this is mainly owing ; and certainly no  
“ man ever before bestowed such a gift on his kind. The  
“ blessing is not only universal but unbounded ; and the fabled  
“ inventors of the plough and the loom, who are deified by the  
“ erring gratitude of their rude contemporaries, conferred less  
“ important benefits on mankind than the inventor of our pre-  
“ sent Steam Engine.

“ This will be the fame of Watt, with future generations ;  
“ and it is sufficient for his race and country.”

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And now, Ladies and Gentlemen, after this splended tribute to the memory of departed genius, it remains only for me to hope that whatever deficiencies you may have found, in this attempt to recommend science to your notice will be pardoned.



