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978-1-108-07103-1 - An Historical and Descriptive Account of the Steam Engine:  
Comprising a General View of the Various Modes of Employing Elastic Vapour  
as a Prime Mover in Mechanics

Charles Frederick Partington

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### An Historical and Descriptive Account of the Steam Engine

Though much about his life is uncertain, Charles Frederick Partington is known to have lectured at the London Institution between 1823 and 1830 on a variety of technical topics, and he delivered some of the first lectures specifically designed for young people. He had a particular interest in the steam engine, and this book, reissued here in the first edition of 1822, was one of the earliest overviews of its history and development. A third edition appeared in 1826. Noting the excessive frequency with which ‘the faults of any new invention are unjustly magnified, while its real advantages are seldom duly appreciated’, the author is keen to act as evangelist. Detailed and illustrated descriptions of various early engines are included, comparing their characteristics and advantages. Also of note are Partington’s descriptions of early attempts to mitigate the ‘smoke and noxious effluvia which proceed from their capacious vomitories’.

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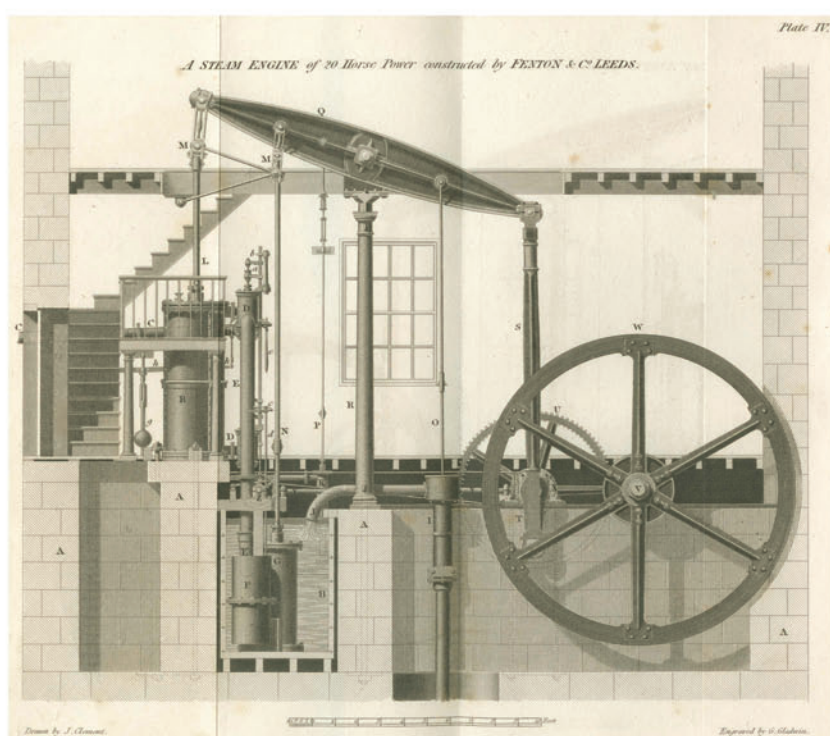
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MOVER IN MECHANICS ;  
WITH  
AN APPENDIX  
OF PATENTS AND PARLIAMENTARY PAPERS CONNECTED  
WITH THE SUBJECT.

BY CHARLES FREDERICK PARTINGTON,  
OF THE LONDON INSTITUTION.

“ Soon shall thy arm, unconquer'd Steam ! afar !  
Drag the slow barge, or drive the rapid car ;  
Or on wide-waving wings expanded bear  
The flying chariot through the fields of air.” *Darwin.*

*Illustrated by Thirteen Engravings and Diagrams.*

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TO

WILLIAM HASLEDINE PEPYS, Esq.

FELLOW OF THE ROYAL AND LINNEAN SOCIETIES; A VICE-  
PRESIDENT OF THE GEOLOGICAL SOCIETY; MEMBER OF  
THE ROYAL INSTITUTION, OF THE ASTRONOMICAL SO-  
CIETY, &c. &c. AND HON. SECRETARY OF THE LONDON  
INSTITUTION :

As a Tribute of Respect for his high Scientific Attain-  
ments, and liberal encouragement of Philosophical Learn-  
ing ; this Historical Account of one of the most valuable  
applications of Science to the Arts and Manufactures of  
a great Commercial Nation, is, with his permission,  
respectfully inscribed,

By his much obliged,

and faithful humble Servant,

CHARLES FREDERICK PARTINGTON.

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## INTRODUCTION.



**T**HE great practical use of machinery to a commercial country is so well known, and its superiority to animal force so universally acknowledged and felt in every branch of our manufactures, that but little apology will be necessary for introducing to the man of science and practical artizan, a work, the avowed object of which is, to render the uses and general principles of the Steam Engine familiar to every class of persons. That it has enabled England to support a proud pre-eminence, both in arts and political power, is equally apparent; and it is a fact much to be deplored, that while some of the least important of the arts connected with domestic life, have been illustrated and explained by men celebrated for scientific research, a description and account of the uses of this stupendous machine, have been left to the Cyclopædias and other works of a general nature.

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The principal object to be attained by the employment of the Steam Engine, as well as every other species of machinery, being the reduction of animal labour, it may be advisable, before we proceed to the more immediate subject of the present work, to compare the various species of artificial power that have hitherto been employed for that purpose; and by this method we may be enabled to calculate with certainty and precision, on the most economical mode of producing a given force. To form, however, an accurate estimate of the saving thus effected, it will be necessary to examine, though but briefly, the amount of animal force and its result as applied to machinery.

From the most accurate observations, it appears, that the physical powers of the human race differ very widely, not only in various individuals, but also in different climates; the value of a man therefore, as a working machine, will not be so great beneath the torrid zone as in the more temperate climate of Europe. This will serve to illustrate the great advantage which our Colonists, particularly in the West Indies, would derive from the more general employment of inanimate force; the day labour of a negro in the sugar

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countries, amounting to little more than one-third of that performed by an European mechanic.

A labourer working ten hours per day, can raise in one minute a weight equivalent to 3750 pounds one foot high, or about sixty cubic feet of water in the same time; while the power of a horse working eight hours per day, may be correctly averaged at 20,000 pounds. Smeaton states, that this animal, by means of pumps, can raise two hundred and fifty hogsheads of water ten feet high in an hour. It is a well known fact, also, that men when trained to running, are able on the average of several days being taken, to outstrip the fleetest horse; and yet it will be seen from the above statement, that his force, if properly applied, is at least six times that of the most powerful man.

The use of water as an impelling power, both for the turning of machinery and other purposes connected with the useful arts, appears to have been known at a very early period. Vitruvius describes a variety of machines for this purpose, the earliest of which were employed merely to raise a portion of the fluid by which they were impelled. The

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most simple method of applying this element as a mechanical agent, evidently consisted in the construction of a wheel, the periphery of which was composed of a number of float-boards. This, on being exposed to the action of a running stream, was afterwards employed to give motion to a variety of mills, and is at the present time employed in almost every species of machinery.

Among the most celebrated hydraulic machines, we may enumerate the Machine of Marly. This, when first constructed, appears to have produced one-eighth of the power expended, so that seven-eighths of its power were usually lost. This misapplied power has been injurious to the engine; and the wear it has occasioned, has reduced the mechanical effect very materially. But this may be considered as an extreme case, and we select it merely as an instance of that total ignorance of the first principles of mechanics, which characterized some foreign engineers of the last century.

It may, however, be advisable to examine the ratio of power expended in comparison with that of the effect produced in some of the most simple hydraulic machines; and by

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this calculation, the amount of friction, &c.  
may be accurately ascertained.

	<i>Power</i>	<i>Effect</i>
Undershot water wheel . . . . .	9	= 3
Overshot do. . . . .	10	= 8
Hydraulic Ram. (This machine will make from 20 to 100 strokes per minute.) . . . . .	10	= 6
Large machine at Chremnitz, (each stroke occupying about three minutes.) . . . . .	9	= 3

But the water-mill, which is the usual machine employed, even in its most improved form, is far from being beneficial either to the agriculturist or the manufacturer. The former is injured by the laws which prohibit the draining of mill-streams for the purposes of irrigation, by which much improvement is kept back that would otherwise take place; while the health of the latter, in the immediate neighbourhood of manufacturing districts, is much injured by the stagnant condition of the water which is thus unnecessarily dammed up.

Wind, which we may consider as the next substitute for animal power, appears to have been first employed to give motion to machinery in the beginning of the sixth century.

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The use of this species of mechanic force, is however principally limited to the grinding of corn, the pressing of seed, and other simple manipulations ; the great irregularity of this element precluding its application to those processes which require a continued motion.

A windmill with four sails, measuring seventy feet from the extremity of one sail, to that of the opposite one, each being six feet and an half in width, is capable of raising 926 pounds, two hundred and thirty-two feet in a minute ; and of working on an average eight hours per day. This is equivalent to the work of thirty-four men ; twenty-five square feet of canvas performing the average work of a day labourer. A mill of this magnitude seldom requires the attention of more than two men ; and it will thus be seen, that making allowance for its irregularity, wind possesses a decided superiority over every species of animal labour.

To shew, however, the great advantage the Steam Engine, even in its rudest state, possesses over mere pneumatic or hydraulic machinery, we will now examine its effective force when employed in the working of pumps. It has been already stated, that

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the Machine of Marly, formerly considered the most powerful engine in the world, when first erected lost seven-eighths of its power from friction, and other causes; while the overshot water-wheel which can act only in favourable situations, produces nearly eight-tenths of the force employed. Now it is stated by Dr. Desaguliers, that the atmospheric engine working at Griff-mine, nearly a century back, produced full two-thirds of effective force for the power employed; and this too at a comparatively moderate expense. We find, farther, that an hundred weight of coals burned in an engine on the old construction, would raise at least twenty thousand cubic feet of water twenty-four feet high; an engine with a twenty-four-inch cylinder doing the work of seventy-four horses. From this it will be seen that a bushel of coals is equal to two horses, and that every inch of the cylinder performs nearly the work of a man.

An engine upon Captain Savery's plan, constructed by Mr. Keir, has been found to raise nearly three millions of pounds of water one foot high with a single bushel of coals; while the best engine on Newcomen's principle will raise ten millions, and Mr. Watt's

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engine upwards of thirty millions of pounds, the same height. If we add to the advantage gained by the employment of so cheap a prime mover, the vast concentration of force thus brought into immediate action, its value may easily be appreciated.

One of the largest engines yet constructed, is now in action at the United Mine in Cornwall, it raises eighty thousand pounds one hundred feet in height per minute: and to effect this enormous labour, it only requires about thirty pounds of coal for the same period of time.

To the mining interests this valuable present of Science to the Arts has been peculiarly acceptable; as a large portion of our now most productive mineral districts must have long ere this been abandoned, had not the Steam Engine been employed as an active auxiliary in those stupendous works. In draining of fens and marsh lands this machine is in the highest degree valuable; and in England, particularly, it might be rendered still more generally useful. In practice it has been ascertained that an engine of six-horse power, will drain more than eight thousand acres, raising the water six feet in height;

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while the cost of erection for an engine for this species of work, including the pumps, will not exceed seven hundred pounds. This is more than ten windmills can perform, at an annual expenditure of several hundred pounds; while, in the former case, the out-goings will not exceed one hundred and fifty pounds per annum.

To the mariner, also, the Steam Engine offers advantages of a no less important and novel nature than those we have already described. By its use he is enabled to traverse the waters, both against wind and tide, with nearly as much certainty, and, as the machinery is now constructed, with much less danger, than by the most eligible road conveyance.

In proof of the speed of these vessels, it may be sufficient to state that the passage from or to London and Margate, which is more than eighty miles, by water, is often performed in the short space of six or seven hours! It too frequently, however, happens that the faults of any new invention are unjustly magnified, while its real advantages are seldom duly appreciated; and this axiom has been fully verified, in the clamour so unjustly raised against the application of the Steam

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Engine to nautical purposes. Accidents are now, however, of but rare occurrence; and it is more than probable, that the great improvements that have been made in the boiler and safety-valve, will effectually secure these parts of the engine from a recurrence of those tremendous explosions, which unfortunately characterized the first introduction of Steam Navigation.

And, lastly, the political economist must hail with the most heartfelt gratification, the introduction of so able and efficient a substitute for animal labour as the Steam Engine. It has been calculated that there are at least ten thousand of these machines at this time at work in Great Britain; performing a labour more than equal to that of two hundred thousand horses, which, if fed in the ordinary way, would require above one million acres of land for subsistence; and this is capable of supplying the necessaries of life to more than fifteen hundred thousand human beings.

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