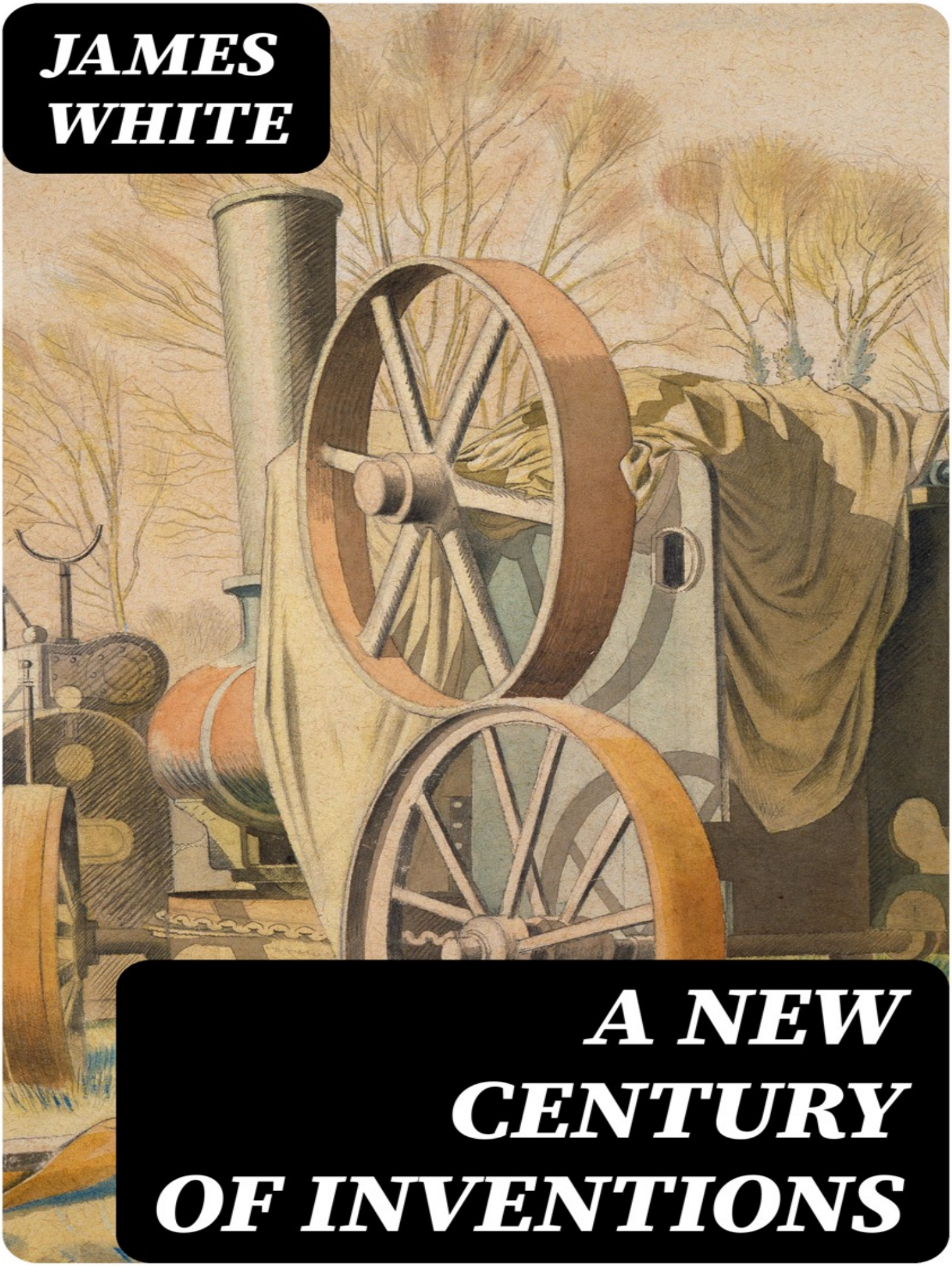
JAMES WHITE



A NEW CENTURY OF INVENTIONS

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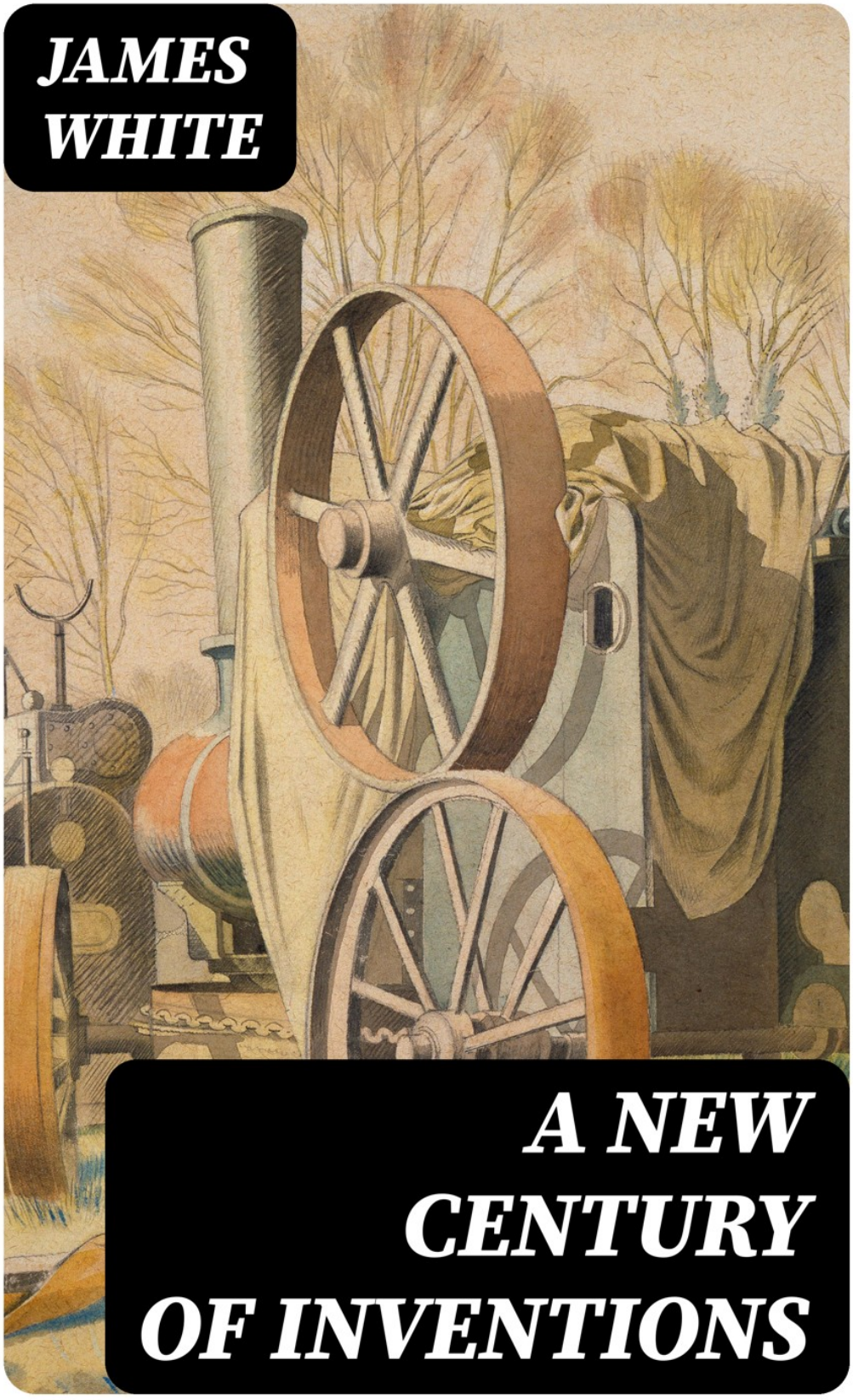

A NEW CENTURY OF INVENTIONS

James White

A New Century of Inventions

Being Designs & Descriptions of One Hundred Machines, Relating to Arts, Manufactures, & Domestic Life

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PREFACE.

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It has been my lot, during a long and eventful passage through life, to have my attention forcibly drawn to a multitude of Mechanical Subjects; the present review of which permits me to hope, that in making them publicly known, I should render an important service to the Arts and to Society. But the manner of doing this has been so long a question with me, that I have sometimes feared my ability would be extinct before I could do it at all. The reasons, however, that urge me to make the attempt acquire strength with the lapse of time: and whenever my declining health bespeaks the approach of that “night in which no man can work,” I feel deep regret, that this tribute should not have been thrown into the treasury of human knowledge while yet, by the favour of a good Providence, the means of doing it were more fully at my disposal.

I have determined therefore to publish these Inventions. Not because they have been matured into a regular System of Mechanical truth; but because they consist of *many* distinct objects of immediate application:—coupled with *some* ideas of a more comprehensive nature, that may probably extend the usefulness of this admirable study, in the hands of Artists yet unborn.

The form, or rather the title of this work, has but one example, that of the illustrious Marquis of Worcester; whose name may, perhaps, prolong the remembrance of mine: an event the rightful anticipation of which, I confess, would give me pleasure. Not that I either covet or regard what is

commonly called popular applause: but the approbation of the wise and good I do regard, and aspire to obtain; since that alone seems to fulfil the adage—“Vox populi vox dei.”

On the subject of our respective Inventions, my views are somewhat different from those of the Noble Marquis; whose description of his labours, as the custom then was, seems chiefly calculated to excite the desire of knowing them better: whereas my wish is to infuse, at once, the knowledge of my subjects into every head capable of receiving it.

This Work then, treats less of Theory than Practice. What are called Principles in Mechanics, are, and must be, founded on numerous suppositions; to present which to “the mind’s eye” requires often a *forest* of signs, which some readers *will* not, and others *can* not penetrate; so that, for many, Theory might as well not exist. This evil is increased when, as it sometimes happens, these suppositions are laid so far from reality, as to leave the result, though correctly deduced, further from the truth than the point to which a sound understanding unassisted by science, would have carried it. To this extreme discrepance of views between theoretical and practical men, may be ascribed their well-known antipathy to each other—in indulging which, they are alike to blame! since no theory inconsistent with fact can be complete; nor any fact be adduced, that a perfect theory will not account for and confirm.

Happily these discussions do not affect my present purpose. For although I shall offer nothing contrary to sound theory, I do not consider that as my subject; but make it my business to present rational methods of producing useful effects.—In other words to describe these Inventions as

connected with immediate Practice. And if, hereafter, it should become desirable to resume the discussion of any *principle* relating to these subjects, I shall cheerfully enter upon it; but hasten, mean while, to do what seems more important—to place the subjects themselves beyond the danger of being wholly lost, whatever may befall me in the course of those events which are still among the secrets of Heaven.

In the pursuit of knowledge, in general, it is often desirable to trace it from its *upper* source; and to know all the circumstances that have attended its progress, down to the very moment when it falls under our observation. Nor is it a matter of indifference to examine the minutest form which talent assumed, in the young mind whose subsequent efforts have engaged our attention, or gratified us with more varied and solid productions. In this view I have presumed to think myself justified in commencing this Work, by a succinct reference to those feeble efforts which marked my first steps in this career. Young I then was, and my musings puerile indeed! But they were original: they were the links of a chain which time has not yet snapt asunder—and of which my honoured Father saw the connection with my subsequent labours, long before I thought, myself, of any thing but working for the purposes of amusement; or, in the childish phraseology, of “playing at work.”

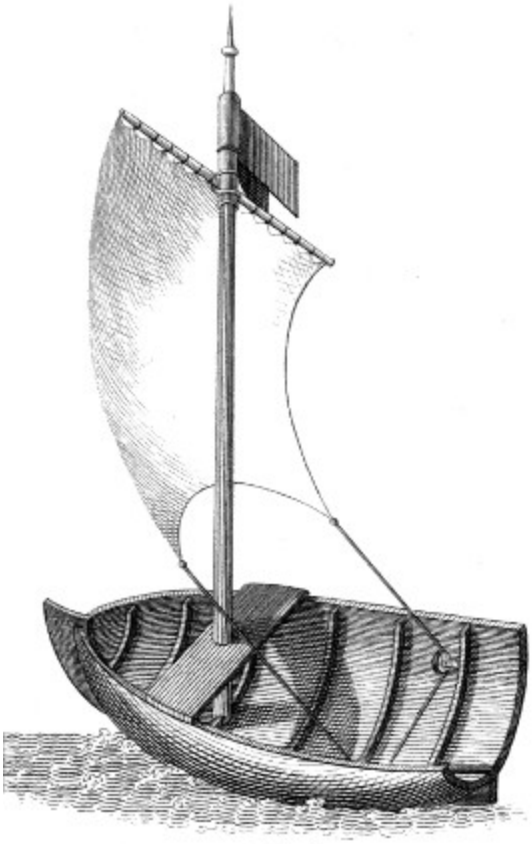
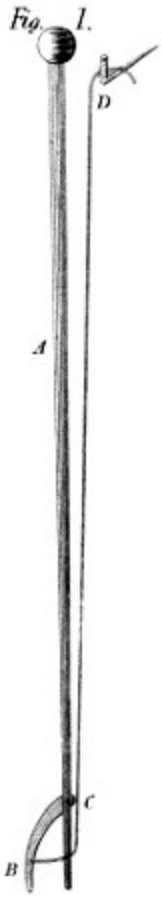


Fig. 3.

Should any reader then enquire what were my first avocations? the answer would be, I was (in imagination) a Millwright, whose Water-wheels were composed of Matches. Or a Woodman, converting my chairs into *Faggots*, and presenting them exultingly to my Parents: (who doubtless caressed the workman more cordially than they approved the work.) Or I was a Stone-digger, presuming to direct my friend the Quarry-man, *where* to bore his Rocks for blasting. Or a Coach-maker, building Phætons with *vaneer* stripped from the furniture, and hanging them on springs of Whalebone, borrowed from the hoops of my Grandmother. At another time, I was a Ship Builder, constructing Boats, the sails of which were set to a side-wind by the vane at the mast head; so as to impel the vessel in a given direction,

across a given Puddle, without a steersman. (See Plate 2. Fig. 3.) In fine, I was a Joiner, making, with one tool, a plane of most diminutive size, the [relative] perfection of which obtained me from my Father's Carpenter a profusion of tools, and dubbed me an artist, wherever his influence extended. By means like these I became a tolerable workman in all the mechanical branches, long before the age at which boys are apprenticed to any: not knowing till afterwards, that my good and provident Parent had engaged all his tradesmen to let me work at their respective trades, whenever the more regular engagements of school permitted.

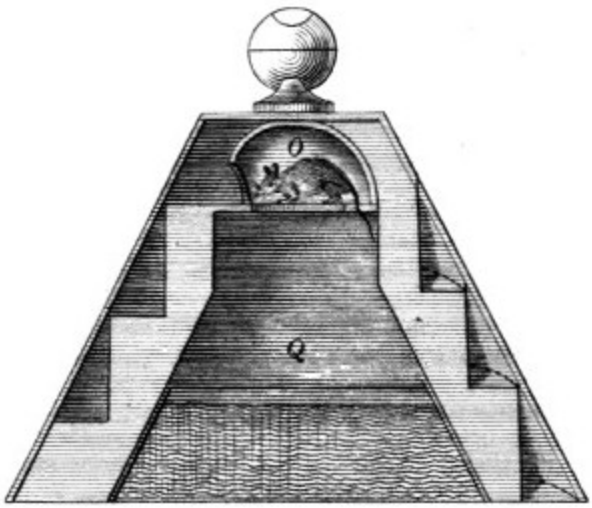
Before I open the list of my intended descriptions, I would crave permission to exhibit *two* more of the productions of my earliest thought—namely, an Instrument for taking Rats, and a Mouse Trap: subjects with which, fifty years ago, I was vastly taken; but for the appearance of which, here, I would apologize in form, did I not hope the considerations above adduced would justify this short digression. If more apology were needful.... Emerson himself describes a Rat-trap: and moreover, defies criticism, in a strain I should be *sorry* to imitate! my chief desire being to instruct at all events, and to please if I can: without, however, daring to attempt the elegant PROBLEM, stated and resolved in the same words —"Omne tulit punctum, qui miscuit utile dulci."



The town of Cirencester (my native place) is intersected by several branches of the river Churn, whose waters are pure and transparent, and whose banks, formerly, were much perforated by the industry of the Rats that had made them their residence. These holes had generally two openings; one at or near the surface of the ground, and the other near the bottom of the river: so that the rats could range the fields from the former, and dive into the water from the latter—where they were often seen gliding along the bottom, either up or down the stream. The Instrument for taking them in these circumstances, was no other than my Father’s Walking-stick, (represented at A. Fig. 1. Plate 2.) connected with the curve B by the joint C; the curve having a string fastened to it, which, passing through the body of

the stick, rose to the hand at D, for the purpose of closing the fork at the proper moment. The Machine, thus constructed, was put over the rat's back while in the act of diving; and by pulling the string C D, he was sufficiently pinched to be drawn out of the water, where a Dog stood ready to dispatch him.

Fig. 2.



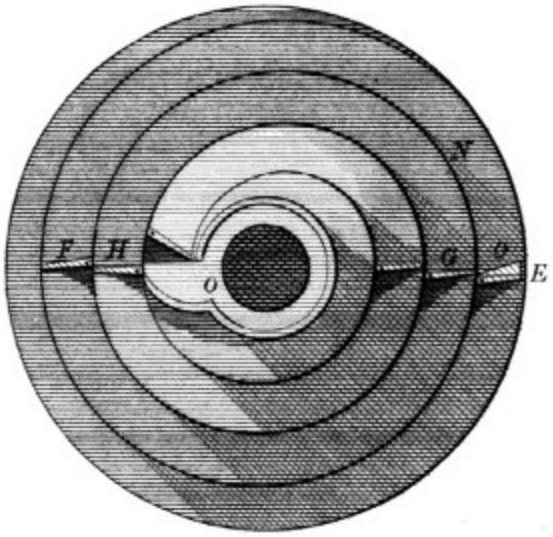


Fig. 4.

On the Mouse-trap (Fig. 2. and 4.) more thought was bestowed. It appeared adviseable (I remember) to lay the deceptive plan rather deep: and to lull the little animal into a false security till the snare had taken full effect; and even then to hide from her some of its horrors till she was far enough from this vestibule of misery, *not* to deposit there any of those tokens of distress that might deter other mice from following her example. The trap then, consisted of a *long* passage, formed spirally round the surface of a Cone, like the figures we have of the Tower of Babel. This passage is uncovered in Fig. 4 to shew the entrance E, and the subsequent gates F G H, &c. which like the valves of a pump, gave easy entrance to the victim, but forbade her return. At the length of a mouse from the outer gate E, was

placed the first bait N, say a small rind of cheese, well toasted to allure, but nailed down to prevent its removal. Its position was further indicated by a train of meal reaching from it to the outer gate E; which latter was nicely hung on pivots inclined a little to the perpendicular, so as to open with ease but never fail to close itself again. It had besides an horizontal plate O, fixed to its bottom on the inside, so that if the mouse attempted to open it that way, she trode on this plate and destroyed the result of her own efforts.

When, therefore, the little wretch had passed this barrier, she was in reality taken: but unconscious yet of danger, she nibbled the first bait with pleasure, and then skipped forward in search of more substantial food: but to obtain this she must pass more of these faithless gates, F G H, &c. which with progressive effort she opened, and at length found the inner compartments replete with good things, on which she fed to satiety, and then only began to think of her situation. Nor yet, with *much* alarm: for at the end of this labyrinth, so easy of access, she hoped to find an easy exit. But alas, these hopes were illusive. Instead of light, she found the *dark* gallery O; the least evil of which was to be too narrow for two mice abreast, since it overhung a tremendous cavern, Q, that entirely occupied the Cone below, and was filled with water deep enough to drown her, were she to fall, or be jostled into it. And one of these disasters she could hardly escape! for other mice would not fail to be beguiled into this cruel Bastille; to reach the same spot; and finally, to plunge her into this watery grave.

Having endeavoured to recollect the substance of these youthful attempts to unite cause and effect, or to fulfil a

given purpose by preconcerted means, I now turn to things of greater importance, and more worthy to be the theme of my readers' attention. The subjects to be presented will observe a miscellaneous order; since they have not only originated at different periods, but offer likewise different degrees of interest—to *equalize* which throughout the Work, appears a desirable attempt. As to the *manner* of treating each subject, it will be, generally, to describe the Machines by a reference to the Figures; and then to add some remarks on their date, construction, properties, and uses.

PART FIRST.

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A NEW CENTURY OF

Inventions.

A DYNAMOMETER; OR, *Machine for measuring Power and resistance while in Motion*.

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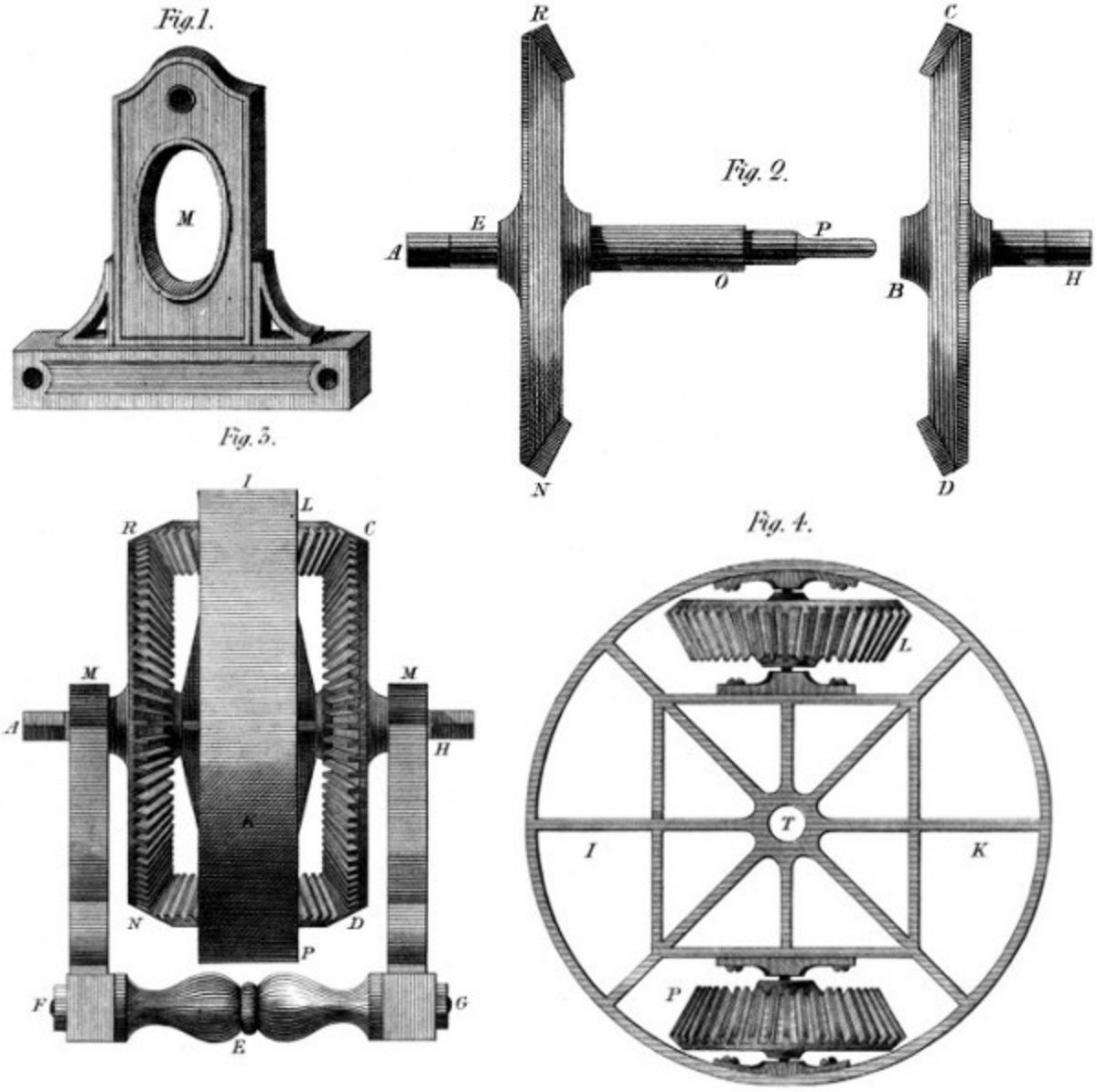
Dynamics being a science that relates to bodies in motion—comprehending not their weight only, or their velocities only, but the product of the one by the other; so the Dynamometer is a mean of measuring both these circumstances together, and thus of making known the *momentum* of a power or resistance in motion. As this Machine has a connection more or less intimate with almost every other, it seems entitled to the first place in this collection. Its description follows:



In Plate 3, Fig. 1 and 3, M M, represent two cheeks, standing parallel to each other, and forming a cage or frame by means of the cross bars E and the nuts F G. A P, Fig. 2, is the principal axis of the Dynamometer, fixed to the wheel R N of which it is the centre of motion. It has a square end A, formed to receive the wheels and other supplemental parts, to be mentioned below. After the square A, comes a bearing E, to fit the steps in the frame; and beyond the wheel R N is a cylindrical part O, fitted to the hollow axis T of the wheel

or frame I K, (Fig. 4); and in fine the form P of this shaft fits and turns in the *cannon* of the axis B H, of the wheel C D; so as, when put together and connected with the frame I K, to assume the form C R F G of the third figure. L P, Fig. 3 and 4, are two intermediate wheels (thus placed to balance each other on the common centre T) whose axes turn on proper steps in the frame I K; and which by their teeth connect the motion of this frame with that of *both* the wheels R N, and C D.

Such are the parts of the Dynamometer properly so called; and they are shewn as in their places in Plate 1, where the parts above described, as far as visible, are marked with the same letters. Moreover, this figure shews a scale-bason P, to receive the weights used to measure equable powers, as will be seen hereafter.

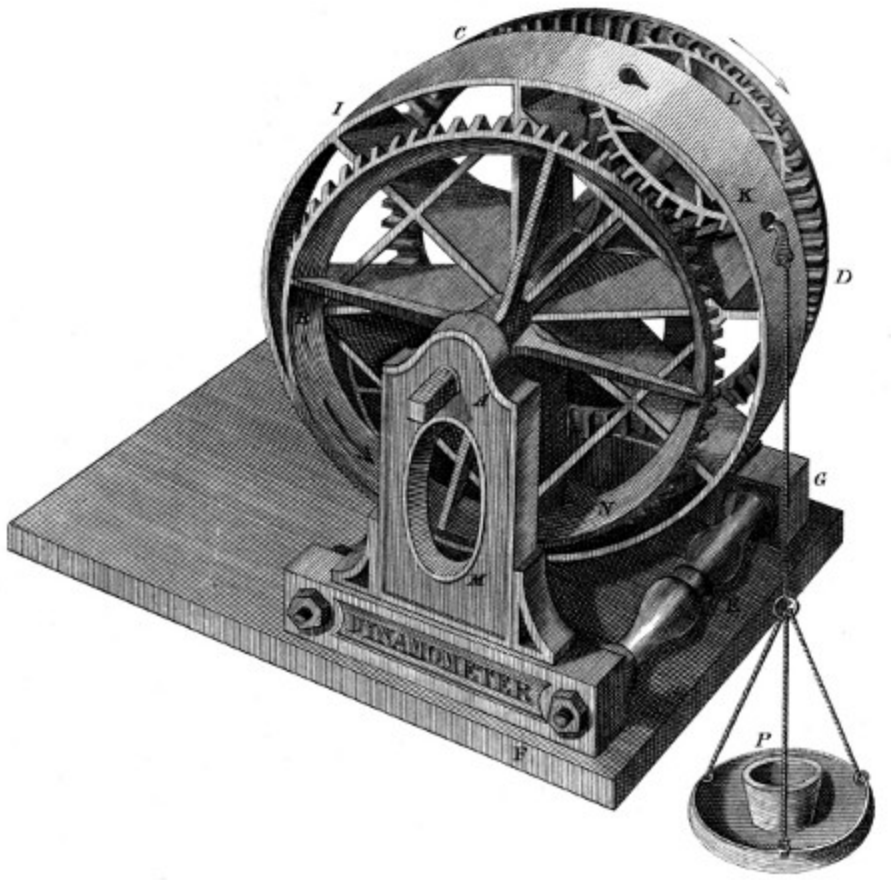
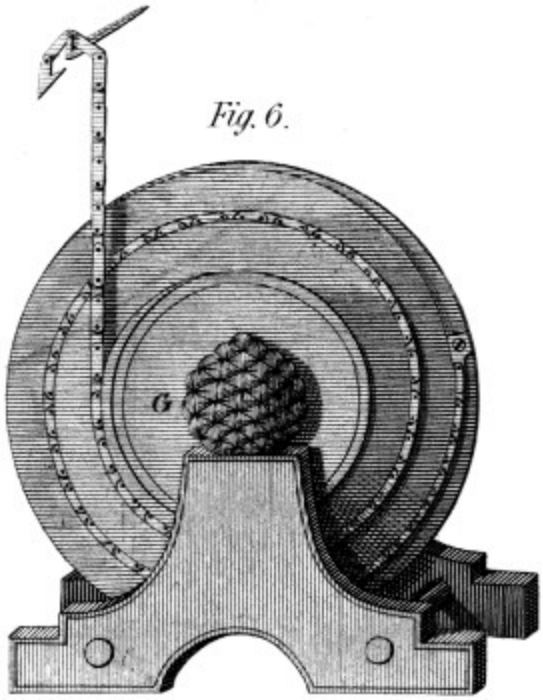


Plate 4 contains some of the auxiliary parts of this Machine. But before we proceed to describe them, it may be proper to observe that the *measuring power*, by the action of which at K, (Plate 1) the energy of the *force* is transmitted to the *resistance*, must, to meet every case, be susceptible of change, according as the resistance or force to be measured is uniform or convulsive. For example, in a mill grinding corn, driven by a fall of water, the whole process is sensibly uniform, and a weight at P is the proper measurer. But if it were desired to measure the effect of a pump driven by water, or of a tilt hammer worked by a Steam Engine, then the measuring power at P must be a spring: for in these cases the *vis inertiæ* of a weight would add to its force of gravity when suddenly raised, or detract from it

when the resistance should suddenly give way. Whenever therefore, the force and resistance are both *equable*, a weight will best measure them; and when *either* is convulsive, a spring: but a spring so equalized as to offer the same resistance at every degree of tension it may have to sustain.



In the 6th. and 7th. Figures, (Plate 4) these demands are fulfilled. The first represents a barrel-spring, similar to that of a watch, but *surrounded* by a fusee, the increasing radii of which compensate for the increased tension of the spring in the barrel G; so that the action of the system on the chain is always the same.

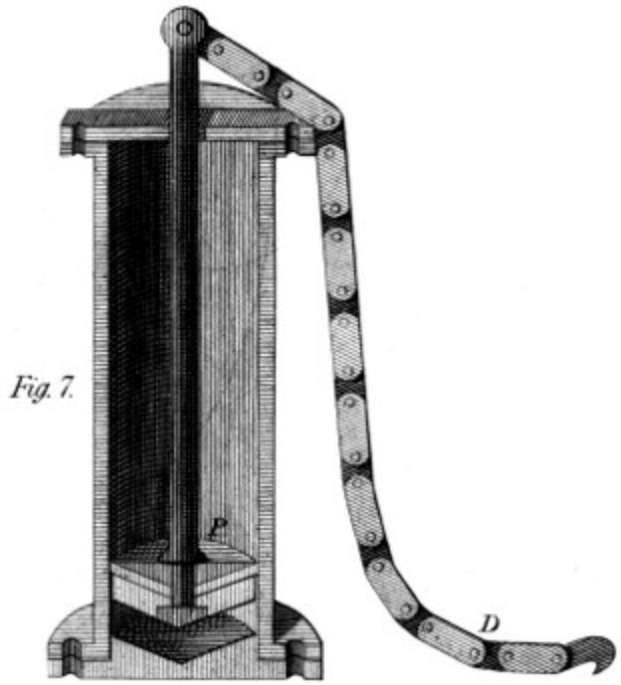


Fig. 7.

The 7th. Figure exhibits a spring adapted to heavier purposes. It is a cylinder nicely bored and hermetically closed at bottom; in which works a Piston P plunged in oil, which when forcibly drawn up forms a vacuum in the cylinder, into which the atmosphere endeavouring to enter, acts like a spring on the Piston; and preserves the same stress whatever be the height of this Piston in the cylinder.

This then, is also an *equalized Spring*, such as these experiments require; but it is *not* my invention. I first saw a vacuum used, as a spring, by my noble Patron, the late Earl Stanhope: to whose mechanical attainments, I owe this tribute of applause on the present occasion.

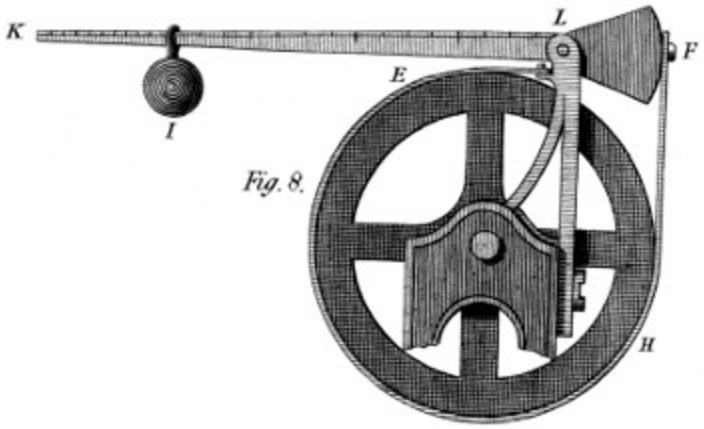
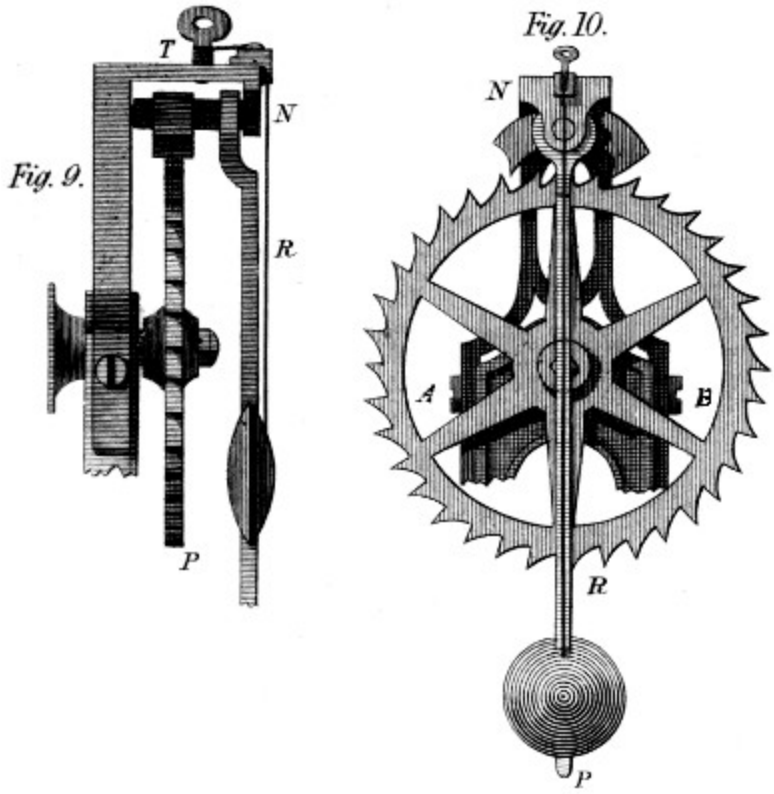


Fig. 8.

In the three Figures of this Plate, 8, 9, 10, are shewn two of the means I use for creating those factitious resistances that are sometimes wanted in the process of measuring power. In Fig. 8, E H F, is a gripe or brake, such as millers use to stop their wind-mills with; fixed under L, it surrounds the wheel E H, and is then fastened to the end F of the lever K L. The brake is thus pressed with greater or less force against the wheel, as the weight I is placed more or less distant from the fulcrum L of the lever. By these means a resistance of the equable kind is produced, capable of being adapted to *any* power it may be wished to measure; which makes this Dynamometer a real *tribometer* or measurer of friction.



The second kind of resistance brought forward in this Plate, is a Pendulum P (Fig. 9 and 10,) set a vibrating by a pallet-wheel A B, connected with the axis of resistance; and working in the pallets N. It appears besides, in the Figure, that the times of vibration can be changed by the mechanism T N R, which raises or lowers the ball P. This then, is another resistance, such as we sometimes want: but it is also a mean of finding the quantity of resistance that a vibrating body opposes to motion, when oscillating in times *not* those due to its length as a pendulum. In other words it is a mean of measuring *vis inertiæ* itself—which an *astounding* modern writer declares does not exist!

I hasten to give a description of certain other parts relating to the measuring system: and some methods of connecting with the Dynamometer the several kinds of forces it may be desirable to examine.

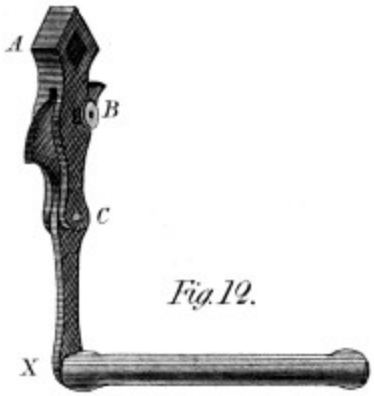


Fig. 12.

In Plate 5, Fig. 12, A X represents a Crank or Handle with a variable radius, the intent of which is to adapt a man’s strength to the velocity and intensity of any resistance he may have to overcome. The manner is this: B is a Screw pressing on the quadrant, and fixing the arm C X to any required angle with the part A C: thus determining the virtual radius of the handle.

Fig. 14.

Fig. 14, shews a method of applying to the Machine the force of a man pumping: for the catch N permits the handle

O to rise alone, but carries round the wheel R, at every downward stroke, while the fixed catch C secures all the forward motion thus given. The same Figure shews, at B, the force of a man in the act of *rowing*: for the catch M permits the lever V M to recede when the man *fetches* his stroke, and carries the wheel round when he *takes* it. An operation, by the bye, which I think the best mode of employing human strength, if every possible advantage is taken of the method.

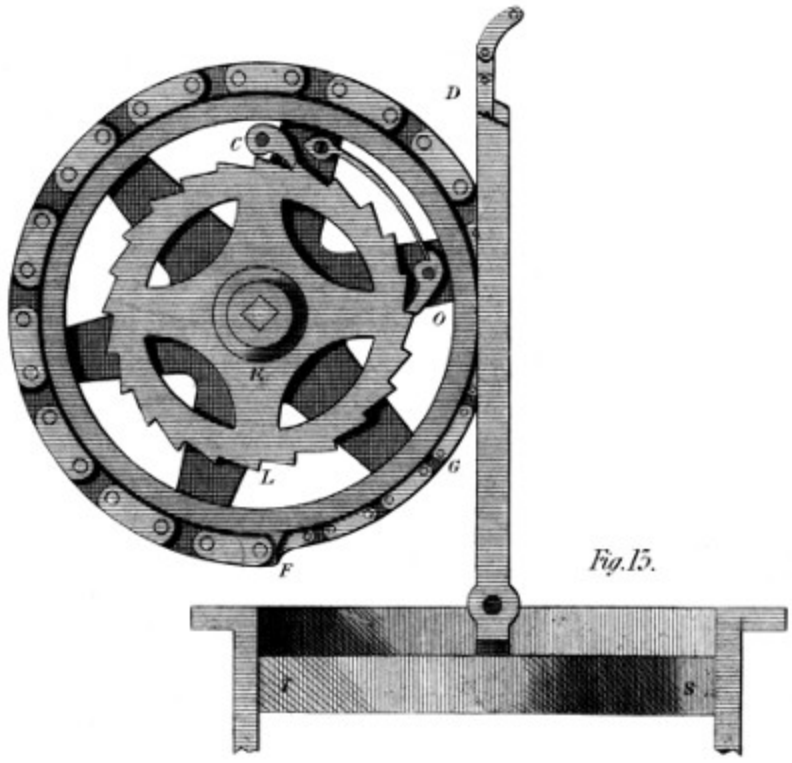


Fig. 15.

The 13th. Figure shews the last method I shall now offer of adapting power to the Dynamometer. T S represents the Piston of a Steam Engine, the rod of which is formed of *two* bars, including between them the chains F G and F D, the first of which is single, merely to carry back the acting wheel; and the last double, to draw round the ratchet wheel E, by the catch O, at every stroke of the Piston.

I must obviate here an objection that may strike some readers. This Piston T S, acts only one way, like that of an atmospheric engine, a thing now quite out of date! I answer that this figure is chiefly intended to give the *idea*; and shew a rotatory Steam Engine that *might* act without a fly. I will add, that it is my intention some day to bring forward a method of using these suspended actions, better than by a mere ratchet wheel: and especially without incurring danger from the length of the ratchet teeth, or the blow they suffer at the beginning of the strokes. But of this more hereafter.

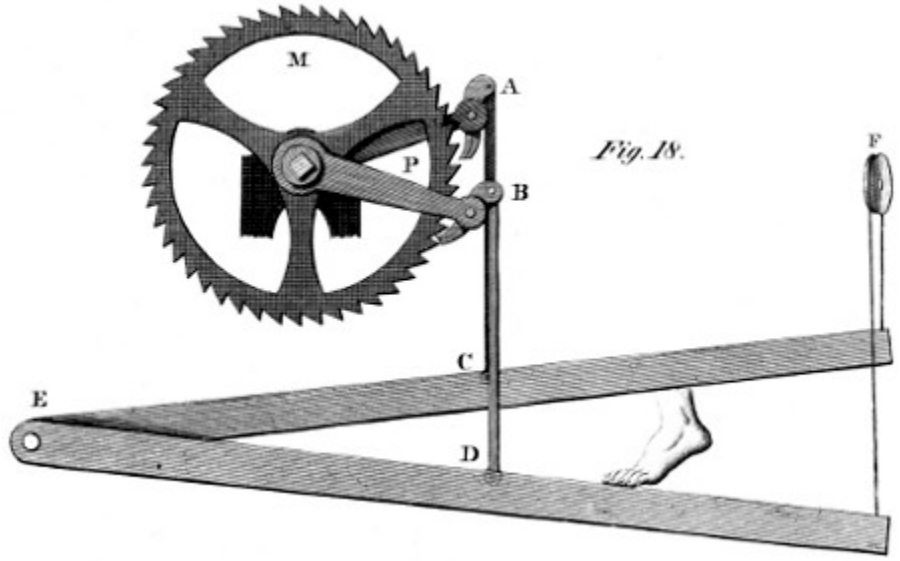


Fig. 18.

A short description will suffice for the mechanism of the 18th. figure (Plate 6), which is intended to convert the alternate pressure of a man's feet into rotatory motion, and then to measure his *power*. To do this two catches A B, take into the teeth of the same wheel M, and each catch carries an arm, P, embracing somewhat stiffly the boss of the wheel. The treadles have a common centre at E, and are fastened to the same rope going over a pulley, F, so as for the depression of the one to raise the other. Again, the pulling bars C D, are connected with the treadles, and from

the form of the catches, it is evident (since the levers move with some stiffness), that the first effect of an ascending motion will be to draw the rising catch out of the teeth, and keep it out until arrived at its greatest height; when the very beginning of its descending motion will bring the catch into the teeth again, and thus carry round the wheel at every downward movement of the treadle;—a method this of making a ratchet work without rattling upon the wheel.

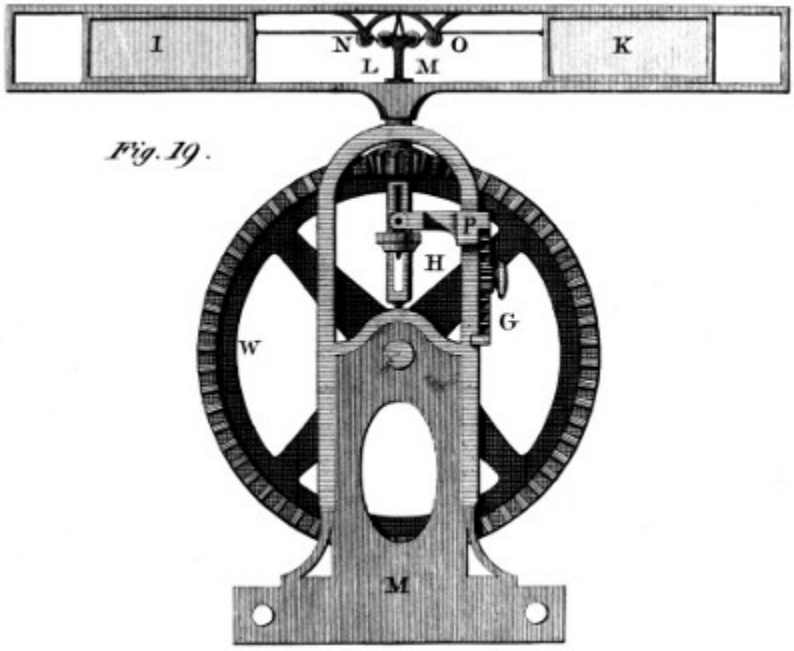


Fig. 19.

The mechanism shewn in figure 19, is intended to produce another of our factitious resistances; and it serves likewise to make experiments on the resistance of the air. It is a fly, meeting with an *equable* resistance as does the fly in the striking train of a clock. The wheel W, is put on the axis of resistance of the Dynamometer; and its teeth geer in those of the vertical shaft L H. This latter is perforated from above, and has an open mortice all along its body, which a small bar penetrates, meeting at bottom the ring H, to which it is fastened by a pin going through the mortice. Again, this ring H, is moved, downward, by the rollers of the