INTRODUCTORY ESSAY.

1. In the classic ages, Invention was restricted almost exclusively to Poetry and Painting, hence to however remote a period we may trace the history of manual arts, we find it barren of all interest, save that which always attaches to a comparatively primitive character. Except as considered Metaphysically and Mathematically, we cannot but feel surprised how the idea of a self-motive mechanical power should have originated, or at what period it could have been called into existence. As emanating from the fruitful fancy of the poet or romancer, it may readily be conceived, but with what object and by what means the rude mechanician of a remote antiquity would attempt it, is not readily to be conjectured. All modern ideas on the subject would reasonably ally it with improvements early connected with Horologe, when automata of every kind engaged the attention of the ingenious mechanician; or, to a period when water and other natural agents were commonly to be seen operating machines employed in mechanical arts, and which, as they were early brought to a state of considerable perfection, the *ne plus ultra* would most likely, for a long time, appear to have been attained; and what then would be more natural, in the onward progress of improvement, than to seek for the obtaining of power by some direct application of gravity? The problem of a Perpetual Motion once promulgated would prove highly attractive, as it would appear in a primitive age easy, natural, and perfectly attainable. Imagination may thus supply the probable process originating this pursuit, one equally curious, contra-

dictory, and seductive. We cannot trace the history of its practical operations previous to the sixteenth century, and at that era only to a very limited extent.* When, however, we consider the mutations and difficulties attending early histories generally, we have little to be surprised at in the fact of this meagre information. Whatever may have been the fate of this class of lost inventions, certainly—so far as may be judged from modern models—we seem to have no great occasion for regret; except, indeed, such as would unquestionably apply to the curiosity of their mediæval character.

2. In the seventeenth century we find schemes for applying magnetism, pneumatic agency, weights, and atmospheric changes. To this period belongs the celebrated invention of the Marquis of Worcester, exhibited by him before Charles I. and his court. During the same century were established, in London, the Royal Society; and in Paris, the Royal Academy of Sciences.† These learned bodies showed less fastidiousness than they afterwards observed, in the class of Memoirs they admitted, consequently we find both were drawn into discussion, by their members, on the then popular topic of the time—"Perpetual Motion." Patents were also being granted in England thus early for reputed perpetual motion machines.

3. In the eighteenth century it was currently reported that the discovery was at length made; sometimes propagated by the public press, at others by the scientific journals then coming into repute. The latter admitted papers in which

* In the 16th century, Edmund Jentill, in a letter to Lord Burghley, dated October, 1594, amongst other matters, professed to have discovered "A perpetuall motion of sufficient force to dryve a myll;" afterwards, in another statement, adding the words, "in any standinge water, or quike springe, which maie alsoe be converted to sundrie other uses comodious for all estates, which have hetherto byn supposed to be unpractyzable." See "Science in England," illustrated in letters from the reign of Queen Elizabeth to Charles the Second, edited by J. O. Halliwell, F.R.S., &c., 8vo, 1841, pp. 35-6.

† See their decision against admitting and discussing papers on the subject, pp. 190-1.

the subject was treated rather favourably than otherwise; and the "Annual Register" and "Gentleman's Magazine" made known the invention of Orffyreus, which had acquired remarkable notoriety in Germany; attributable perhaps to the large premium he required, and the patronage of a Prince of Hesse Cassel. To crown all, during the South Sea Bubble mania, the prospectus was issued of a company "For a Wheel for Perpetual Motion."*

4. But it is to the present century we must look for abundant and various schemes. The ready means afforded for making such plans public, through the medium of cheap popular scientific journals and magazines, and likewise the facilities afforded for patenting inventions, have brought to light much curious matter.

5. Before proceeding further, it becomes requisite to premise in what sense the term PERPETUUM MOBILE, or Perpetual Motion, should be taken; that is, in its mechanical application, which is the only one we have to consider. The term must unquestionably be used in a modified, and not in its absolute literal sense; being thus accepted as one early, yet wrongfully, though popularly applied, it distinguishes inventions intended to be operated through the medium of their own peculiarly-constructed internal arrangements, and seems afterwards, though improperly, to have been extended to ingenious automata, worked by external agents, as magnetism, &c.; which latter we reject entirely. It is manifest that the term neither does, nor ever can, strictly apply to any product of human intelligence. In this limited sense it means any machine which (independent of wear) would not run out. A ball always rolling, a fluid always flowing, a wheel always turning—each operating by gravity alone—would exactly fulfil the required condition. But not so machinery moved by any external communicated power, as the tides, wind, electricity, temperature, or like agencies. We may even go

* See Anderson's History of Commerce.

the length to assert that, in this strict mechanical sense, even the planetary system offers no exhibition of perpetual motion in the several planets themselves, although each is in perpetual movement. The distinction lies here:—the motions of the earth, for example, are referable to other causes than its own structural arrangement, internal or external. By Perpetual Motion, then, is simply to be understood—a self-sustained continuous mechanical motive power; and which we shall now next proceed to consider.

6. A German metaphysician declared his preference to truth being hid, even had he the choice of its being otherwise, from the exquisite gratification which the search after it affords the true philosopher. The long-hidden truth respecting Perpetual Motion has exercised the mental energies of men of the highest intellect, and has entangled in its toils men of the humblest attainments. Much as is known respecting what has been done in this investigation, how much remains untold! In action, if not in words, those who seek for this *perpetuum mobile*, much as they desire to find it, take no small pleasure in the endless contrivances it requires and suggests. The inquiry always presents itself to the mind as exceedingly simple and easy; particularly to the uninitiated. The early life-history of inventors continually informs us of the youthful genius fascinated with the pleasing prospect of cutting the Gordian knot. The early career of Sir Richard Arkwright was marked by his acquaintance with the clockmaker Kay, who made the first model of his memorable cotton-spinning machine, through his applying to him to construct a perpetual motion model. And it is really remarkable to find that inventors are not wanting who, although not possessed of any assured proof of its possibility, nay, in direct opposition to every announcement of its impracticability, and as if in contempt of every censure heaped on the pursuit, are still to be found rushing into this hazardous arena. It has been condemned as a chimera, an *ignis fatuus*, an absurdity; and yet adventurers are nothing

daunted. Surely this opens to us a curious phase of the human mind, that sets at nought the dicta of mechanics and mathematics, and the admitted laws of nature.

7. Any machine would deserve the distinctive character of being a perpetual motion, that acquired its rotation, supposing it to be a wheel, from a property consequent on the arrangement of its internal parts, always compelling one side to become heavier than the other; such motion being no other than the ability in a machine to generate and maintain its own power of movement.

8. The attempts to solve this problem would seem, so far, only to have proved it to be thoroughly paradoxical. The inventions resulting from it during the last three centuries baffle any attempt at classification developing progressive improvement. It would almost seem as if each inventor had acted independent of his predecessors; and, therefore, frequently re-inventing, as new, some exploded fallacy. These retrograde operations, and strange resuscitations, have led to unmitigated censure, and a sweeping charge of ignorance, imbecility, and folly. No doubt many instances exist especially deserving the severest treatment; but unsparing censure loses half its causticity, and it shows a weak cause, or weaker advocacy, to condemn all parties alike as deficient both in learning and common sense. It has long been, and so remains to this day, an unsettled question, whether Perpetual Motion is, or is not, possible. To name no other, it is evident, from their writings, that Bishop Wilkins, Gravesande, Bernoulli, Leupold, Nicholson, and many eminent mathematicians, have favoured the belief in the possibility of Perpetual Motion, although admitting difficulties in the way of its discovery.* Against it, we find de la Hire, Parent, Papin, Desaguliers, and the great majority of scientific men of all classes

* A recent German writer says:—"The discovery of such a motion is difficult, *but not impossible*, as Kästner, Langsdorf, and other celebrated mathematicians, have frequently shown. (See page 405.)

and countries. It is evident, therefore, that even mathematicians are not agreed. But to the further consideration of this point we shall presently return.

9. The inventive faculty in most men in early life, and in others during their lives, according to the power and bent of their genius, information, and position in life, takes an essentially romantic turn, unless curbed by experience or necessity. This is no evil omen in youth, but is scarcely excusable at a riper age. Invention should not be always soaring among clouds, and finding delight only in mysticism. A fervid imagination forbids the seeing of impossibilities, even when opposed by stern realities. The theoretical or the practical engineer, unhappily led away by this substitution of prolific fancies in place of sound judgment, is the last person to be convinced by the most obvious obstacles to success, in the fulfilment of his views and statements. To him, every opponent is the victim of little-mindedness, prejudice, and envy. To himself, all his opinions stand for realizable objects. We cannot avoid having some, though a very chastened, sympathy with such enthusiastic projectors, who would seem to pride themselves on the strongly-expressed notion that "genius to madness is near allied." It is, unquestionably, in such cases, a constitutional weakness, ill fitting its possessor for that calm, cool, reflective character which alone commands confidence and ensures respect. The class of men who form the largest body of inventors are better practical than theoretical mechanicians; to them the refinements of geometers are truly a fountain sealed, and it would perhaps be difficult to offer propositions and definitions level to their general comprehension; but the attempt is worthy of the most gifted mind. If they do not always see the bearing and consequence of one being equal to one, a pound to a pound, the like to the like, and other profound expressions, of this at least they may rest pretty well satisfied—that the easier the problem of self-motive power appears to them, just in a reverse ratio is it the more difficult;—and that just

in proportion as they see two or any greater number of equally feasible constructions, they may with certainty take them as representing, not Perpetual Motion, but the squares of distance they are by consequence from the goal of their ambition.

10. The history of the search for Perpetual Motion does not afford a single instance of ascertained success; all that wears any appearance of probability remains secret, and, like other secrets, cannot be defended in any satisfactory way against the opinions of the sceptical, who have in their favour, in this instance, an appeal to learned authorities against the principle of all such machines, and the total want of operativeness in all known practical results. Published statements afford sorry examples of talents and ingenuity strangely misapplied. Some, but very few, are slightly redeemed from contempt by a glimpse of novelty. Of genius all are deficient, and the reproductions of known fallacies shows a remarkable ignorance of first principles on one side, and of the most ordinary sources of information on the other. One of the grossest fallacies of the mind is that of taking for granted that ideas of mechanical constructions, apparently the result of accident, must of necessity be quite original. The history of all invention fairly leads to the conclusion that, were all that is known to be swept from the face of the earth, the whole would be reinvented in coming ages. The most doubtful "originality" is that which any inventor attributes to his ignorance of all previous plans, coupled with an isolated position in life. It may be granted that the desire of *secrecy* often renders investigation difficult, and, from some remarkable feeling of this nature, most inventors of supposed perpetual motion machines, believing themselves possessors of this notable power, make it a matter of profound secrecy.

11. It is difficult to surmise whether the expectancy of honour or hope of high reward has most contributed to promote investigations of this character, and led to the folly of

making a great secret of the presumed discovery. Each in its turn has indubitably had its influence. They who sought fame have been most miserably disappointed; and as to wealth, who has ever seen a return for his first outlay? At one period, the large premiums of from £10 to £20,000, offered by Government for means to discover the longitude at sea, stimulated many; and when rescinded, the problem lost nothing of its interest with many really ingenious individuals; for at that period there was a real difficulty for the inventive to know what to invent, to satisfy their desire of producing novel mechanical contrivances. The evils of secrecy are numerous. The inventor is left to believe in a bubble; the public are deluded, and impostors reap the only harvest, by imposing on the credulity of all lovers of the wonderful—of which *a secret* will generally be accepted as one; while the deceived are mostly prompted by the hope of making a discovery. And who can deny the pleasure there is in solving a secret?

12. An object of such long-continued, inveterate, and industrious inquiry might at least be supposed to be attainable, and when attained to be of superlative value. Reserving the first inquiry for further observation, we will only presume its possibility admitted, and direct attention to the only probably correct estimate of its intrinsic value. It has been attempted to effect Perpetual Motion by water, mercury, sand, levers, inclined planes, Archimedean screws, Barker's mills, water-wheels, single wheels, drum wheels, multiplied wheels, and other mechanical means. One might almost desire to know what has not been put on its trial to make wheel-work continually turn itself. A thousand failures do not prove the thing impossible, because a thousand persons may have taken a wrong direction. But it proves this, that something, however trifling, is wanting; so small, it may be, perhaps, that no one has hitherto taken the trouble to look for it! Suppose it to be something to act as a lubricator; or something as a detent, at a particular point. Does not this at once suggest

the weakness and feebleness of such a machine for any utilitarian purpose? It must be plain that it would, at best, be little more than an exquisitely curious toy.

13. Many persons may have been drawn into this amusing pursuit under the influence of vague impressions that self-motive power was but a lost invention. The more abstruse the inquiry, the more some minds are gratified in probing the subtleties which mystery abundantly affords. Hence Judicial Astrology, the Philosopher's Stone, the Quadrature of the Circle, the Multiplication of the Cube, the Elixir Vitæ —a panacea for all diseases—have each been sources of intense study. The metaphysical Cowley says, in "The Adept," that, though he—

> —— his great secret miss,
> For neither it in art or nature is,
> Yet things worth while his toils he gains;
> And does his charge and labour pay
> With good unsought experiments by the way.

The Baconian Philosophy has so far discouraged as to have dispelled nearly all these chimeras. Only for its influence, dreams of philosophy would have increased, rather than, as they have done, fallen into decay.

14. We will not, however, close here, but endeavour to show, from comparatively recent personal experience, the working effects of taking up the study of Perpetual Motion as a serious employment—some men experimenting for years, others for the best part of a lifetime. All studies of a mental kind may be, and continually are being, carried to excess. It has been so in Painting, in Statuary, in Music, in Literature, and in all the Learned Professions. The "pursuit of Knowledge under difficulties" has driven many to despair; and the irritability, anxieties, and distresses of "Genius" under every phase, have been admirably depicted by D'Israeli. The "Martyrs of Science" have been many—the victims to the pursuit of Perpetual Motion not a few. If Hartmann of Leipsic hanged himself from despair at his vainly-spent life

in prosecuting this hopeless attempt, could not an equally sad tale be related of many a Poet and Artist? But to proceed, we will first give a series of short narratives relating to modern instances of devotion to this search after a self-motive power*; followed by extracts from several years' correspondence.—First, of personal narratives:—

I. A tall old Welshman, a custom-house officer, imagined he had found out Perpetual Motion by some peculiar application of sand from the sea shore. He went to London with the machine he had invented, and applied to the Board of Longitude, but without receiving any encouragement. He used to say that it was while listening to a sermon at St. James's Church, Liverpool, from a particular text (which he never named) that he had the first idea of the machine he had invented.

II. A watchmaker showed his customers the model of a wheel and weights in his shop, belonging to a German. It had employed a man three months cleaning, and had been left on his hands for ten years, therefore he supposed the German would never redeem it, although he had travelled with the machine all over Europe. He had some means of making it work; but walking across the room, or a passing cart in the street, would suffice to jostle and stop the works. The same watchmaker had been presented by some other party with a pamphlet entitled "Perpetual Motion: explained as it is discovered in nature. By Peter Brentano. Gloucester: Printed by William Verrinder, 24, Southgate Street, 1830." 27 pages. It is arranged under these heads:—

Page 3. "Perpetual Motion, or, self-possessing power to move in space void of air caused by a method of forcing the

* Since these narratives were arranged, the author has been informed, on unquestionable authority, that Ramsden, celebrated for his dividing machine, used frequently to mention the fact of the late Duke of Gordon, at Aberdeen, being deeply and expensively engaged in carrying out experiments for obtaining Perpetual Motion.

water which runs out of a tube, back into the same tube again, the power for forcing back the water gained by levers."

This is followed by two engravings, one representing an "Iron Case."

Page 11. "Formation of a Vacuum for the Moving Machine."

Page 12. "Illustrations."

Page 14. "Creation of Time." [Genesis, chap. 1, verses 1, 2, 3, 4, 5.]

Page 20. "The Formation of Time." [Genesis, verses 6, 7, 9, 10, 13, 16, 17, 18.]

Page 24. Job, chap. 38, verses 5, 8, 9, 10, 11, 14.

III. Mr. S—— had a curious Perpetual Motion contrivance, constructed of double cones, made with mathematical precision. His first trial of it was before his wife, and shut up in his room, where all it wanted was his continued presence and assistance!

IV. Mr. E——, a very ingenious workman, devoted all his time to mechanical pursuits in relation to Perpetual Motion, reducing himself to a state of beggary through his fondness for his favourite pursuit. He was always in high spirits, speaking confidently of his success being near and certain; yet, to the last, one thing was wanting, the very thing first sought.

V. Mr. P—— followed the pursuit of Perpetual Motion above twelve years, until at last his mind became affected. Later in life he preferred being silent on the subject. He used to say his notions of it were very simple, so much so, that were he only a practical mechanic he should not doubt of success, but that to place his plans in the hands of workmen would only expose his inventions to his disadvantage. He contrived a quantity of apparatus principally on a large scale, with different kinds of wheels, some operated by water, and all intended to be kept constantly overbalancing.

VI. Mr. E—— states that Mr. Charles, of Bala (Wales), in

his Dictionary of the Bible, under the article "Mills," relates of mills in Wales which worked without wind or water, or the aid of man, after being once set in motion. This, Mr. E—— says truly, is very like Perpetual Motion. Mr. Charles, he proceeds, further states that, about the year 1500, William Salisbury (first translator of the Bible into Welsh) had a mill of this description. He also gives an account of a wheel and millstone found near Corwen, supposed to have belonged to such a mill. The wheel was all of wood, *except one quarter;* the axle was the thickness of a man's thigh, and the millstone three feet diameter, having a piece of metal attached to its edge, which had probably been a loadstone! Mr. E—— says he has tried many plans for Perpetual Motion, all of which have failed; he has thought of a hundred schemes or more, but still he thinks he knows of one plan superior to all hitherto tried.

VII. In Manchester, a man forty years of age, who had made his money as a common moulder in a foundry, expended the sum of three hundred pounds in models of wheels having falling arms, arranged with the intention of always preponderating on one side, made for him by a watchmaker.

VIII. Mr. B—— of London, philosophical instrument maker, entered into an engagement with a gentleman, who bound him on oath to keep the secret of his plans in working out his scheme for Perpetual Motion, under a penalty of one thousand pounds. His employer, a rich gentleman, expended above two thousand, and himself one thousand pounds in fruitless efforts. Mr. B—— when speaking of their career, would take up a scrap of paper, and tearing off a very small portion, exclaim—"We got it—all but that," throwing the paper scrap on the table.

IX. Mr. R—— was made a confidant by a friend of his, who so firmly believed himself possessed of a veritable self-moving and most powerful machine, that he consulted Mr. R —— on a means of stopping it, after its being once set in motion!

X. A mechanic, a model maker, had a neat brass model of a timepiece, in which were two steel balls A and B;—B to fall into a semicircular gallery C, and be carried to the end D of a straight trough D E; while A in its turn rolls to E, and so on continuously; only the gallery C not being screwed in its place, we are desired to take the will for the deed, until twenty shillings be raised to complete this part of the work!

XI. Mr. F—— professes to have an unfailing Perpetual Motion, obtained by making the vertical pressure of a column of water work a four-feet wheel, which by a fall of eight feet will enable him, with a one-foot crank, to raise water to a pump to supply the cistern above, and, after allowing for friction, leave a surplus of above one-third of the power employed. He has, he says, studied Perpetual Motion for twenty years; and has several plans, but this he estimates to be worth all the rest. His brother, who has followed the same pursuit, has a room set round with machines, none of which ever went. His nearest approach to success was in a method acting by the percussion of balls, one after another, as a wheel revolved; on which, and other plans, he has expended upwards of £1500. Mr. F—— knows a gentleman who has been thirty years engaged on this subject, and is pecuniarily assisted by a person of good means.

XII. In a conversation with Mr. ——, he stated that a friend of his, although he was a Professor of Mathematics in one of our Colleges, had invented a mode of propelling vessels, which was only what would be called a Perpetual Motion; yet he was for years infatuated with his plan, before he could satisfy himself that it was preposterous to expect it to operate as a propulsive power.

XIII. Mr. ——, a dissenting minister, then resident in the North of England, in conversations with his nephew, about the year 1835, mentioned his having been 14 years seeking to discover Perpetual Motion, in which he at last succeeded, having had a wheel with rolling balls in motion several days; after which he destroyed it to avoid discovery, retaining only

his drawings. He had castings made, which he could finish in a lathe himself, with all other requisite work for his invention. He was a good linguist and mathematician, and died at forty years of age; his relative considered that he must have expended at least £1500 in experiments. His brother, also a minister, could not be persuaded, by drawings, of the possibility of this continuous movement, but still he sent an account of his brother's invention to a local publication, about 1835-6.

And secondly, the following extracts from correspondence are offered in further corroboration of the opinions and feelings of inventors once entangled in the meshes of this mechanical dilemma:—

XIV. Mr. P—— writes from Slough, 6th Nov., 1847:—"I have discovered a system by which *Power* to any extent may be procured by a self-acting piece of machinery. My object is not the amount of money, but to meet with a party who possesses sufficient knowledge and influence to procure and protect a patent."

XV. Mr. H——, Islington, 28th July, 1848, says:—"Having matured the plan of a mechanical improvement which I am persuaded will be highly profitable to any capitalist who will join with me in taking out a patent and applying the invention to practical use, I beg leave to certify the same to you. When I state that I have submitted a drawing and description to the scrutiny of Lord G—— and Mr. V——, and that they have both borne practical testimony of their favourable opinion by presenting me with a handsome contribution, I trust you will not allow any preconceived opinion of the impossibility of Perpetual Motion to operate to my prejudice, when I announce that such is the object of my invention."

XVI. Mr. H——, of Weymouth, 12th Feb., 1849, communicates about "a continuous revolution machine, which overcomes gravity," and "has friction wheels to stop it!"

XVII. Mr. H——, Hinckley, 21st Jan., 1850, writes:—"Sir,—As I am confident of the machine going, but am in want of money, which stops its progress, I am sure from £4 to £6 will set it a-going." He had previously written:—"Sir,—We have always understood that there was a free patent and a premium for any one that discovered the Perpetual Motion."

XVIII. Mr. R——, Liverpool, 26th Nov., 1850, states:—"I have invented a machine to give motion to any kind of machinery. Its power is not derived from any changeable or expensive element; in short, it is a Perpetual Motion. It may be applied to any stationary machinery, but not to ships and carriages. I have not made a practical experiment of it, but its truth is clear and simple.* What I expect to have for it will be £500 sterling."

XIX. Mr. K——, Pentonville, 20th Dec., 1850, corresponds about two inventions:—"No. 1. Maintaining power by machinery, to gain any power that may be required, to any extent; and No. 2. A maintaining water power from a well, or still tank, thereby to get a perpetual water power."

XX. Mr. M——, Liskeard, 10th May, 1852, writes about his "new motive power," of which he states:—"The advantages are its *cheapness* and *simplicity*, not costing more than about £1. per horse power, and its perpetuity of motion, for it will start itself, and will go for ever without requiring any attendance, except for oiling, repairs, &c. As it is not patented, of course I would not describe it further than to say, it is worked by an entirely new principle which I have discovered." In another letter he says:—"The motive force is the buoyant power of water, a force which costs nothing, and is easily obtained."

XXI. Mr. H——, Kent, 23rd Aug., 1852, writes in a strain which excites our interest and sympathy:—"I have com-

* It turned out to be an endless band or chain carrying buckets to fill an upper cistern, from which it was to be worked.

pleted (he says) a most valuable invention to give true time at sea; it supersedes the use of the chronometer, has no spring, and never requires to be wound up, being self-acting. It acts by the gravity of mercury, and as *gravity* is not affected by temperature, when set to Greenwich mean time continues to show that time in every climate or part of the world. It is an invention of the most simple kind, truly mathematical in its mechanical construction, both in practice and theory. It solves the problem of *Negative Attraction*, which is this;—A raises B, acting on a wheel C; and B raises A to its former position, continuing the motion of the toothed wheel C, *negativing* the attraction of the gravity of A, merely by the *change* in the *position* of B, which is mercury, whose gravity shifts in the tube that contains it; and this change of position, from left to right, and *vice versa*, constitutes a self-acting balance compensating lever, and that acts on an equally simple and compensating escapement, which is effected by the force of A and B, ultimately; with these, and four wheels, the machine is a complete chronometer, giving quarter second time. It can be varied in size and weight, and can be equally applied for a church clock or a watch. This invention has cost me thirty years' study and experience, and now that I have obtained the result required mathematically, I am aware of its value in a double sense; the English patent alone is worth £60,000 *to the trade* of Horlogery generally, and at the same time from neglecting every other thing to attain this object, I am in want of means to render me so far independent of the trade as to be able to *demand* the above sum, or carry out my principle by absorbing the sale of self-acting chronometer watches and clocks."

XXII. Mr. S—— writes from Creetown, Scotland, 12th June, 1855:—"I have a small machine I think might come to be of some use to the public; it is a small engine, the same nearly as a steam-engine, which could work itself, without either steam or anything to assist it. It would require no assistance after it commenced, except oiling. I

think I might have something for it, as it would save every cost after put up. It would require no winding up or anything. I heard that Government had a reward out for to try and find out something that could work itself. I think it would be of great use; it could drive mills or the like itself."

XXIII. An Irish correspondent (Mr. G——) writes from the county of Donegal, dated Moville, 25th Sept., 1855:—"After long and painful study of mechanical power, I have at present arrived at my purpose of a power that will drive the British Fleet, at no expense, and at speed never before thought of. I have been directed by some scientific gentlemen to bring the matter before you."

On the 5th Oct. he again wrote:—"I received your most instructive letter, and I trust it (the invention) will not turn out like the mouse and the mountain. To give you some idea of this great power, it is of very simple construction. There is but one wheel in the work, and the power can be raised to any imaginable height; this power turns the wheel, and the wheel turns the crank, and it will be found that no such simple, useful, and practicable invention has ever come under your notice. It is equally applicable to propel by either sea or land; either the largest ship or the simplest mill or loom can be driven by it, with the same ease; and the power can be raised in proportion to the necessity for it. It is taken from the clock, the mill, and the loom combined together. I have not the least doubt of the success of my invention. I have given it many trials, and produced very satisfactory results, but unfortunately I am not in a position, for want of capital, to carry out this great invention; it may fall back another century, if something does not arise to my aid. I have spent a great deal of money on this matter."

XXIV. Mr. P——, a gentleman of a very igenious turn of mind, writing from Cheshire, 29th Jan., 1856, says:—"I have not been brought up a mechanist in any shape, but invention and ingenuity are *natural* to all our family. Like many other fools, I spent about nine months in trying to dis-

cover perpetual motion. Now, Sir Walter Scott tells us such a thing can never be done, but were he here I could convince him to the contrary, for I discovered it in my first attempt, which was by attraction onwards on a level plane, and then by ever-counterbalancing gravitation backwards down an inclined plane. I secondly tried it on by leverage; I worked at it about six months, levers, wheels, cranks, and everything else innumerable, and the further I went the nearer I got to perpetual stand-still. In my third attempt I considered that in Hydrostatics the same thing that finds its centre of gravitation upwards, in Pneumatics finds its centre of gravity downwards; for instance, drop a piece of wood, it falls; place that same piece under water, it rises; so here, by a very simple contrivance, I got up and down perpetual motion to full perfection, but they all amount to nothing; I cast them aside as mere playthings, for all the power they can ever give is taken up in moving themselves."

XXV. Mr. A——, writing from Ireland, dated Ballywatter, 20th Feb., 1856, speaks of a "motive power" he has discovered, of which he states:—"It will prove safe, speedy and economical, though of astonishing power; it will be uniform and steady in operation, and at the highest velocity perfectly within the control of one man, I may say boy. When properly adjusted, it may also for hours, indeed for days, be left to its own discretion; especially if by mechanism oil be kept to its very few bearings. The power is a combination of weight, as the first mover, with the power of the lever, to which is added velocity as the result of both, and which varies with the amount of both."

XXVI. Mr. B——, of Bermondsey, 28th July, 1857, says:—"Sir,—I have (through curious circumstances) discovered 'perpetual motion.' It will be a wonderful engine, as it can be constructed to keep in motion (without the least assistance of anybody) everlastingly. I have not the means of carrying it on by myself, therefore I want somebody with money to assist me in doing so."

XXVII. Another Mr. B——, Wheyhill, Andover, Hants, 15th Oct., 1857, writes:—"Sir,—I beg permission to inform you that I am in a position to *prove positively* that motive power to any amount for propelling all kinds of machinery may be maintained without any cost whatever, save the wearing of the machinery by friction. This invaluable invention supersedes the steam-engine, but I cannot proceed to a public development without capital."

XXVIII. The last communication that will be here noticed was made by enclosing a printed circular, giving notice that —"Speedily will be published, dedicated to the British people, a Treatise on the discovery and application of a Continuous, Increasing, and Self-generating Motive Power, whereby the agency of steam is superseded in mechanical enterprises. By John Henry Vries, Esq., M.D." In this work the prospectus states:—"The Inventor enters into details relative to the Pneumatic Engine, of whose utility, as applied to practical purposes, Dr. V. is the discoverer.* General remarks follow (it adds), wherein the labours of Watt, Erichsen, Sir Humphrey Davy, and others, are dwelt upon, &c., &c." Only a limited number of copies are promised, at the price of 50s. each.

15. It is needless to extend personal narrative or correspondence as indicative of the general diffusion of a desire to discover the solution of the problem of a *perpetuum mobile;* in each instance adduced, however, will be found characteristic traits of the progress, hopes, disappointments, and untiring zeal that distinguishes the various inventors of this order. Those who read for the first time these statements of devotedness to what seems little better than laborious idleness; and peruse the collected examples of published plans

* Dr. J. H. Vries, in January, 1853, had granted him provisional protection for six months, for "Improvements in obtaining Motive Power," but not having been proceeded with, has become void. He employed electricity, the gases from water, a generator, and a rotatory engine.

for Perpetual Motion; and find that men have been so enamoured with these schemes that for three centuries they have not only continued patenting abortive efforts to maintain self-motive power, but rather increase than diminish in avidity to perpetuate their errors, will admit that it becomes matter for serious inquiry, Have Mathematicians and Mechanicians exhausted their powers of demonstration? Who is amenable for the evil which somewhere or other undoubtedly does exist to a lamentable extent; so much so, indeed, as to be a reflection on the intelligence of the present age of boasted enlightenment? We shall proceed to examine in order, the several facts connected with this remarkable subject, according to the various aspects in which it is generally viewed.

16. Perpetual Motion either is, or is not, attainable. We do not pretend to decide the question, but merely to show that much may be said on both sides. They who engage in experiments to discover Perpetual Motion, as well as they who undertake to disprove its possibility, equally find themselves beset with difficulties. It proves a paradox to both.

17. It is accepted by most scientific men that Perpetual Motion is impossible, because no body can at the same time be heavier and lighter than itself. But may there not, after all, be exceptions to this law, as in some other laws, stated in equally general terms? Thus, although water is said always to find its level, and heavy bodies to fall lowest,—yet, no one disbelieves in capillary attraction, or that the heavy fluid, carbonic acid gas, rises to a mountain's height.

18. The eminent French mathematician and astronomer Philip de la Hire, born in 1640, died in 1718. At the age of about 38 years he offered a demonstration on the impossibility of Perpetual Motion,* which it would seem has never been improved on for 182 years; and although the fact of its existence has been repeated by numerous writers, it never

* See page 102, and Appendix D.

appears to have occurred to any to reproduce it; his name, but not his reasoning, has been reiterated during the above period as sufficient to warn all projectors from any further pursuit of their favourite schemes. To say the least, such indifference is indefensible. Authorities are not wanting who employ his reasoning, but silence on this fact left the mechanic to suppose that something even still more conclusive against him lay hid in the closets of the learned. The wonder with many was, what M. de la Hire could have said so decisive and infallible. We now have his reasons before us; and we learn that they leave Gravesande, Bernoulli, and many eminent Continental mathematicians in doubt whether Perpetual Motion is impossible, and consequently whether M. de la Hire may not have offered too sweeping a denunciation against its possibility. The demonstration, intended to apply generally, does actually but take into consideration, as data, schemes previously known to be fallacious; therefore, such demonstration, however clearly unfavourable to one class of schemes, may not strictly apply to an entirely different order of inventions. As late as Nicholson (1800), we find this opinion supported. We may remark, for instance, [illegible] granted the free, unre-

attainable, the greater is the necessity for reducing the question to its true conditions, and satisfactorily settling the inquiry. An inventor desires to ascertain, not one, but all the difficulties that he may expect will frustrate his attaining his object. Knowing the real difficulty is next to being half-way to the attainment of his search. Here it is, however, that Mathematics ceases to assist him. It predicts nothing; it makes no discovery in mechanical invention.

19. Taking their tone from the strongly-expressed objections raised, and clearly and ably defined and demonstrated by Mathematicians, by Natural Philosophers, and Scientific Bodies, the public voice has, for more than a hundred years, been directed against Perpetual Motion as a dream, a delusion, a chimera, an *ignis fatuus*. It is likened to Alchemy and to the Squaring of the Circle. Censure is of the easiest possible acquirement. Few are aware how difficult it is to steer a medium course, and that, while there is no wisdom shown in abuse, it actually requires some skill, some information, and not a little practice, to praise or censure discriminately. It is not by displaying a nervous irritability that shrinks from all explanation, other than reiterated stale platitudes, that minds above mediocrity are to be satisfied on scientific matters. Why should a Perpetual Motion invention be pursued, more than other, timidly and secretly? More, perhaps, for one reason than any other; because persons who proffer friendly advice go so far out of their way, to cover their own ignorance of the matter, by offering false, and consequently offensive rather than convincing arguments.

20. Incessant failure does not, of itself, offer sufficient argument against the possibility of Perpetual Motion. The history of all science affords abundant evidence of this fact. Such opponents affect to despise Alchemy, the precursor of Chemistry; false enough in itself, and yet where would Chemistry have been at this day had Alchemy been unknown? Necessity often, but more frequently accident, led to the dis-

covery of many early inventions. In modern times, most discoveries are made solely by a train of scientific reasoning.

21. Another frequent but false argument is the offering of disparaging opinions drawn from absurd contrasts; as if failure in one invention or pursuit afforded cogent reasons against the possibility of some other diametrically opposite invention or pursuit. This favourite course of weak opponents, is too ridiculous an estimate of the proper method of settling such disputed points, to require farther comment.

22. Inutility is the presumed consequence of an impossible experiment, and no one can deny the fact. But on what ground is the experiment itself assumed to be impossible? It does not show very good common sense to argue without a sensible reason. What was the use of rubbing a small piece of amber?—or noticing the quivering of a dead frog's legs, or the action of copper and silver laid on the tongue? In a word, of what use is the electric telegraph?

23. But the most invidious distinction and the weakest argument adopted by well-meaning persons is, that the pursuit leads to "wasting time and fortune." We have no wish to uphold improvidence, but let us ask, what pursuit in life is ensured against this species of loss? That it is not peculiar to making geometrical drawings and innocently motionless wheels we feel well assured; nay, we doubt whether domestic life, with its many frivolous amusements and accomplishments, is always equally thrifty in expenditure, with these well-abused Inventors. If we admit our opinions to be swayed by such representations, how much have the inventors of Rotatory Engines, Screw Propellers, and a thousand other schemes, to answer for on the score of vast unproductive expenditure!

24. Lastly,—It is a singular want of liberality to impeach the understanding of any one who, for any reason whatever, attempts the discovery of Perpetual Motion. It is not too much to say, that there is scarcely any ingenious youthful engineer or machinist who has not more or less given his

mind to solving the problem. Infatuation is not confined to the pursuit of Perpetual Motion; and without attempting or intending the least apology for spending a lifetime or fortune, as a worthy employment of the one or the other, on a matter of such apparently second-rate value, yet, what is unjust in relation to arts and sciences generally, for the acts of a few of their weaker followers, is equally unjust in the present instance, which charges on thousands the foibles of a few eccentric individuals—a class of enthusiasts from which, unhappily, no pursuit and no walk in life is entirely free.

25. Opposition in the right direction might effect much good. A mathematician of an inventive turn of mind would, in endeavouring to prove the impossibility of Perpetual Motion, be in a fair way to discovery (if within mortal reach), as compared to the cleverest mechanic, seeing nothing before him but its ready achievement. The first would seek difficulties and ponder them; the other would see a machine in motion even before it was made; and we all know the danger of over confidence. Theoretically, Perpetual Motion may be actually neither impossible nor absurd; not so, however, the many pretended self-motive machines to which precipitation has given rise, all abundantly absurd. If the theory be sound, then in practice, have all results to which it has led been most unfortunate; whether considered in reference to inventors or to opponents.

26. We have, in this tantalizing pursuit, only found an ingenious lock, for which we want now to find a key. The key is all that is wanting. Many set out on the search for it, declaring its discovery to be of very easy attainment; experience has taught some humility, but posterity follows in their footsteps. Many an ardent student feels assured he has all but found it—such a mere trifle wanting. A few declare they know exactly where it is, and are providing instruments for its recovery. Several hasty aspirants have published their good fortune, to avoid piracy. Two found it, but alas! it has followed them to their graves; so

that, after all this boastful parade, the key is not yet forthcoming.

27. It is sufficient stimulus to the human mind, in entering upon any great undertaking, to believe in its possibility. What has been done by one may be done by another; so all reasonably argue. Now no doubt, what has tended more than anything else to keep alive the pursuit of Perpetual Motion, is an idea of its being merely a lost invention, and, therefore, undoubtedly possible. The scientific sage, however, views all these schemes alike as fallacies and absurdities; he can only see in them Nature opposed to herself, which is quite untenable.

28. Implicit credulity, no less than unlimited scepticism it, has been well observed, evidences mental imbecility. The multitude adopt the popular opinion; and the common belief of scientific men, and through them scientific treatises, being against the possibility of Perpetual Motion, it is self-evident which is the popular side. And there is little in the whole arcana of scientific knowledge to warrant any strikingly opposite view. Half a dozen scientific authorities ranged against some hundreds is not a very encouraging spectacle. And such is a true picture of the case.

29. Even Science is fallible; but Mechanics is not a science open to the discovery of new laws, as in Chemistry. If we seek for argument in favour of the possibility of Perpetual Motion, we must believe it attainable on known laws, by means which in no way infringe them, and which themselves only offer additional proof of their stability. Of this there can be no reasonable doubt. And Mathematicians, too, are correct, as far as they go, and where they stop.

30. The only appeal that can be made in apology for the pursuit of Perpetual Motion, is derivable from the results represented to have been obtained by the Marquis of Worcester in one instance, and by Orffyreus in another. All the circumstances relating to their singular inventions excite our curiosity, raise our scepticism, and induce us to pause in

our decision. Let us first consider the inventors personally; and secondly their inventions and the circumstances attending their exhibition. The two men were of very different character and position in life. The first noble by birth, of ancient lineage, loyal to the extent of sacrificing his property in support of the cause of Charles I., and evidencing by his prayers, his truly religious sentiments. About or before 1648 (as the King died 1649), he exhibited his wheel, or perpetual motion, in the Tower, before his Majesty, two Extraordinary Ambassadors, the Duke of Richmond, Duke Hamilton, most part of the Court, and Sir William Belford, Lord Lieutenant of the Tower. We have to consider the upright character of the Marquis, his having invented the steam-engine, his worthiness in all respects, and the circumstances here detailed, and then ask ourselves :—Little as Science favours any belief in such an invention, can we see any reasonable grounds for error in this great experiment, or believe that a person so distinguished, and so much to be admired in all other respects, could thus boldly and recklessly deceive himself, his noble company, and the public: taking ten years or upwards to elaborate and record a gross falsehood? It seems incredible, and true respect for the Marquis's memory will go far to maintain doubts respecting the infallibility of all mathematical demonstrations adverse to the possibility of a self-motive power. Secondly :—

31. Orffyreus was of humble origin, versatile talents, fickle, discontented, unsettled, irregular, and eccentric. He was ambitious, boasting, and the very man to raise up enemies. Between 1712 and 1718 he made and destroyed in succession four wheels or machines. He had learnt the art of clock-making, and several mechanical arts, and is supposed to have constructed or put these wheels together himself. He had a princely patron, who wished to obtain practical results from the invention for manufacturing and other operations. A misunderstanding ensues; and from that time to his death, in 1745—at least twenty-eight years—the subject lies

dormant, and the invention dies with him. This last fact, coupled with the wheel having raised so great a weight as 70 lbs., makes a doubtful case still more doubtful; and particularly when, about the same time, Geiser imposed on the German public with a mere piece of clockwork, as a true perpetual motion.

32. Next, as to the inventions of these two remarkable characters:—

The Marquis of Worcester's wheel was fourteen feet in diameter; it was rotated by the action of forty 50 lb. weights —2,000 lbs.—an enormous weight, requiring some very laborious operations of the carpenter, to erect a sufficiently strong framework. Its completion must have taken some time, and led to frequent visits from the noble inventor, as well as experiments to test its correct working, before offering a practical demonstration before majesty.

33. Orffyreus's fourth or last wheel, at Hesse Cassel, was twelve feet in diameter, fourteen inches broad, made of light oak framing, and covered with oil-cloth. It would revolve either way, and this alone casts a shade of doubt on there being any deception in practice with it. But, strange to say, it had power enough to raise 70 lbs. to a considerable height. Its operations were seen and attested by so many, that these broad facts rest not alone on the inventor's authority. It was so ingeniously made, that M. Gravesande wrote to Sir Isaac Newton on the subject; and his letter and mathematical reasonings, in reference to the matter, appear in his works, edited by Professor Lalande, 1774.

34. The subject of Perpetual Motion opposes paradox to paradox. It is viewed both as being most simple and most difficult to find. The learned justify both its possibility and impossibility. Many mechanics believe it possible; but of the only two accepted cases, both prove secrets. Its pursuit always commences in confidence, only to end in doubt. It is as near being discovered now as it was three hundred years ago; it was then tried, and is now beginning. Inventors

stand at cross-roads, arguing as to which is the right path; although there are only two roads, all are allured to take the wrong. Of two men supposed to have got into the right track, some think both were impostors, and many believe that, one at least deserved no better character. Most inventors reap honour, or at least commiseration; here they are assailed with opprobrium. Such is the fate of this paradox of paradoxes.

35. It is a singular coincidence, that the only two accredited inventions acting as evidences of Perpetual Motion, one about 1649, the other 1712, should both have been treasured by their inventors, and yet be lost to posterity. Nothing satisfactory can be advanced to justify secrecy under such circumstances. If due to accident, it may have been unavoidable; if otherwise, it evinces a narrow selfish principle, to the suspicion of which no man should lay himself open. Our belief in either is necessarily wavering. We view each with suspicion. Our confidence is shaken by known facts, and receives no confirmation from any results obtained by those who thus withhold from us that evidence, the truth of which we ourselves might easily have tested.

36. Disbelief in the possibility of Perpetual Motion pervades all scientific classes of society, from whom the popular tone is taken. Yet among scientific men it is often disbelief with a mental reservation. The most incredulous mathematician would like to examine a so-called perpetual motion, while he would scout the idea of listening to any attempted proof of the multiplication of two equal amounts to produce an unequal one. It is in the very nature of mathematical and mechanical science to afford evidence that runs entirely counter to the idea of self-motive machinery. At the same time, as scientific attainments enlarge the understanding, they could have no effect to prejudice the most learned against receiving ocular demonstration of any fact on this subject, however opposed to preconceived views.

37. There are only a limited number of methods which at

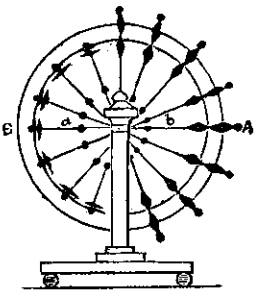
the utmost can be expected, by the most sanguine, to offer a transient hope of success; as wheels, with solid or fluid weights arranged somewhere around their peripheries. Such plans are capable of analysis; but, if complicated, are all the more likely to prove abortive in results. It is not to be expected that the discovery, if to be made at all, will ever be the result of haphazard experiment. Ignorance has already done its work, and no one should now have the presumption to attempt it, unprovided with a large fund of intelligence, and no small ability in experimental investigations generally; remembering—

> A little knowledge is a dangerous thing:
> Drink deep, or taste not the Pierian spring;

for, as sad experience truly shows—

> There shallow draughts intoxicate the brain.

38. Appearances are every way so much opposed to offering any plausible hope of success, that all the wisest can say amounts to no more than—It may be found; or, it may never be found; and, if found, the discoverer will probably establish the fame of others quite as much as, if not more than, his own. The insufficiency of the only supposed means of solving the problem—namely, by contriving a wheel so that all the weights on one side shall be constantly farther from the centre than the weights of the opposite side—has been attempted to be shown in a palpable manner by Desaguliers (see pages 79 and 89); but the author has invented a model apparatus of a more convincing character, being an actual wheel, as represented in the annexed diagram. We have here a wheel A B, having a number of spokes, each terminating, at or beyond the periphery, with a weight. It is represented with all the weights extended farthest on the right hand side,



Now, on giving it a reverse revolution, all these weights will recede, and the weights on the left hand side be extended in like manner. Yet will nothing be gained; in every position it will remain neutral. It consists of spokes, as A *a* and B *b*, each terminating at their ends A and B in compound levers, or lazy-tongs, while their opposite ends *a* and *b* pass through a hole drilled in the axle; and so for each spoke, which must have a weight equal to the weight of the opposite end. Spokes thus made, when vertical on the top side of the wheel, are extended, while the opposite bottom spoke is depressed or shortened; and so on with each.*

39. In conclusion, we would briefly observe that we think a careful perusal of all that has been gathered respecting Perpetual Motion clearly establishes that much remains to be done to prove the impossibility of practically solving this knotty problem; and that a full demonstration of the difficulties that environ it is worthy of being attempted, even by the most exalted mathematicians. It is not requisite that they should descend to the level of the most ordinary minds, but leave it for others to reduce their elaborated reasoning on the subject to some generally comprehensible form. We fear the proposal partakes too much of the difficulty of proving a negative; but still, as the attempt has been made by celebrated savans, and is generally considered insufficient; and as data may have been wanting, which we conceive a collection of the chief known examples will supply; we recommend the consideration of this matter to all geometers. In his Lives of the Poets, Dr. Johnson characterises the "Dunciad" as a work "of which the design is to ridicule such studies as are either hopeless or useless, as either pursue what is unattainable, or what, if it be attained, is of no use."

* The spokes can only slide up or down while *vertical*, in consequence of a ring or rim around them, placed to act as a shoulder against the axle, so long as the spokes are inwards, and *not* in a vertical position; otherwise they would act at an angle of 45°. The shoulder of each spoke is small enough to slip freely through the hole in which it slides in the axle, when the same becomes vertical during rotation.

It is difficult to surmise to what extent Pope thus benefitted literature; but it is certain that all the minor "Dunciads," in lashing Perpetual Motion, have failed to rid Natural Philosophy of many misgivings respecting its feasibility; and it is either *impossible*, and the Marquis of Worcester was himself strangely deceived; or it may be ***possible***, and the noble inventor of the steam-engine remain worthy of his high character as a truthful narrator of facts: quite incapable of misrepresenting, much less elaborately falsifying them. In a mathematical point of view, we think this subject is far from being exhausted; and, after what has been advanced, may very properly be considered as claiming grave consideration. And that, scientifically examined, it is a mark of mere shallowness and querulousness to attempt the substitution of ridicule and satire for the more difficult, but consistent course of sound, close reason and argument, such as the wonted sobriety and severity of scientific criticism accords to its investigations generally.

*** The printing of this work had progressed too far to introduce, in its proper place, the demonstration of Professor AIRY in favour of Perpetual Motion being possible. It is taken from a copy of the Cambridge Philosophical Society's Transactions, in the British Museum, and forms the last article in the Addenda.