Scientific American.

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN. S. H. WALES. A. E. BEACH.

☞ "The American News Company," Agents,121 Nassau street,New York.
☞ "The New York News Company," 8 Spruce street.

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VOL. XX., No. 19...[NEW SERIES.]....*Twenty-fourth Year.*

NEW YORK, SATURDAY, MAY 8, 1869.

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VIS INERTIA.

All are familiar with one of the many definitions given in the works on physics, of the term "Vis Inertia"—a want of power in a body to move itself when at rest or to come to rest when in motion. As however no human eye has ever seen a body or matter in a state of absolute rest, and as we know nothing of matter in that state, it is perhaps to be doubted whether we are justified in predicating anything of it in that condition. In fact it is quite possible that matter does not anywhere in the universe exist in a state of rest; and it seems quite consistent with the facts already established in physics, to consider motion as an essential condition of the existence of matter, that is so far as any knowledge of it is obtainable through the medium of our senses.

All the ideas we can get of matter are inseparably connected with motions of atoms, molecules, or masses. Let these motions at once and wholly cease in any aggregation of matter, and we have not the slightest ground to suppose that its existence would be determinable by us. We could walk through it without experiencing any resistance; it would no longer have color, form, weight, or any of those characteristics by which we are able to recognize material objects.

But while we know nothing of the state called rest, we see around us everything in motion and refusing absolutely to move less, without increase of motion in some other matter. Nay, the amount of motion lost in any body must be exactly compensated for by the motion of other matter. Nature will not permit a loss from the sum total of motion of even an infinitesimal amount. Her books always balance. We see then that of matter at rest we know nothing, and consequently, can predicate nothing. In moving matter we see the most positive tendency of motion to continue. Note this is not a negative proposition. Motion is as positive a property of matter as gravity.

Now, if "vis inertia" means anything, it is negative in its signification. It means that a body *cannot*, of itself, change its state, whether that state be one of motion or rest. Now, we might go on to any length and predicate negative qualities of matter without giving or attaining a single idea in regard to it. To say that vinegar is not sweet, would give no idea of vinegar to any one who had no knowledge of it. It is only when we assert some positive quality that ideas are conveyed. If we say vinegar is sour, then we express a quality of vinegar, and a definite idea is conveyed by our language. When we say, as does Bartlett, in his "Philosophy of Mechanics," that *matter is inert* in relation to the state of motion and rest, we are either hiding a negative meaning in a positive form of expression, or stating a false proposition.

Many modern writers have seen this and have dodged the issue in their definition of inertia, in so far as they have confined it to the tendency which bodies have to maintain such motion as they possess.

Now we submit—and we believe the greater number of those who write and think upon this and cognate subjects will coincide with us in the opinion—that if it be desired to indicate the tendency of motion to continue, no more inappropriate term could have been selected to indicate this property than inertia.

The use of terms which in their primary signification mean one thing, to indicate something which is not only different but diametrically opposite, is not, to say the least, logical; and the different views of the real meaning of the term in question, have not only given rise to differences in opinion but also to grave error. The term is the offspring of obsolete notions of force, and the attempts to make it do duty in the vocabulary of modern science should be abandoned. Certainly it would not be difficult to agree upon a substitute that should aptly characterize the tendency of motion to continue, and shake ourselves clear of ideas pertaining to a purely hypothetical state of matter—rest.

CENTENARY OF THE STEAM ENGINE---JAMES WATT.

For the purpose of perpetuating the fame of revered patriots and renouned warriors,almost every nation has been accustomed to hold anniversary ceremonies. In more recent times such occasions have been laudably instituted to pay respect to great poets, such as Shakespeare, Schiller,and Burns—those mighty bards who have made the chords of the human heart vibrate with every emotion. But there is another class of great men whose achievements have been as beneficial to society as those of heroes, poets, and statesmen, and yet, so far as we recollect, no suitable anniversary ceremonies have ever been held to do honor to their memory. We refer to inventors of improvements in mechanism—those men who by their genius, skill, and perseverance have made the forces of nature,

the docile servants of man. We therefore embrace the present opportunity of paying a tribute of respect to the memory of one whom we regard as the representative man in his domain of invention. We mean James Watt, the great improver of the steam engine—that wonderful motor which has not inaptly been called the iron apostle of civilization." This is not his natal day but it is the centenary of the occasion when his first improvement was made manifest to the world by descriptive enrollment in the London Patent office.

A century ago, there was not a single steam engine in the strict sense of the term, in the wide world. The windmill, the water wheel, and the horse-gin were the common extraneous powers employed by man to assist him in executing severe toil. Excepting in the case of animal labor, these powers could only be used in few situations. Look now at the triumphal career of steam power. Since 1769, it has become the chief ruler over the manufacturing and commercial world, as it is applied everywhere, on land and water, for innumerable purposes. It operates mechanism in mines on the lofty Cordilleras, as well as in mines in the valley of the Mississippi. It moves vessels on the rivers of every continent—on the Nile, the Ganges, the Thames, and the Hudson, and, scorning the fickle winds, it has made the Atlantic ocean a great ferry between the old and new world. And in its latest and most princely adaptation—the locomotive—it moves long trains of elegant carriages over the Alps, and the Alleghanies; and on the railroads of the United States alone, no less than fifteen thousand of such engines are at present employed. From the cradle to the grave, it has become the faithful servant of man, operating the mechanism which prepares his daily bread, and the loom which weaves his swaddling bands, his wedding garment, and his funeral shroud. There is no individual now living who does not share in the benefits which James Watt has conferred upon society.

The town of Greenock, in Scotland, is the native place of James Watt; the 19th of January, 1736, was the day of his birth. From infancy his health was feeble, but he early gave evidence of possessing superior mental gifts. Not being able to attend the parish school, his father, who was an educated man, gave him instruction at the fireside, and the pupil was not an inattentive scholar. His very amusements were of a useful and recondite character. Drawing, geometry, and the construction of machines were his delight. Having been provided with a box of tools, he made various machines before he was twelve years of age, and among the number was one with which at that early date, he astonished the household and the boys in the neighborhood by giving them shocks of electricity. As he advanced toward manhood, his thirst for solid information and his power of acquiring a knowledge of the severer sciences seem to have been wonderful. His love of practical mechanics, however, was dominant,and his predilection led him to London at the age of nineteen years, for the purpose of perfecting himself in the art of making philosophical instruments, there not being a single establishment, at that period, in all Scotland, where he could be instructed in the business.

It is stated that after a year's residence in the British metropolis, he returned to his native land with such a high reputation for mechanical skill that he was at once employed to repair and set up the astronomical instruments for the new "Macfarlane Observatory," connected with the college of Glasgow. Being a stranger and not a burghess of the city, the old trades guilds would not allow him to do business on his own account within the bounds of the corporation. But the faculty of the college—always distinguished for encouraging practical mechanics—got over the difficulty by providing the young mechanic with a shop within the gates of that famous institute.

Here he pursued his calling unmolested by the trades societies, and he fitted up the instruments in the observatory to the entire satisfaction of his patrons. The learned authorities had also the good sense to retain him afterward as their mechanic, to superintend, make, and repair all the machines and instruments required in exposition of the subjects taught in the classes. It was while engaged in repairing one of the working models belonging to the class of natural philpsophy, that he made the discovery, and invented the improvement, which has immortalized his name in connection with the steam engine.

A small working model of what was called "Newcomen's combined steam and atmospheric engine," was placed under his charge for repairs, as it did not work satisfactorily. It represented practically all that was then known of steam applied to operate mechanism, and consisted of a boiler 9 inches in diameter; a vertical cylinder 2 inches in diameter and 6 inches in length. The cylinder was open at the top, but fitted with a piston to which was attached a chain connected with a walking beam, secured on a pin to a post upon which it vibrated; the other end of the beam was connected with the plunger of a pump. Steam was admitted from the boiler under the piston, and when the latter was elevated to the end of the stroke, the steam was shut off and a jet of cold water from an elevated reservoir was injected into the cylinder, condensing the steam and forming a vacuum under the piston, which descended by the pressure of the atmosphere upon its outer surface. When the piston had made its descent, the condensed water was allowed to flow out of the cylinder, steam was again admitted and condensed, and the piston elevated and depressed, as before described, thus giving a vibratory motion to the beam and working the pump. It was single acting—not a pure steam engine—crude of construction, and only about a dozen of such were in use in Great Britain for pumping in some of the English mines. Its waste of fuel was so great, that some of the mines where it had been employed were about to be abandoned as unprofitable investments. The great waste of steam in heating the cylinder, which was the condenser,up to 212 deg. after each stroke of the piston, at once arrested Watt's attention and engaged his thoughts; and it is related that, while taking a walk on the banks of the river Clyde, on the morning of the 28thof April, 1765 (this date rests upon memory, no record having been made at the time by the inventor),the thought beamed into his reflective mind, like a ray from the celestial regions, that steam being an elastic fluid, if he placed a second cylinder on Newcomen's engine, connected with the steam cylinder by a pipe, and allowed the jet of cold water to play upon it, the steam from the working cylinder would flow into it, at the end of the stroke, and be condensed forming a vacuum under the piston. If this could be effected, he reasoned, the working cylinder would be maintained at a uniform temperature and a great saving of fuel secured. Within twenty-four hours after this thought flashed into his mind, he had made a rude model and tested the invention by an experiment with such satisfaction to himself that his mind was filled with rapture. From this we trace the invention of the separate condenser—that improvement in the steam engine, which at once saved two-thirds of the fuel formerly required and rendered the steam engine the King of motors.

We have been somewhat minute in describing this invention because it was the first grand improvement in steam engineering by which, in these latter days, commerce and the manufacturing arts have been revolutionized, man supplied with almost uulimited productive power, and the name of Watt become to practical mechanics what Newton's is to philosophy.

At the time of this invention, James Watt was twenty-nine years of age, and during nine of these years he had been mechanician to the college in Glasgow. During the regular hours of labor he attended faithfully to his trade—his regular business—but his spare hours were devoted to the highest and noblest ends—acquiring solid and useful information. And so superior were his abilities and powers of acquisition, it is related that he became a philosopher and scholar as well as a skillful mechanic. He was acquainted with chemistry, anatomy, architecture, civil engineering, and the science of music; and he acquired the Latin, French, Italian, and German languages for the purpose of finding out what knowledge in science and the arts was contained in these tongues. His parlor was the rendezvous for all the students remarkable for scientific predilections, and the celebrated Dr. Robison—afterward professor of natural philosophy—said of him: "Whenever any puzzle came in the way of any of us, we went to Mr. Watt. He needed only to be prompted: everything became to him the beginning of a new and serious study, and we knew he would not quit it until he had either discovered its insignificance, or had made something of it. No matter in what line—language, antiquity, natural history, nay poetry, criticism, and works of taste; as to anything in the line of engineering, whether civil or military, he was at home and a ready instructor. Hardly any projects, such as canals, deepening rivers,surveys,or the like were undertaken in the neighborhood without consulting him." Such is the testimony of a very distinguished man to the character, skill, and acquirements of our representative mechanic.

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