lar, he gave the theory of inclined planes, which was un known to the ancients, though it is of the very first importance in almost every machine. He even states in the most express terms the principle afterwards made the foundation of the whole of mechanics, and published as a valuable dis covery by Varignon, viz. that three forces, whose directions and intensities are as the sides of a triangle, balance each other. His theory of the pressure of fluids, or hydrostatics, is no less estimable, including every thing that is now received as a leading principle in the science. When we con sider the ignorance, even of the most learned of that age, in mechanical or physico-mathematical knowledge, we must consider these performances as the works of a great genius ; and we regret that they are so little known, being lost in a crowd of good writings on those subjects which appeared soon after.

Hitherto the attention had been turned entirely to equilibrium, and the circumstances necessary for producing it. Mechanicians indeed saw, that the energy of a machine might be somehow measured by the force which could be opposed or overcome by its intervention : but they did not remark, that the force which prevented its motion, but did no more than prevent it, was an *exact* measure of its energy, because it was in immediate equilibrio with the pressure exerted by that part of the machine with which it was connected. If this opposed force was less, or the force acting at the other extremity of the machine was greater, the mechanicians knew that the machine would move, and that work would be performed ; but what would be the rate of its motion or its performance, they hardly pretended to conjecture. They had not studied the action of moving forces, nor conceived what was done when motion was communicated.

The great Galileo opened a new field of speculation in his work on local motion. He there considers a change of motion as the indication and exact and adequate measure of a moving force ; and he considers every kind of pressure as competent to the production of such changes. He con­tented himself with the application of this principle to the motion of bodies by the action of gravity, and gave the theory of projectiles, which remains to this day without change, and only improved by considering the changes which are produced in it by the resistance of the air.

Sir Isaac Newton took up this subject nearly as Galileo had left it. For, if we except the theory **of** the centrifugal forces arising from rotation, and the theory of pendulums, published by Huygens, hardly any thing had been added to the science of motion. Newton considered the subject in its utmost extent ; and in his mathematical principles of natural philosophy he considers every conceivable variation of moving force, and determines the motion resulting from its action. His first application of these doctrines was to explain the celestial motions ; and the magnificence of this subject caused it to occupy for a while the whole attention of the mathematicians. But the same work contained pro positions equally conducive to the improvement of common mechanics, and to the complete understanding of the mechanical actions of bodies. Philosophers began to make these applications also. They saw that every kind of work which is to be performed by a machine may be considered abstractedly as a retarding force ; that the impulse of water or wind, which are employed as moving powers, act by means of pressures which they exert on the impelled point of the machine ; and that the machine itself may be considered as an assemblage of bodies moveable in certain limited circum stances, with determined directions and proportions of velo city. From all these considerations resulted a general ab­stract condition of a body acted on by known powers. And they found, that after all conditions of equilibrium were sa­tisfied, there remains a surplus of moving force. They could now state the motion which will ensue, the new resis­tance which this will excite, the additional power which this will absorb ; and they at last determined a new kind of equilibrium, not thought of by the ancient mechanicians, be tween the resistance to the machine performing work and the moving power, which exactly balance each other, and is indicated, not by the *rest,* but by the *uniform motion* of the machine. In like manner, the mathematician was enabled to calculate that precise motion of water which would completely absorb, or, in the new language, balance the superiority of pressure by which water is forced through a sluice, a pipe, or canal, with a constant velocity.

Thus the general doctrines of motion came to be considered in two points of view, according as they balanced each other in a state of rest or of uniform motion. These two ways of considering the same subject required both dif­ferent principles and a different manner of reasoning. The first has been named *statics,* as expressing that rest which is the test of this kind of equilibrium. The second has been called Dynamics or Universal Mechanics, because the different kinds of motion are characteristic of the powers or forces which produce them. A knowledge of both is indispensably necessary for acquiring any useful practical know ledge of machines ; and it was ignorance of the doctrines of accelerated and retarded motions which made the pro gress of practical mechanical knowledge so very slow and imperfect. The mechanics, even of the moderns, before Galileo, went no further than to state the proportion of the power and resistance which would be balanced by the intervention of a given machine, or the proportion of the parts of a machine by which two known forces may balance each other. This view of the matter introduced a principle, which even Galileo considered as a mechanical axiom, viz., that *what is gained in force by means of a machine is exact­ly compensated by the additional time which it obliges us to employ.* This is false in every instance, and not only prevents improvement in the construction of machines, but leads us into erroneous maxims of construction. The true principles of dynamics teach uβ, that there is a certain pro portion of the machine, dependent on the kind and proportion of the power and resistance, which enables the machine to perform the greatest possible work.

It is highly proper therefore to keep separate these two ways of considering machines, that both may be improved to the utmost, and then to blend them together in every practical discussion.

Statics therefore are preparatory to the proper study of mechanics; but they do not hence derive all their importance. They are the sole foundation of many useful parts of know ledge. This will be best seen by a brief enumeration.

1. They comprehend all the doctrines of the excitement and propagation of pressure through the parts of solid bodies, by which the energies of machines are produced. A pressure is exerted on the impelled point of a machine, such as the float-boards or buckets of a millwheel. This excites a pressure at the pivots of its axle, which act on the points of support. This must be understood, both as to direction and intensity, that it may be effectually resisted. A pressure is also excited at the acting tooth of the cogwheel on the same axle, by which it urges round another wheel, exciting similar pressures on its pivots, and on the acting t∞th perhaps of a third wheel. Thus a pressure is ultimately excited in the working point of the machines, perhaps a wiper which lifts a heavy stamper, to let it fall again on some matter to be pounded. Now statics teach us the intensities and direction of all those pressures, and therefore how much re mains at the working point of the machine unbalanced by resistance.

2. They comprehend every circumstance which influences the stability of heavy bodies ; the investigation and proper ties of the centre of gravity ; the theory of the construction of arches, vaults, and domes ; the attitudes of animals.