APPARATUS FOR ILLUSTRATING NEWTON'S LAWS.

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The elementary or fundamental laws of force, known generally as Newton's laws, and variously formulated in the different text books, may be illustrated by the use of the apparatus shown in the cut accompanying this article. In general terms, it consists of an arrangement for projecting or throwing a marble in a horizontal direction. A piece of board, about 2½ inches wide and 8 or 10 inches long, forms the base of the apparatus. On each side are fastened two thin strips, that rise half an inch from its surface, so that a wide, shallow groove is formed. A block of wood, about 4 inches long, is made of exactly the width of the groove, so as to slide freely in it with no lateral shake or "lost motion." Pins are driven into its rearward end, or a little bar is nailed across its upper surface, near the end, and projecting on each side. Corresponding pins are driven into the base of the apparatus, near its front. These are for the reception of springs.

For the latter, India rubber bands, or, what is far better, spiral wire springs, may be employed. These are attached to the two sets of pins, as shown in the engraving, so that the sliding block is drawn forward and downward by them. The springs, in drawing the end of the block downward, carry out an arrangement adopted to keep the block in position. Were the pull of the springs horizontal, there would be a constant liability on the part of the springs to throw the block up and out of its seat.

To prevent the block from being drawn too far forward, strings limiting its motion in that direction are attached to the same pins that hold the springs, and thence are carried to the rear end of the base. When the springs are at the end of their strain and just ceasing to pull the block forward, the strings come into play and prevent the block from going any further forward. This leaves a space of three or four inches free in front of the sliding block.

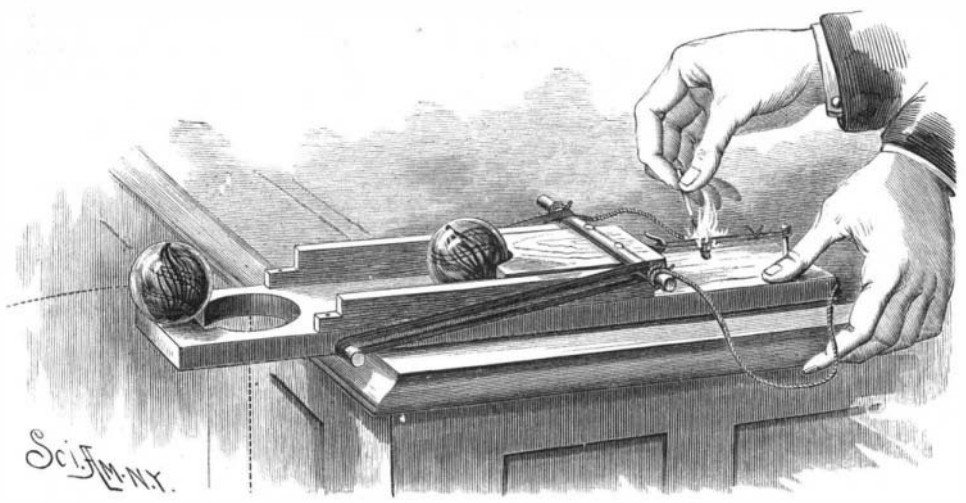
As near the front of the baseboard as possible a large hole is made. This should be considerably larger than the marble it is proposed to employ. The dimensions followed in this description apply to an apparatus constructed for marbles of 1½ inches diameter. The hole where these are used may be made about 2 inches in diameter. It is well to have the front end squared out. Across the front a strip of wood is left about one-half inch wide. Exactly in the center of this strip a slight depression, which need not exceed one-sixteenth of an inch in depth, is made. With equal exactness a notch—a triangular one is best—is made in the center of the front end of the sliding block. This notch should be about three-quarters of an inch across. If the block is drawn back, a marble placed on the base against the sliding block, and lying in the notch, when the block is released the marble will be projected across the depression in the front of the apparatus.

To illustrate the law that forces act upon a body independently of each other, and also to present an incidental illustration of the law of impact of elastic bodies, the block is drawn back and tied back, as shown. Hooks or nails are provided for this purpose, one on the block and one on the base. The apparatus is placed on the edge of a horizontal table and held firmly there. One marble is placed resting in the depression in front; the other is placed against the sliding block. The string is now burned through with a match.

As the string parts, the block is drawn forward, driving the marble also before it. As it goes forward it strikes the other one in front. The impact, in virtue of the law as affecting elastic bodies, stops its course. Nearly all its mechanical energy is imparted to the other ball, which at once flies forward six or eight feet before it touches the floor. The first marble thus checked falls vertically through the large hole. Both marbles strike the floor with one report. The vertically falling and horizontally projected ball reach the ground simultaneously.

By using a single marble and placing the apparatus on rollers, on projecting the marble, the distance to which it will go will be much abridged, while the apparatus will fly back. This illustrates action and reaction. By endeavoring to repeat the first experiment with the apparatus on rollers, the front ball will tend to fall vertically, and the other ball will go over it and fall in advance, and probably will collide with it in passing over it.

The mode of release by burning a string is far the best, as it avoids all disturbance. Accuracy of construction is essential. Glass or stoneware marbles answer admirably. As fast as they break, new ones can be substituted. Wooden or ivory balls are not sufficiently elastic, although far more durable.



APPARATUS FOR ILLUSTRATING NEWTON'S LAWS.

Conserve Your Force.

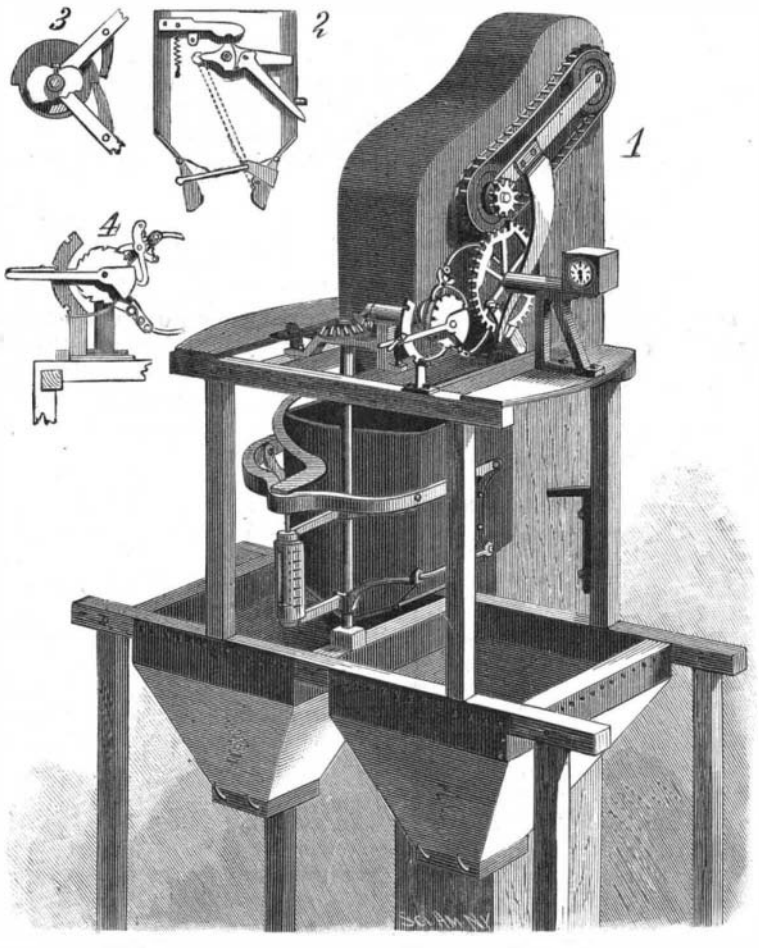
Hamerton says: "It often happens that mere activity is a waste of time, that people who have a morbid habit of being busy are often terrible time-wasters, while, on the contrary, those who are judiciously deliberate, and allow themselves intervals of leisure, see the way before them in those intervals, and save time by the accuracy of their calculations."

Another writer, unknown, says:

"Some men are in incessant action, early and late and all through the day. They have no time for family or friends. As for holidays, the less for them the better. They have inherited a nervous temperament, and are doing just the wrong thing with it—allowing it to hurry them to an untimely end. They wear themselves out. Their brain is ever in a state of morbid activity almost like that of an insane man. A little careful planning and a proper laying out of work, and especially doing everything in the proper time, would avoid all such hurry and worry, make work much easier, secure an abundance of leisure, and greatly increase length of life."

A MACHINE FOR WEIGHING, REGISTERING, AND BAGGING GRAIN.

A machine which takes the grain from the separator of the thrashing machine, measures and registers it, and finally delivers it in measured quantities to bags, has been patented by Mr. George R. Kendrick, of Bucyrus, Ohio, and is shown in the accompanying illustration, Fig. 2 representing the grain-measuring receptacle, with its hinged bottom open, and Figs. 3 and 4 the cam of the shifting mechanism, with the levers in different positions. The upper shaft of the elevator, which is connected at its lower end with the separator of a thrashing machine, is connected by a sprocket wheel and chain with a lower shaft in a swinging frame, the latter shaft carrying a pinion adapted to mesh into a gear wheel, which has its teeth depressed in one part of its rim, this gear wheel being secured on a shaft mounted to rotate in suitable bearings on the main frame. From the face of this gear wheel also projects a lug adapted to engage, at each revolution of the wheel, an arm having an offset, on which rests the lower end of an arm secured to the swinging frame, whereby the doors forming the bottom of the receiving spout are automatically opened and closed, as the grain-measuring receptacle is being filled or discharged. The weighing beam is hung in suitable bearings on an arm fastened on a shaft mounted vertically on the main frame, the outer end of the beam being connected with a spring scale, and its inner ends supporting the grain-measuring receptacle, the bottom of which consists of two hinged doors pivotally connected with each other, so that the doors open and close simultaneously, the receptacle swinging with the vertical shaft, so as to discharge alternately into hoppers placed alongside of each other, each having hooks at its lower end on which the bags to be filled are hung. The amount of grain passed into the bag is shown by the scale, a registering device registering the amount. The swinging motion of the vertical shaft, enabling the operator to discharge the grain alternately into the hoppers, or two or three times successively into one hopper before changing to the other, is readily regulated by a simple adjustment of the lever with segmental arm in connection with the cam and pawl shown at the front of the machine, the two hoppers permitting the operation to be continuous, as, while one bag is being filled, the operator can remove the filled bag from the other hopper and put an empty bag in its place.



KENDRICK'S GRAIN WEIGHING, REGISTERING, AND BAGGING MACHINE.

Atmospheric Influence on Combustion.

Scientific minds, says the *American Artisan*, have never been able to give a satisfactory explanation of the mysterious atmospherical influence which aids, at certain times, in causing conflagrations to spread with astonishing rapidity, and makes the checking of the progress of the flames so much more difficult than at other times. Every one who has attended to an ordinary grate or stove has had frequent occasion to observe that a fire which burns brightly at certain times with a certain draught, requires at other times a much greater draught to keep it from going out. This result, in the great majority of instances, is attributable to occult causes, which neither science nor practical observation has ever yet been able to cope with or satisfactorily explain. The simple fact remains that the earth's atmosphere in its different conditions is a subject concerning which, like a great many other things, science is able to explain infinitely less than professed scientists are willing to admit.

There are certain philosophical truths in regard to the atmosphere which surrounds us which are generally understood, but there are still others, in reference to which the *savants* of the nineteenth century remain as profoundly ignorant as were the early Romans; and among the very many unexplained and mysterious phenomena connected with the subject of the air we breathe, science is wholly at sea with reference to the numerous phenomena produced by the action of the elements on fire at different times, whether the same be confined in stoves and grates or whether it takes on the nature and conditions of an open and disastrous conflagration.

Fire Engines Operated by Electricity.

A great improvement in the handling and working of fire engines might be brought about by the application of electricity, says the *Jewelry News*. In fact, an engine can by such means be operated from a central station in the same manner as electric light is distributed over a large space or a city. While the pumps are being attached to the hydrants, the engineer may be attaching the connections of his motor to the proper wires, and the alarm having notified the central station, the electric current therefrom would operate the fire engines, entirely avoiding the transport of heavy accumulators, either on the engine or the hose carriage. Other great advantages would be in the lighter weight of the engine, and hence the greater speed and ease with which it could be taken to a fire; and also the celerity with which it could be brought into action, and its reduced cost.