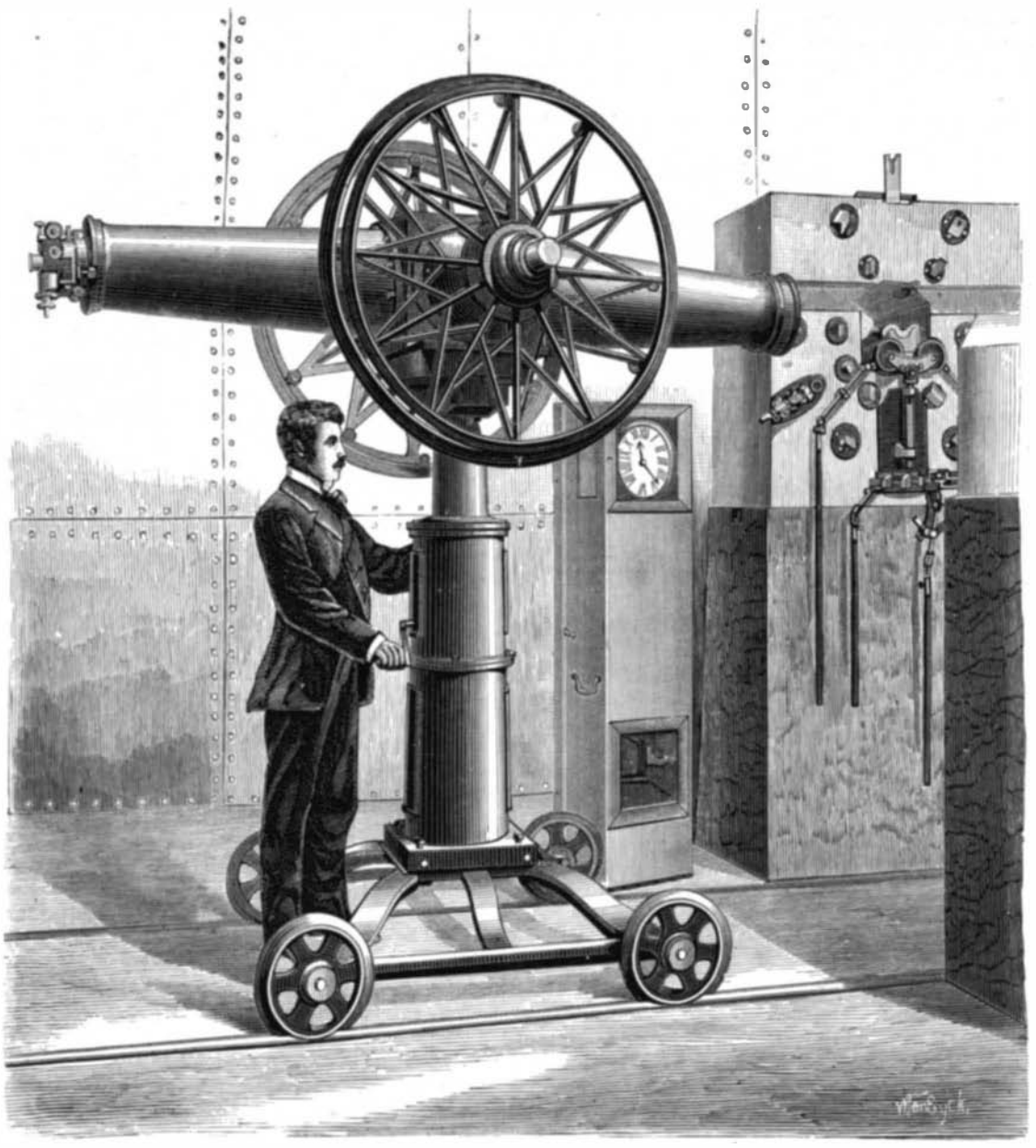
[*Continued from first page.*]

said axis must intersect the earth's pole. A level which rests upon a support or yoke upon the trunnions of the telescope serves to measure and correct the inclination of the axis of rotation. The spider threads above referred to are rendered visible at night by a beam of light coming from a gas lantern placed in the western pediment, which beam is reflected toward the eye-piece by a small prism fixed at the middle of the telescope. A movable screen allows of nice adjustment of the intensity of the light with regard to the brilliancy of the star under observation. For very faint stars an ingenious mechanical contrivance suppresses all light in the field and concentrates it upon the threads, which appear as bright lines against the dark sky.



THE MERIDIAN CIRCLE IN THE PARIS OBSERVATORY.—Fig. 2.

Simple Apparatus.

Many teachers in common school and academies think they cannot illustrate the principles of natural philosophy without expensive apparatus. Beautiful well-made and costly apparatus is, indeed, desirable, but by no means essential to success in illustration. The principles of the lever can be as well shown from the teacher's table, with a common stick and blocks, as with brass levers, fulcrums, etc., made by the skilled workman. Better still, each member of the class can provide himself with the apparatus and prove for himself the truths that may be the subject of the lesson.

There are three ways in which a pupil may obtain a knowledge of an experiment. First, by committing to memory the words describing such experiment; second, by seeing the teacher illustrate it with proper apparatus; third, by performing the experiment himself. The last is undoubtedly the best way, particularly if it has been preceded by a thorough study of the principle involved, of the manner of the experiment, and of the result to be obtained.

Some years ago I heard an excellent teacher lecture on a subject pertaining to astronomy, in which he made use of several experiments. First, to illustrate that a body will always revolve on its center of gravity; second, to show why the earth is flattened at the poles. These experiments could be performed by means of apparatus found in almost every schoolboy's pocket, namely, a piece of string, a lead pencil or a short stick, and a piece of brass or steel chain not larger than a small watch chain. Tie to the middle of a lead pencil a piece of string about three feet long. Suspend it so that the pencil will balance itself. Now twist the end of the string between the thumb and the first finger of the right hand, steadying and holding the string with the left hand. A circular motion will thus be communicated to the pencil, and it will revolve around the point on which it is suspended. Tie a piece of white string around the middle of the pencil, or its center of gravity, simply to show the position of that point. Now, again tie the first piece of string half way between the end of the pencil and the center of gravity, and communicate the circular motion described above, and we shall observe that the pencil will still revolve around its center of gravity, the point marked by the white string being at rest. It can thus be shown that anything, of whatever shape, will revolve on its shortest diameter. If the end links of the chain referred to above be hooked together, and the string tied to a link and the circular motion given, it will be observed that the chain begins to take an elliptical form, which gradually approaches that of a circle, until at last it becomes a circle and then it revolves horizontally. This shows that even a ring is subject to the same law, that is, revolves on its shorter axis, the center of gravity. Simple as this experiment is, it illustrates the revolution of the earth on its shorter diameter. The above simple articles will illustrate many of the principles in Steele's Philosophy, particularly those illustrated by Fig. 32.

Again, many experiments in hydrostatics and pneumatics are passed over because of a supposed lack of apparatus. Take a bottle of cylindrical form, smooth, about six or eight inches high and three inches in diameter, and fill it with water to the top. Now take a small vial, such as are used by homœopathists for their medical pellets, and fill it with water. Invert it and some of the water will run out, or may be shapen out. Put this, inverted, into the larger bottle, and if it just floats the apparatus is ready for use. If the small vial sinks or is too light, water must be placed in it, or taken out as may be required, until its weight is but a trifle less than the amount of water displaced. By a pressure upon the cork in the larger bottle the small vial may be made to sink, or remain in any desired position in the water.

With this apparatus, which any schoolboy can prepare, all the experiments indicated by Fig. 94, Steele's Philosophy, can be performed. By a pressure upon the cork, water is forced into the smaller bottle. We prove by this, first, that pressure upon water is transmitted in all directions; second, that air is compressible. Upon relaxing the pressure, the small vial will rise to the top, thus proving the expansibility of air. Graduating the pressure upon the cork until the small vial is maintained at the middle of the water, we can illustrate the buoyant force of liquids, shown by Fig. 80 in Steele's Philosophy.

Most principles can thus be illustrated, by a little ingenuity on the part of the teacher, with means within his reach. —*Thos. B. Lovell, in Barnes' Educational Monthly.*

New Mechanical Inventions.

A new Shoulder Plate for Spoke-Finishing Machines has been patented by Mr. W. McNeal, of Stockton, N. J. Its object is to finish the spokes broader upon the outer than upon the inner edge.

A new Lift Pump in which the necessity of packing the plunger is obviated is the invention of Messrs. G. C. Merrill and C. C. Utter, of Saginaw City, Mich. It consists of a valved pump chamber in connection with a valved plunger having annular grooves for water packing, perforations at the upper end, and an air chamber at the top.

A Tire Tightener, which can be attached to large or small wheels with equal facility, has been patented by Mr. A. G. Shepard, of Malvern, Iowa. The rim of the wheel is permanently expanded, and the tire thus tightened by very simple mechanism.

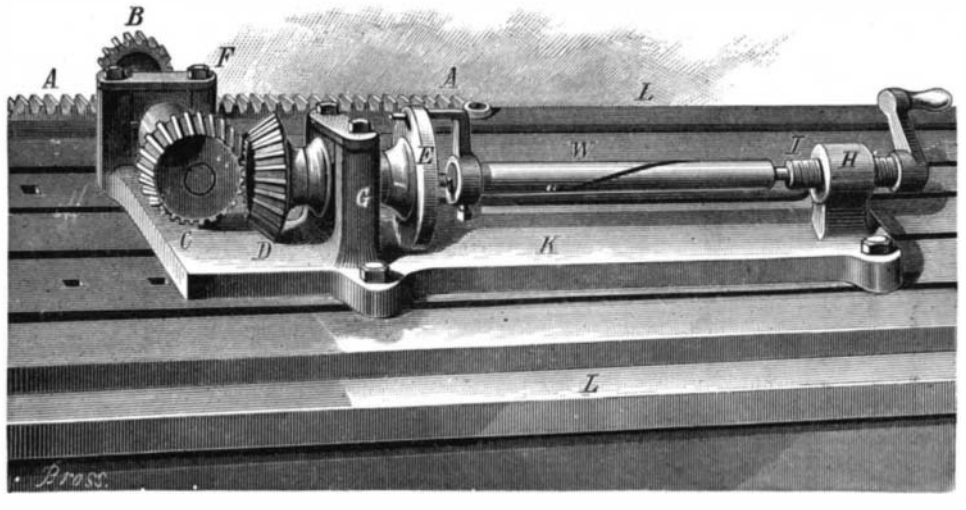
A new Metal Screw-Threading Machine, the invention of Mr. Samuel L. Worsley, of Taunton, Mass., contains among others the following new features: A mandrel carrying a die for forming the screw threads, a clutch for reversing the motion of the mandrel, a differential motion for controlling the clutch, a leading device, and a blank feeder.

Mr. Russell T. Stokes, of Garnett, Kan., has devised a new Windlass Water Elevator, which consists in combining with an endless chain of buckets a center discharge wheel, which is constructed with inclined partitions forming cells, that lead into spouts extending beyond the open side of the wheel, and which are arranged to direct the streams of water into a discharging trough.

A Dish Washer, patented by G. V. White, of Middletown, N. Y., consists of an adjustable casing with interior propeller wheel that takes up the water through a gauged opening of the casing and throws it into a fixed tube at right angles to the casing, from which it passes. through a revolving tube fitted thereto and a perforated brush head, on to the dishes. The casing is adjusted in the washer by means of a fixed perforated band and suitable locking devices. The dishes are thus cleaned rapidly and thoroughly.

AN INGENIOUS METHOD OF CUTTING SPIRAL OR RIFLE GROOVES WITH AN ORDINARY PLANER.

It is often required to cut spiral grooves in cylindrical work, and our illustration shows how this may be done by the aid of a simple attachment fastened to an ordinary iron-planing machine. Upon the bed of the machine alongside of the table is bolted the rack, A A, into which gears the pinion, B, which is fixed to the same shaft as the bevel gear, C, which meshes with the bevel wheel, D. Upon the same shaft as D is the face plate, E, and in the spindle upon which D and E are fixed is a center, so that the plate, E, answers to the face plate of a lathe. F is a bearing for the shaft carrying D and C, and G is a bearing carrying the spindle to which E and D are fixed. H is a standard carrying the screw and center, shown at I, and hence answers to the tailstock of a lathe. A represents a frame or plate carrying the bearings, F and G, and the standard, H. L represents the table of the planing machine, to which K is bolted. The reciprocating motion of the table, L, causes the pinion, D, to revolve upon the rack, A A. The pinion revolves C, which imparts its motion to D, and the work, W, being placed between the centers as shown, is revolved in unison with E, revolving in one direction when the table, K, is going one way, and in the other when the motion of the table is reversed; hence, a tool in the tool post will cut a spiral groove in the work.



CUTTING SPIRALS AND RIFLE GROOVES.

To enable the device to cut grooves of different spirals or twist, all that is necessary is to provide different sizes of wheels to take the places of C and D, so that the revolutions of E, and hence of W, may be increased or diminished with relation to the revolutions of B, or, which is the same thing, to a given amount of table movement.

© 1878 SCIENTIFIC AMERICAN, INC