SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVIII.—No. 1. [NEW SERIES.] NEW YORK, JANUARY 5, 1878. [$3.20 per Annum. [POSTAGE PREPAID.]

Utilization of the Heat of the Sun.

The other day a trial was made, in the presence of several gentlemen, including representatives of the press, of Mr. Adams' patent solar cooking apparatus; and the result was pronounced to be highly satisfactory. The compound of the High Court was the place selected for the experiment.

At 11 o'clock in the forenoon the apparatus was so placed in the open air as to receive the solar rays, and about every half hour its inclination was changed by a touch of the hand. About 4 o'clock in the afternoon the apparatus was removed from the spot and placed in a room, covered with a railway rug. At 8 P.M., when the cover and the rug were removed, the contents (several pounds of mutton and some vegetables were found thoroughly cooked.

We should not omit to mention, that the stew, which proved to be most palatable to those who partook of it, was found to be quite hot, while the vessel could hardly be touched by the naked hand.

The apparatus, we may state, consisted of a copper vessel tinned inside and painted black outside, with a glass cover enveloping the vessel with an inch of hot air.

The solar rays, passing through the glass, we were told, became transformed into obscure heat which the glass retained. The vessel was fixed on to the bottom of a conical reflector lined with common silvered sheet glass, and was 21 inches square at its large base and 8 inches at its small base.

Mr. Adams has made another apparatus of greater simplicity than the one experimented upon, which, by means of solar rays, and in the open air, can cook chops and steaks as well and as expeditiously as over a coal or coke fire. A very important point is that the heat can be retained as long as three hours and a half, and perhaps longer. Mr. Adams hopes soon to be able, under more favorable circumstances than at present, by means of an apparatus constructed on the same principle, and by a combination of flat reflectors, to concentrate solar rays to such a degree as to work wonders in science yet undreamt of. —*Times of India.*

A New Cement.

Mr. Emlen T. Littell, in the *American Architect*, says the following formula for cement has been very successfully used. The product is of very great strength; and the materials may be obtained where other cement cannot: 1 heaped bushel of mortar made in the usual way for brickwork, add 3½ quarts of iron scales, 1½ quarts of molasses; to be mixed in these proportions in quantity that can be used the same day.

Cremation in Italy.

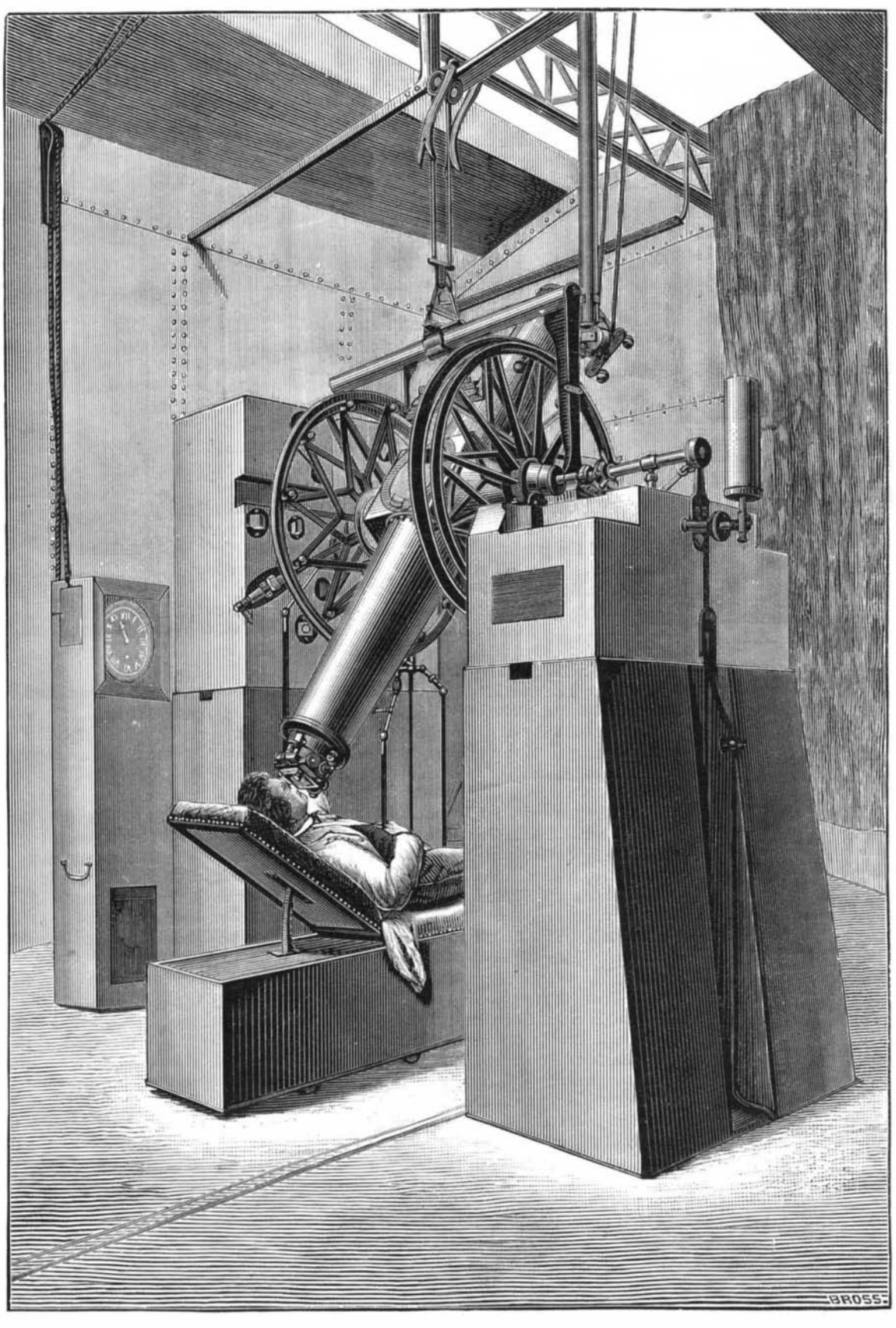
The *Lancet* says that on the 9th of October, at the cemetery of Riolo at Lodi, Professor Gorini made a new trial of the crematory apparatus invented by himself. There were several distinguished persons present, among them Dr. Bono who was delegated by the Council of Milan; Dr. Nardi, also of Milan; and the representatives of the leading Italian papers, professional and lay. The number of army surgeons in attendance was also remarked. The body destined for cremation was that of a man, sixty-two years of age, and weighing forty-two kilogrammes. It was introduced into the apparatus at 1 P.M. At 3 P.M. the fire had done its work, and there remained of the body only 5 per cent of its original weight. Not the slighest fetor or disagreeable sensation was experienced by the bystanders. This result was obtained with the consumption of two hundred kilogrammes of wood. A round of applause saluted Professor Gorini, and, in the name of the company, Dr. Bono congratulated him on having produced the most expeditious and thorough crematory apparatus yet known.

Test for Alkali.

As a substitute for ordinary test paper, Dr. E. Luck draws attention to a new substance, phenol-phtaleïn, which may easily be prepared by heating phenol with phtalic anhydride and concentrated sulphuric acid. This body is entirely colorless in neutral or acid solutions, but exhibits an intense purple color in the presence of the least excess of alkali. The change of color is instantaneous, and its depth intense, so that even mere traces of the indicator and of an alkali become recognizable.

THE MERIDIAN CIRCLE IN THE PARIS OBSERVATORY.

The annexed engravings, which we extract from *La Nature*, represent the new meridian circle recently presented to the observatory of Paris, by M. Raphael Bischoffsheim. The apparatus consists of two instruments, the transit circle, Fig. 1, by means of which and an astronomical clock the observer is enabled to determine the time transit of a star across the meridian of the plane of observation, and the mural circle, Fig. 2, which measures the angular distance of the same star from the pole or zenith. Instead of being constructed of rolled brass, connected by simple brazing or screw-threading, the bodies of these magnificent instruments are formed of cast iron attached to axes of steel. The bronze circles are cast in a single piece, and by numerous cross ribs are guarded against any possible deformation.



THE MERIDIAN CIRCLE IN THE PARIS OBSERVATORY.—Fig. 1.

The following brief description will afford an idea how these instruments are used. A few minutes before the passage of the star to be observed across the meridian, the astronomer directs the tube of his transit apparatus, so that the star may apparently travel over its field. To this end the interior circles fixed to the axis of the instrument have a coarse graduation. The observer then places himself as shown in Fig. 1. When the star enters the field of view the observer notes the second and fraction thereof of time at which the star passes each of the spider lines in the instrument. The mean of these noted times is the moment of passage over the middle thread or meridian. Ordinarily the transit instrument contains either five or seven threads, all at equal intervals. While the observer is noting the progress of the star across the transit threads, he at the same time, by a delicate adjustment of the telescope in altitude, places it so that the star appears to run along a fixed horizontal thread; and then, the transit observation having been completed, he reads even to the fraction of a second, from the circle microscopes, the precise point corresponding to the altitude of the star.

In this manner the right ascension and declination (corresponding to the geographical longitude and latitude) of the heavenly body are obtained and its absolute position thus fixed.

The instrument must, of course, be accurately adjusted in the meridian of the place of observation. It must be perpendicular to the horizontal axis about which it turns, and the plane in which it moves in passing around

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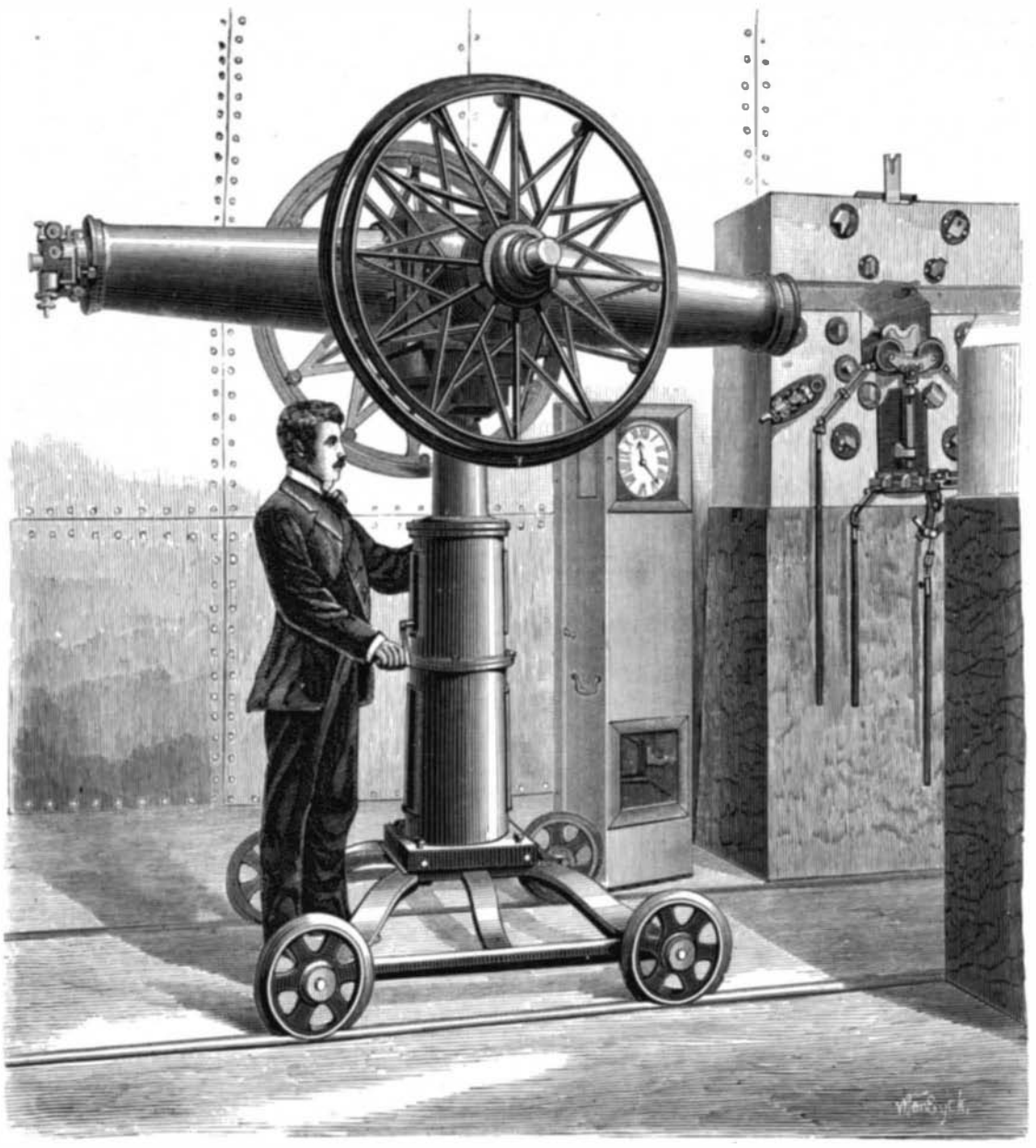
said axis must intersect the earth's pole. A level which rests upon a support or yoke upon the trunnions of the telescope serves to measure and correct the inclination of the axis of rotation. The spider threads above referred to are rendered visible at night by a beam of light coming from a gas lantern 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.

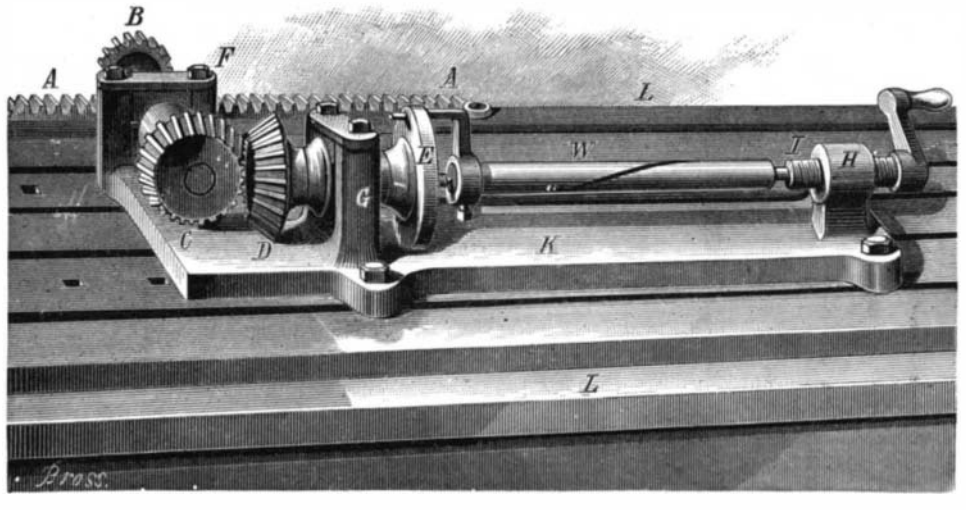
A new Metal Screw-Threading Machine, the invention of Mr. Samuel L. Worsley, of Taunton, Mass., contains among others the following new features: A mandrel carrying a die for forming the screw threads, a clutch for reversing the motion of the mandrel, a differential motion for controlling the clutch,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