share, the thread being perhaps a trifle longer according to the thickness of the casting in which it is screwed. This short stud is replaced by the long one illustrated by fig. 19 in the two-part chuck. The latter stud is marked *l* in fig. 3.

The top slide is figured No. 18. *A* is the slide. It is 2½in. wide. The dovetail is 1¾in. wide at the lowest part, and tapers like the last figure. This slide is fitted in the same manner with the bearing on the tops of the strips. The wheel *b* is solid with the nose-piece on which the chucks screw. The wheel is 3⅛in. in diameter, and has 72 teeth. It is ¼in. full in thickness. The ring on *a*, to which the wheel is fitted, is 2⅛in. in diameter. *Cc* show the space for the radius plate. *D* is the screw tapped into the stud *e*. This is shown in elevation at fig. 19. *H* is the washer fitted on the hexagonal part of the stud.

The stud, fig. 19, is 1⅜in. long; but its length will be determined by that of the nose screw, which is a duplicate of the one on the nose of the mandrel. A ⅜in. thread will hold the stud in the casting; the shoulder may be ⅝in., and the plain part from ⅜in. to ½in., according to the diameter of the nose. An end view of the stud is shown together with it at fig. 19. The screw in the end is ¼in. in diameter, and the hexagonal part nearly ⅜in. This stud is *l* in fig. 3, where it is much longer, through the nose having a ratchet wheel extra.

Fig. 20 is a full-size section of the planet arbor and wheels of the second slide. It serves the same purpose as fig. 12. *A* is a metal casting, with a cannon on it, through which the arbor *b* passes. *A* is secured on the face of the wheel *h* by two screws through the flange. This flange is shaped to the same form as the wheel itself. The two wheels on the arbor *b*, marked *c* and *d*, are fixed by feathers and keyways, or by octagonal fitting, or in some such manner. They are alike in size, having 16 teeth each, and are about ¾in. diameter. A collar or washer *e* fits on the cannon of *a* to hold the link, which goes on at the bottom of *e*, where the space for it is shown. The arbor *b* is $\frac{5}{16}$in. diameter, and 1$\frac{5}{32}$in. long. The wheels *c* and *d* are ¼in. thick. The other measurements are for the most part arbitrary, but a general idea of the proportion will be gleaned by inspecting the illustration. This planet gear is shown in fig. 3, where *y* is the arbor and *w* and *x* the wheels *c* and *d*. Screws are shown in the arbor at fig. 3, but they are not necessary, and not shown in fig. 20.

Fig. 21 is the planet wheel of the third slide. It is in every respect the same as the one last described, excepting inasmuch as the difference of measurements. In this the wheels at the ends of the axis are the only essential smaller parts. The cannon and the arbor may be the same size, but the wheels have 12 teeth only, and measure about ⅜in. in diameter. It will not be necessary to letter and describe each part of this drawing, as it is but a duplicate of fig. 20 in all respects but the one named, and will therefore require no further explanation. This mechanism does not exist in the two-part chuck.

The two-part geometric chuck will be illustrated and described in the next article.

Oil for quick-running Machinery.—A correspondent writes:—"I will say that I have used sperm oil and mineral oil mixed, ⅓ sperm to ⅔ mineral, and have obtained better results than when I have used either alone. Of course the proportion may be varied, but the mineral oil has a heavier body than sperm, and one is too light while the other is too heavy, and a mixture of the two will give the best results."

CAPT. R. PUDSEY DAWSON'S SLIDE-REST FOR CUTTING GEOMETRIC FIGURES.

(For Illustrations, see Lithograph Supplement.)

THE rest is made on the same principle as the ordinary slide-rest for ornamental turning, only it has two slides; the upper slide carries the tool holder for the fixed tool, eccentric, drill, and other cutters, all of which can be used with the apparatus. The top slide has a screw to traverse the tool carriage; the lower slide has a spiral spring in the place of a screw, which is fastened to the right-hand end of the top slide by a steel pin; the other end of the spring passes through a small hole at the end of slide, and is kept in position by a nut and washer that screws on to the end of the steel spring. When the upper slide is pressed against the spring, it oscillates from the elasticity of the spring. At the back of the tool carriage there is a steel arm firmly screwed on to the end of slide, and at the end of this arm is fixed a small steel rubber, which acts against the cams. On the left-hand of the lower slide is a transverse slide, which moves along the slide as required, and is fixed with a set screw underneath; this slide carries a spindle, and the end nearest the lathe head has a screw cut on it and fitted with nut and washers, and carries any of the change wheels of the spiral apparatus.

Motion is given to the spindle by a tangent wheel and screw when the revolving cutters are used, but when a fixed tool is used motion is given by a winch handle that fits on to the square end of spindle, the tangent screw being then thrown out of gear. On this end of spindle a boss is fitted that carries the various cams.

To actuate the apparatus you first set the tool—say a fixed one—at centre, then push the slide that carries the cam forwards till the rubber on the tool slide presses against the cam—the spring is now extended; fix the slide by the binding screws underneath the slide.

Put a 72-wheel on the end of spindle, and 144-wheel on spiral chuck, an intermediate wheel on the radial arm to complete the connection; advance the cutting tool and regulate the depth of cut; turn the winch handle at the end of spindle, and the apparatus is put in motion, and the result will be a six-looped figure if you have an oval cam on shaft, the tool being moved 12 turns out from centre.

The patterns that can be cut from one cam by altering the change of wheels are endless.

When you use the revolving cutters in place of the fixed tool you actuate the apparatus by the tangent wheel, and regulate the fineness or coarseness of the pattern by the divisions of the micrometor screw, moving two or one or half a turn for each cut. Now withdraw the tool, move one turn and cut again, and so continue till the pattern is completed. There is no difficulty in working the apparatus, and after you have once arranged it you can cut the most intricate geometric figures in a few minutes. Should you make a mistake all you have to do is to take out the revolving cutter, put a round nose tool in tool slide and face up the material without disarranging the apparatus further than throwing the wheels out of gear; replace the revolving cutter, and you are ready to start again. This is a very great saving of time.

The illustrations show some specimens of the work done with this rest. When I cut the patterns I did not take a note of the settings, consequently cannot tell for certain what eccentricity was given to the *cam.* As all the discs are 2¼in. diameter, you have no trouble in arranging the settings. Of course you may enlarge the figure as much as you like, or reduce it. You can also vary the pattern by altering the wheels on the spindle.

In the rose engine figures a *stop* is placed on the slide-rest to cut off the length of traverse, and there is a micrometer screw to regulate each cut. The eccentric chuck is used in cutting the other figures. The boss of the chuck carries the change wheels of the spiral apparatus, and is fitted just the same as the boss of the spiral chuck. If you require the settings for *all* the patterns, I shall have to cut them all again, and note the setting down at the time. I should think if you had the settings for a few patterns that would be quite enough. So much depends upon how you arrange the apparatus, and you can make so many changes by altering the wheels or changing the cam. With an oval cam the figure is quite altered if you arrange the apparatus for the rubber to press against the major axis or the minor axis. I could cut hundreds of patterns from one cam. All patterns cut from an oval cam are very effective. I send you a lot of patterns that I have cut on purpose for you, to prove what can be done with the apparatus, and shall be glad to give you any information you may require.

R. Pudsey Dawson.

CHUCKS FOR WOODWORK.

By Paul N. Hasluck.

HEREWITH are drawings of four useful chucks for wood-turning. Though the number might be increased almost indefinitely, yet by the aid of those shown most of the work coming under general turning may be mounted. For special purposes special tools are necessary, and often it is only after seeing the work to be executed that a suitable chuck can be devised.

Rods of wood are invariably turned by means of a prong chuck, the outer end being supported by the back centre. The usual form of prong chuck is

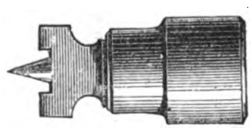

Fig. 1.—Prong Chuck.

illustrated in fig. 1, but several slight modifications of it are made. A plain cross is perhaps the most common substitute for the prong, but it is not so good. Referring to the illustration, fig. 1, it will be seen that the body of the chuck is a plain piece of iron, wrought or cast. The latter material answers every purpose, and is by far the easier to work; hence, when making such a chuck, use cast iron by preference.

The prong itself is made of steel. This is turned down to fit, and is driven into a hole in the body of the chuck. A shoulder on the prong comes against the face end of the chuck, and the prong must be driven in quite tight, so that it is practically solid. The projecting steel is filed flat, its front edge being left about an eighth of an inch wide. The small cone in the centre has to be turned to run perfectly true in the lathe; the point should be sharp to enter the wood easily. The object of the point is to keep the wood true when chucked, and by leaving a central indentation it allows the work to be re-placed perfectly true should it be removed from the lathe. The diametrical edge is filed up from different sides, leaving a chisel-like edge with the bevel on one side only. These bevels are on the sides away from the direction of rotation, leaving the face that drives the work nearly straight, and thus diminishing its tendency to come out of the wood whilst working. The extreme arris of each edge does not form a straight line, and this is very desirable, as a diametrical chisel-like cut would be very likely to split the wood. A careful inspection of the illustration will afford all other particulars. The steel prong is, of course, hardened and tempered to a deep blue.

When using the prong chuck, the rod of wood to be turned is placed as truly as possible on the central cone—if necessary, its truth may be tested by revolving the mandrel. A blow with a mallet on the outer end of the rod drives it on to the prong; the back centre point is then brought up, and the work is ready for turning. If the wood to be turned is very hard it is usual to drill a small hole to receive the central cone, and after marking the precise positions where the prongs take hold to indent the marks by means of a chisel.

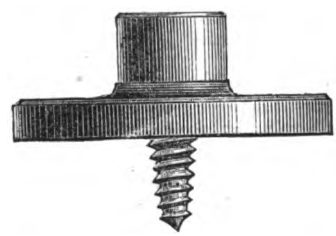

Fig. 2.—Conical Screw Chuck.

The next chuck illustrated is the conical screw chuck (fig. 2). This chuck is used for turning all kinds of wood plankways of the grain, when a central hole is allowable. The back centre is not used as a support for work mounted on this kind of chuck.

The body is made usually of cast iron, but sometimes of brass, gun-metal, etc. It may be from two to four inches in diameter for a 5in. lathe. The front face must be turned quite flat and true. The conical screw is of steel. The thread should be coarse and thin, similar to the thread of an ordinary wood screw but conical. A special screw tool is necessary for cutting conical threads, in order to make them upright. If cut with the ordinary form of chaser the thread would lean forward very much, and would have but comparatively slight hold on the wood into which it was screwed. The steel cone may be fixed into the casting by driving in from the back, or a fine thread will hold it very well, but it must be screwed very tight, and sometimes has to be rivetted at the back to prevent the screw being removed when unchucking work.

Fig. 3 shows the form of comb screw tool suited for cutting the thread of a taper screw so that the thread is itself upright. The teeth are cut in a slanting direction, and those cutting the small part of the cone have their points ground off.

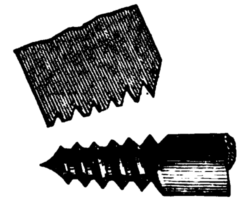

Fig. 3.—Screw Tool for Cutting Cone Thread.

Different sizes are employed, according to the dimensions of the work to be turned; two or three are sufficient for most purposes. To mount work on

Fig. 1.—Eccentric Cam, Eccentric Cutter 4 turns cut, Slide Rest 12.

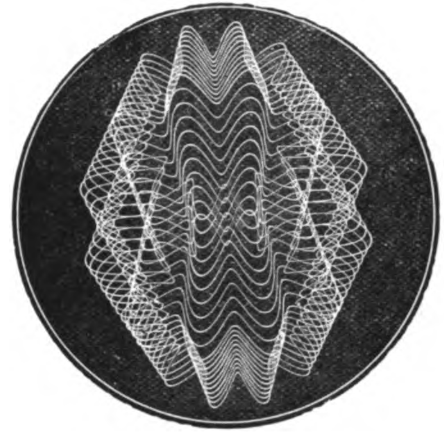

Fig 2.—Eccentric Chuck.

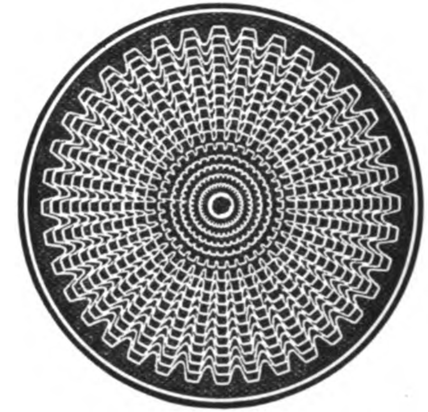

Fig 3.—Stop used on Slide Rest to shorten the stroke at each cut.

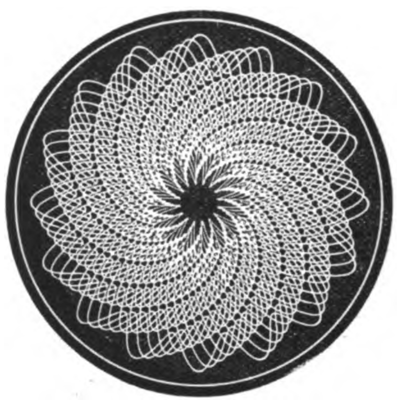

Fig. 4.—Twisted by Dividing Wheel on Chuck.

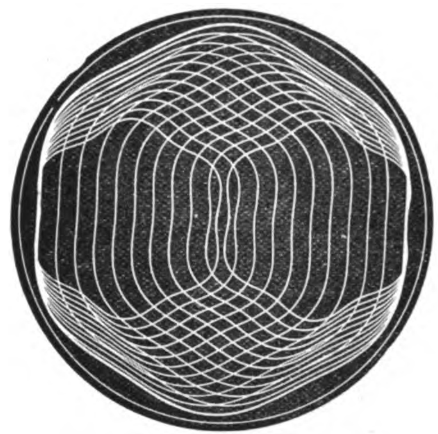

Fig. 5.—Eccentric Chuck, cuts at 48 and 96.

Fig 6.—Oval Cam, Eccentric Chuck, producing shell pattern.

GEOMETRIC FIGURES CUT BY CAPT. DAWSON'S SLIDE-REST.