A TOOL FOR BORING SQUARE HOLES.

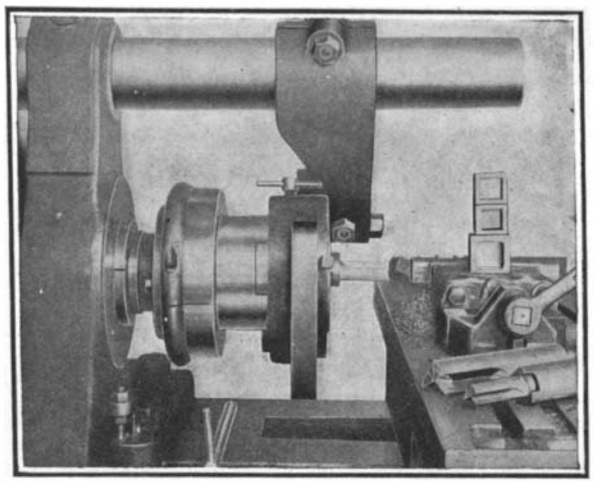
Bits for boring square holes have been on the market for years, but they are adapted for use only in cutting into wood. The tool bores a round hole, while at the same time it cuts out the corners with a cutter, which is fed into the hole without turning. Obviously, such a tool will not work in metals, and yet square holes have a wide use in machinery for keys, wrenches, hand wheels, etc. The present method of making square holes in metals is either to punch them in or cast them, or to drill a round hole and then work it up into the right form with a slotter or shaper.

A tool for boring square holes in metals as easily and almost as quickly as a round hole can be bored has recently been devised by Mr. Carl Philgus, a German inventor. The body of the drill has the form, in cross section, of a spherical triangle. The triangle is made up of equal arcs, each struck from the intersection of the other two arcs as a center. Such a triangle will always touch the four sides of a circumscribed square; and as the triangle is turned, the corners of the triangle will move in a rectangular path, following the sides of the square.

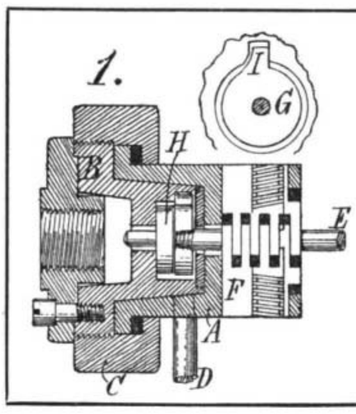
This principle is not a new one. It was discussed in the Scientific American of April 17th, page 300, under the title "Rotagons." It has been used to a limited extent as a cam movement for the purpose of converting rotary motion into rectangular motion.

The tool, which we illustrate in the accompanying engravings, consists of a drill of the form just described and a guide which imparts the rectangular motion to the drill, the two being fitted in a chuck, which may be secured to the spindle of a lathe. As shown in Fig. 1, which is a section taken longitudinally through the chuck, the device consists of a stationary part *A* and a revolving member *B*, the two being connected by a collar *C*. To hold the member *A* stationary, a pin *D* is provided, which projects from member *A*, and is adapted to engage the bed of the lathe, while the part *B* is secured to the spindle of the lathe. The drill is indicated at *E*, and the guide at *F*. Fig. 2 shows the guide in perspective, and also in plan. It will be observed that it is made of two intermeshing members, which may be adjusted toward or from each other to diminish or increase the size of the square opening, so as to serve for different sizes of drills. As the drill is revolved in the opening, it is evident that there will be a bodily displacement of the drill, and for this reason it will be impossible to couple it directly to the revolving member *B*. Instead, it is screwed into a plate *G*, which bears against a wear plate *H*, adapted to take the thrust of the tool. The plate *G* is formed with a projection *I* at one side, as shown in detail in Fig. 1, and this projection is adapted to enter a recess in the revolving member *B*. Owing to this engagement between the plate *G* and the member *B*, the tool will be revolved, and yet will be free to move bodily in any direction demanded by its engagement with the guide *F*. The cutting part of the tool is like that of an end mill, and its action is similar except for the rectangular displacement. The two members of the guide are adjusted with respect to each other by means of a right and left handed screw, which engages a threaded recess in each member. The use of a pin such as that shown at *B* to keep the part *A* stationary, is not recommended for heavy work. In such cases it is better to clamp the part to the lathe bed. The tool is very well adapted for use on a milling machine, the part *B* being screwed to the spindle, while the stationary part *A* is clamped to the supporting arm of the machine.

The drill so far described will cut square holes with rounded corners. For most purposes a hole of this sort is just as good as one in which the corners are sharp. However, there are certain conditions in which a hole with square corners is necessary, and to provide for this a special form of drill is required, which is shown in one of the photographs. The tool is formed in two parts, one being a shank adapted to engage the guide, while the other forms the cutting portion. The shank of the tool is much larger than the cutting part, as shown by the cross sectional view, Fig. 3. Furthermore, it is found that one of the corners of the shank must be rounded, as shown at *J*, so as to permit the adjacent cutting edge *K* of the drill to cut into the corner of the square hole when the part *J* enters the corner of the guide (see dotted position), and yet carry the edge *K* in a straight line while the part *J* is moving along the side of the guide. The other two cutting edges of the tool serve merely to rough out the hole, while the finishing cut is made by the point which lies adjacent to the rounded edge of the shank. The arc *J* and the opposite arc *L* are both struck from a center at the point *K*. The other two arcs *M* are flatter than the arc *L*. The form of shank is worked out empirically, and a complete set of templets has been made for different sizes of tools.



The tool for boring square holes mounted on a milling machine.



Section through chuck.

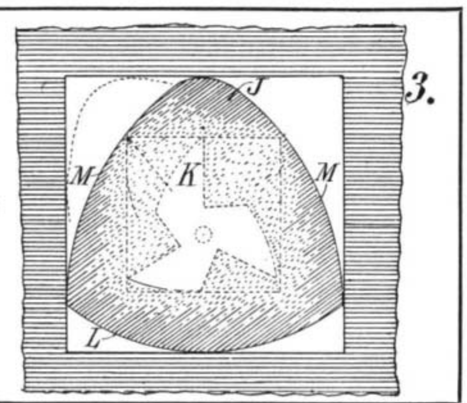
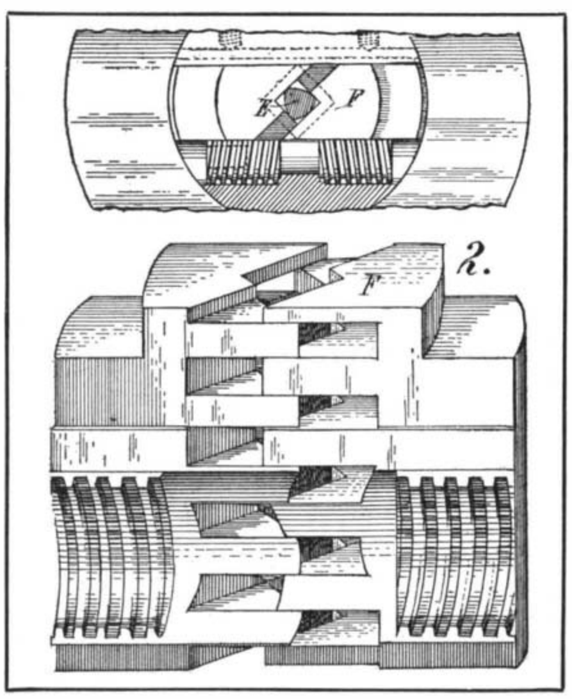
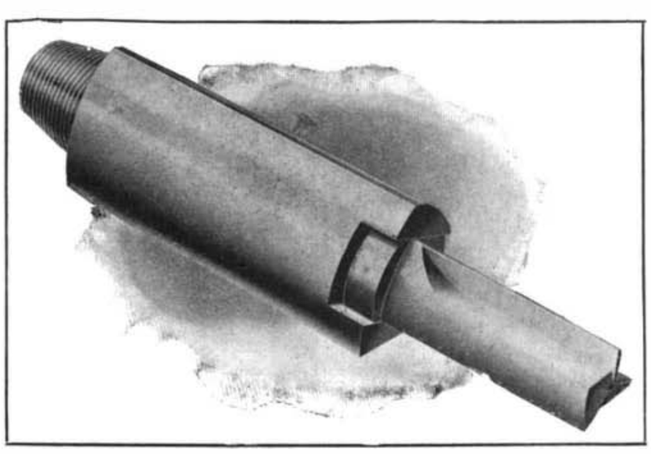


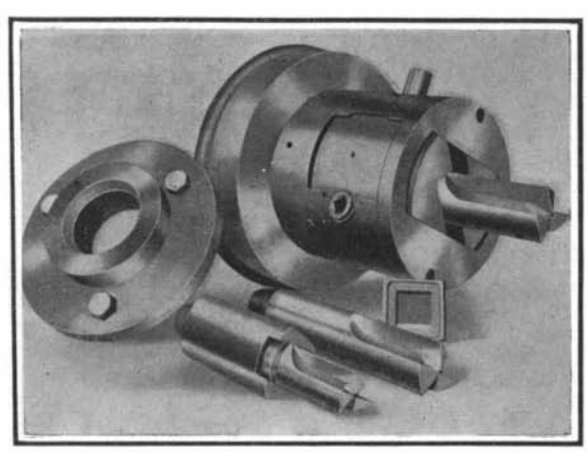
Diagram showing drill for cutting hole with sharp corners.



Details of the guide members.



Drill for cutting square holes with sharp corners.



Chuck holding the guide and drill.

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Sun Spots and Animals.

H. Simroth has attempted to explain successive glacial periods and climatic alternations by changes of latitude caused by a very slow oscillation of the earth, to the extent of 30 or 40 degrees in each direction around its longest axis, which meets the surface in Ecuador and Sumatra. The cause assumed by Simroth for the pendulation is the oblique impact of a former satellite, coming from the west-southwest, upon the earth in the region of the Soudan. With this "pendulation theory" is associated the hypothesis that all animal life originated near the 10 degree meridian (the equator of the pendulation axis), which passes through Central Europe and the Soudan, and one of its consequences is an intricate connection between sun spots and the geographical distribution of animals. Such a connection has long been assumed to exist (in regard to visitations of locusts, for example) but the assumption has found favor with few zoologists. According to the theory the period of fluctuation in animal life should be the mean sun spot period of 11 years, although the interval which actually intervenes between successive sun spot maxima varies from 6 to 17 years. In 1907, in accordance with the theory, many species of animals appeared in unaccustomed places or in unusually large numbers. The following examples, with many others, are mentioned by Simroth in a recent article. Siberian pine jays flocked into Germany in great numbers in 1907, as they had done in 1896. The cause commonly assumed for the migration of these birds is a failure of the Siberian crop of pine nuts, which are their principal food. Simroth, on the contrary, attributes the migration to increase in the number of birds, resulting from an unusually abundant crop of pine nuts in the preceding year. In support of this view he cites the very heavy crop of seed produced by German conifers in 1906, and the remarkably large numbers of squirrels seen in 1907.

Asiatic prairie hens also appeared in Europe in 1907. Their last previous appearance was in 1888, approximately two sun spot periods earlier. In 1907 the woodwork of the National Museum in Washington was seriously injured by termites. A similar attack had been made 11 or 12 years before. In the spring of 1908 about 15,000 pounds of shad were taken from a Prussian lake which had yielded an equally surprising harvest in 1897. In 1907 huge swarms of wasps, thistle moths, and dragon flies appeared in Germany and locusts in Hungary. Simroth attributes to sun spots even the unusual numbers of the white variety of the common great slug (*Luriax maximus*). Without regard to the pendulation theory, the occurrence of so many phenomena of this nature in 1907 is very remarkable, but in the same year many species were unusually scarce. The numbers of every species vary from year to year, owing, doubtless, to climatic influences. Simroth draws from the phenomena a number of conclusions, of which the following are the most interesting:

In the equatorial phase of pendulation, through which Europe is now passing, various organisms return both from the east (e. g., Siberian jays and prairie hens) and from the west (e. g., some American mollusks and plants) to the 10th east meridian. Both the migration and the multiplication of species are connected with the 11-year sun spot period.

The warm period, through which Europe is now passing, occasions a great increase of animal life.—Umschau.

By a German patented process, soluble starch is produced by acting upon a mixture of starch and acetic acid with small quantities of mineral acids at a low temperature. The methods hitherto employed for producing soluble starch do not yield a perfect product and, furthermore, necessitate the employment of heat, because the dilute mineral acids which are used act imperfectly and very slowly on starch in the cold. In the new process the mineral acids appear to act only as conveyers or catalyzers. The product, which apparently is an acetyle derivative of starch, dissolves completely in hot water and the solution does not coagulate, even after long standing. The soluble starch may be used in adhesive pastes, for thickening colors and in many other ways.