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J. W. HUGHES

DRILLING APPARATUS

Filed June 16, 1922

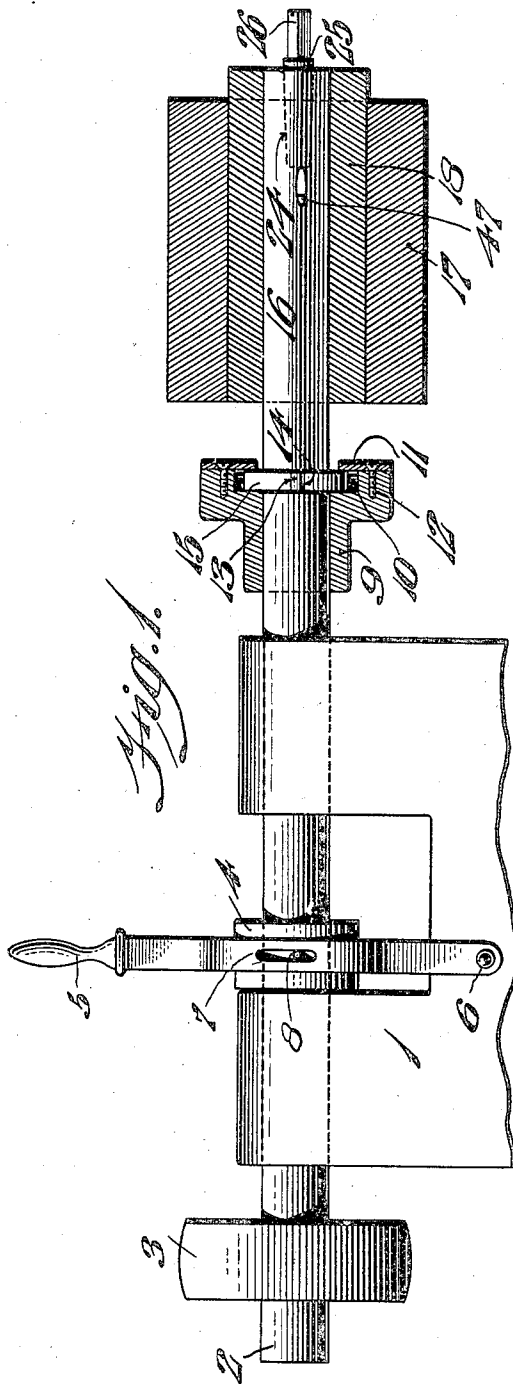


Fig. 1.

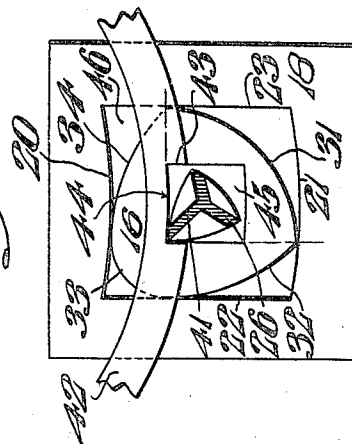
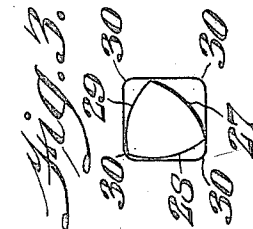
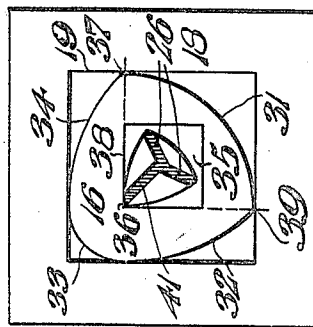


Fig. 2.



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UNITED STATES PATENT OFFICE.

JAMES W. HUGHES, OF WYNCOTE, PENNSYLVANIA, ASSIGNOR TO WILLIAM H. STEHLE,
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DRILLING APPARATUS.

Application filed June 16, 1922. Serial No. 568,723.

To all whom it may concern:

Be it known that I, JAMES W. HUGHES, a citizen of the United States, residing at Wyncote, county of Montgomery, State of Pennsylvania, have invented a new and useful Drilling Apparatus, of which the following is a specification.

My present invention comprehends a novel construction and arrangement of a drilling apparatus wherein the drill or its holder is guided in a novel manner in order that holes of a substantially rectangular contour with one or more curved sides will be formed during the rotation of the drill.

My invention is based on the well known principle of the Cardan circles, and in devices of this character as heretofore constructed one has not been able, in so far as I am aware, to have one or more of the sides curved. In the cutting of piston rings, for example, for which my present invention is especially adapted, although as is apparent it is not limited to such use, it is necessary in order to obtain the best results to make a rectangular cut one side of which is a curve, to conform to the circular contour of the piston ring.

My invention further comprehends a novel construction of a drill shank and novel means for guiding it during its revolution.

Other novel features of construction and advantage will hereinafter more fully appear in the detailed description and the appended claims.

For the purpose of illustrating my invention, I have shown in the accompanying drawings a typical embodiment thereof which is at present preferred by me, since this embodiment will be found in practice to give satisfactory and reliable results. It is, however, to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of these instrumentalities as herein shown and described.

Figure 1 represents, in sectional elevation, a drilling apparatus, embodying my invention, in conjunction with its actuating and controlling means.

Figure 2 represents an end elevation showing the drill in section as employed for cutting a rectangular aperture with rectilinear sides and sharp corners.

Figure 3 represents, diagrammatically, the Cardan circles principle.

Figure 4 represents an end elevation of the drilling apparatus, embodying my invention, with the drill in section, and a portion of the piston ring in which a rectangular cut has been made with one curved side, the guiding member having a plurality of curved sides in order to enable this cut to be made.

Similar numerals of reference indicate corresponding parts.

Referring to the drawings.

1 designates a standard in which is journaled the shaft 2 which carries the pulley 3, whereby it is adapted to be connected with any desired source of power in order to effect the rotation of the driving shaft 2. The shaft 2 has mounted on it a collar 4 operatively connected with the driving shaft 2 in the usual manner so that it can be longitudinally moved by means of a handle 5, which is fulcrumed at 6 to the standard 1, and provided with slots 7 into which extend the pins 8. 9 designates a carrying head keyed to the shaft 2 at its forward end, and having in its forward face an enlarged recess 10. A clamping ring 11 is provided which overhangs the recess 10 and is secured in position by means of the fastening devices 12.

The clamping head 9 is provided with a pin 13 which is adapted to be received in the recess 14 in the periphery of the head 15 of the drill shank 16. The head 15 is retained in position by the clamping ring 11, as is apparent. 17 designates a stationary bearing or housing to which is fixed a guide member in the form of a bearing bushing 18 which has a rectangular aperture 19, the side walls of which are rectilinear, as seen in Figure 2, or as in Figure 4, in which the opposite walls 20 and 21 are curved, while the other opposite walls 22 and 23 are rectilinear. The drill shank 16 is apertured as at 24 to receive the drill 25 which is formed as illustrated with three cutting edges 26 on its periphery. It will of course be understood that one or more cutting edges may be employed.

In order to give the proper results, the shank 16 must be made of proper dimensions and with mathematical accuracy. The principle of the Cardan circles, as illustrated in Figure 3, is the utilization of a section bounded by three circular arcs 27, 28 and 29,

each of these arcs being struck from a centre at the intersections of the three arcs respectively. A shank of this type in cross section, being of the same width in every direction, will fit into a square in any position, and will have four points of contact with the walls of the square. The walls of the square thus act as a guide during the rotation of the drill. The intersections of the curved circles at the corners will cut a square except at the corners, as shown in Figure 3, at 30, where there is a slight curve, the radius of such curve being equal to about one-eighth of the square.

It is often desirable to cut a square with sharp corners and this can be accomplished by guiding the drill in accordance with my present invention, wherein I employ a modified form of the Cardan circles, see Figure 2, from which it will be seen that I employ the arcs 31, 32, 33 and 34, so arranged as to form a uniform cross section as described above, so that it will fit within a square.

35 designates a square hole which is to be cut. The arc 33 is struck from the corner 36 of the square 35. The arc 32 is struck from the point 37 where the sides 38 of the square 35 will intersect with the wall of the larger square 19. The arc 34 is struck from the point 39 where the side 40 of the square 35, if extended, will intersect the wall of the larger square 19. The arc 31 is struck from the same center 36 as the arc 33 is struck from, but with a larger radius, which is sufficient to cause such arc to pass through the points 37 and 39 and tangent to the juxtaposed side walls of the square 19.

In the operation of the drill, it will be clearly seen when the shank 16 carrying the drill 25 and the cutting edge 41 arrives to the position as indicated in Figure 2, that when it is further rotated, the cutting edge 41 pivots about the point 36 which is the center of the circular arc 33 until a still further rotation will carry the edge 41 along the line 38. This operation is repeated at the four corners, thereby cutting the hole 35 with square corners and sides parallel to the greater outside square 19.

Referring now to Figure 4, I have shown in this figure a piston ring 42 in which a rectangular cut 43 is to be made with its inner wall curved, as at 44, to conform to the curvature of the piston ring. The guide member 18 in Figure 4 has one or more sides such as 20 and 21, for example, curved and formed with the same length radius on different centers. When the shank 16 is rotating, it will be apparent that the aperture 45 which is formed will conform in contour to the walls of the aperture 46, the corresponding walls being parallel but of smaller dimensions than that of the larger aperture. The shank 16 corresponds to that seen in

Figure 2, so that a detailed construction of the description and the manner in which it is produced is believed to be unnecessary. The shank 16, see Figure 1, is preferably provided with a drift aperture 47.

In so far as I am aware, I am the first in the art to devise a drilling apparatus wherewith an aperture can be drilled substantially rectangular in form with one or more curved sides, and it is therefore to be understood that I desire my claims to such features to receive the broad and generic interpretation to which a pioneer in the art is entitled.

It will be apparent that the recess 10, which is of greater dimensions than the head 15 of the shank 16, will permit the shank 16 to follow the inner contour of the guide member 18 during its continuous revolution.

It will of course be apparent that in accordance with my present invention the contour of the aperture formed may vary widely in cross section. In accordance with my present invention, a rectangular shaped aperture in cross section can be drilled in a less length of time than a round aperture of the corresponding size.

It will be apparent that the driving shaft 2 is longitudinally slidable in its bearings and is fed forwardly by means of the handle 5, it being understood that any desired drill feeding means may be employed.

It will now be apparent that I have devised a novel and useful drilling apparatus which embodies the features of advantage enumerated as desirable in the statement of the invention and the above description, and while I have, in the present instance, shown and described a preferred embodiment thereof which will give in practice satisfactory and reliable results, it is to be understood that this embodiment is susceptible of modification in various particulars without departing from the spirit or scope of the invention or sacrificing any of its advantages.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A drilling apparatus, comprising a drill with a shank whose outer wall in cross section conforms to the Cardan circles principle, and a guide member having an aperture, the walls of which guide and control said shank and with at least two opposing sides curved and in parallelism.

2. A drill having its body portion in cross section conforming to a figure bounded by Cardan circles, and a guide having an aperture with opposite side walls parallel and with a plurality of such walls curved.

JAMES W. HUGHES.

Witnesses:

H. S. FAIRBANKS,
F. A. NEWTON.