Sept. 14, 1937. J. P. FRANCESCO 2,092,755

BORING TOOL

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Fig. 1.

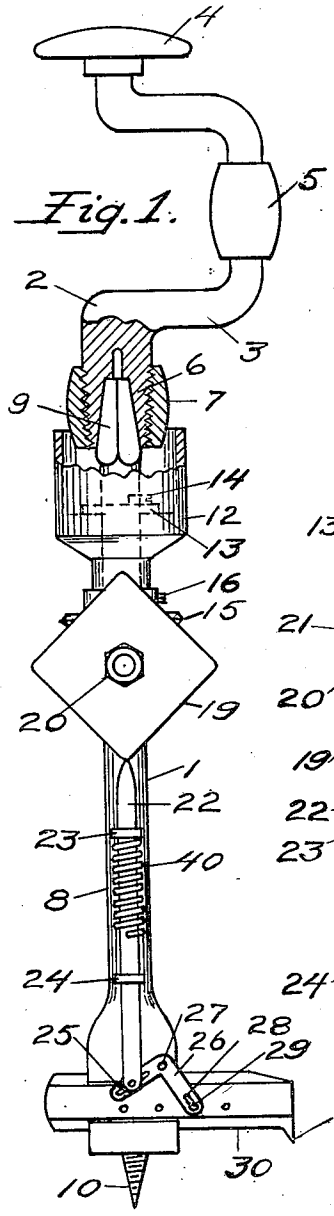


Fig. 2.

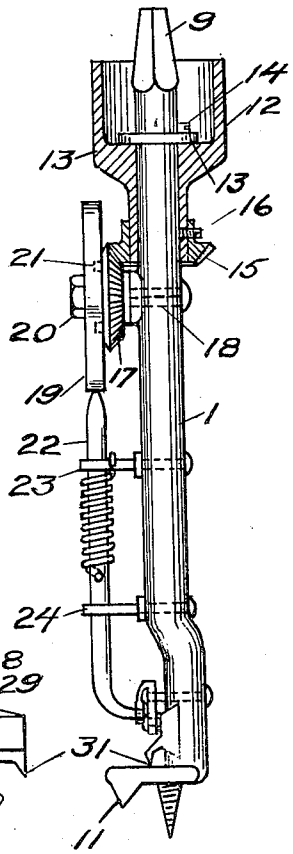


Fig. 5.

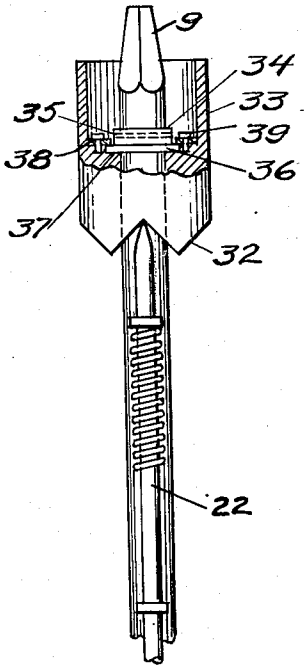
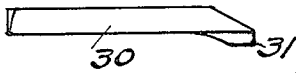


Fig. 3.



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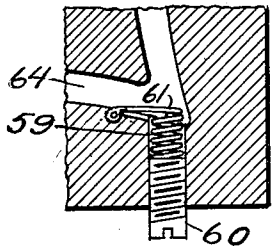


Fig. 10.

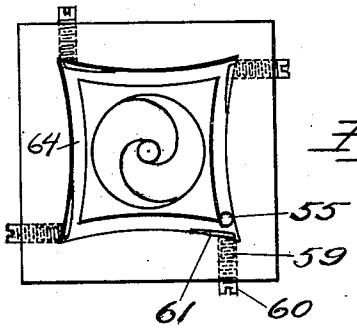


Fig. 9.

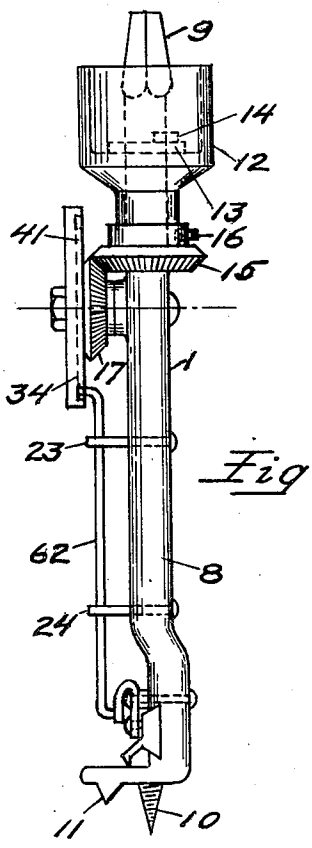


Fig. 4.



Fig. 8.

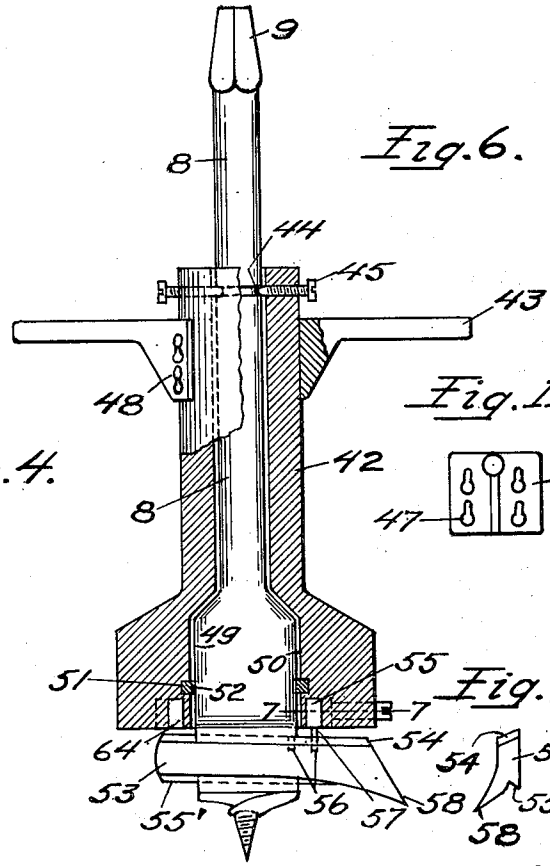


Fig. 6.

Fig. 11.

Fig. 7.

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Patented Sept. 14, 1937

2,092,755

UNITED STATES PATENT OFFICE

2,092,755

BORING TOOL

John P. Francesco, Haverhill, Mass.

Application August 10, 1936, Serial No. 95,136

4 Claims. (Cl. 145—122)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates generally to boring tools, but more particularly to an improved bit adapted for drilling holes of various contours.

The principal object of the invention is to provide a simple and efficient tool of the class described, which may be cheaply manufactured, and one which may be easily varied in its operation to drill holes of various contours and dimensions.

Another object of the invention is to provide means by which an ordinary bit may be converted into a tool of the class described.

Other objects of the invention consist of certain novel details of construction and arrangement of parts as hereinafter shown in the drawings, described in the specification, and more particularly defined in the accompanying claims.

Briefly stated the invention comprises a bit or drill provided with a cup-shaped sleeve and a cam mechanism for operating a radially movable cutter slidably attached to said drill. When the operator holds the sleeve stationary and revolves the drill the blade of the cutter describes a contour which outlines the side walls of the hole drilled, the contour depending on the size and shape of the cam used.

Referring to the accompanying drawings in which corresponding parts are indicated by similar reference characters:

Fig. 1 is a front elevation of a partially sectionalized assembly, showing a standard form of brace and the preferred form of improved bit, provided with a gear operated cam;

Fig. 2 is a partially sectionalized side elevation of the assembled bit shown in Fig. 1;

Fig. 3 is a top plan view of the cutter shown in Figs. 1, 2 and 4;

Fig. 4 is a side elevation of the improved bit shown in Fig. 2, provided with a grooved cam;

Fig. 5 is a partially sectionalized front elevation of a modified form of bit in which the operating cam is formed integral with the sleeve;

Fig. 6 is a partially sectionalized front elevation of a modified form of the improved bit in which the operating cam is of the grooved type formed integral with the sleeve;

Fig. 7 is an end elevation of the cutter shown in Fig. 6;

Fig. 8 is a perspective view of the cutter shown in Fig. 6;

Fig. 9 is a bottom plan view of the sleeve shown in Fig. 6;

Fig. 10 is a partially sectionalized detail view taken on the line 7—7 of Fig. 6, showing a portion of the cam groove and spring mechanism; and

Fig. 11 is a front elevation of a handle and bracket shown in Fig. 6.

Referring to the drawings, particularly Figs. 1, 2 and 3, the numeral (1) indicates the improved bit and (2) a standard form of brace or bit stock. The brace comprises a crank (3) provided with handles (4) and (5) and a chuck comprising externally tapered and threaded resilient gripping members (6), and an internally tapered and threaded sleeve (7) adapted to operate said gripping members and thus form a detachable connection for the shank of said bit.

The bit which is indicated by the numeral (1) comprises an ordinary bit or drilling shaft (8) having a squared and tapered shank (9) adapted to fit the chuck of the brace (2), the opposite end of the bit, which is generally of enlarged diameter as shown in Figs. 1 and 6, being provided with the ordinary drilling point (10) and rotary cutter (11) to which the rotary movement of the brace (2) is transmitted and which are designed to drill a circular hole. To the construction as set forth, which comprises the ordinary circular drill, the following elements are added which convert this drill into an instrument capable of drilling holes of any desired size and contour, depending on the size and shape of cam used, as will be described.

To the shaft is rotatably fitted a cup-shaped sleeve (12) retained thereon by the washer (13) and screw (14). To the bottom portion of this sleeve (12), which bottom portion is of smaller diameter, is fitted a bevel gear (15), rigidly attached thereto by the screw (16). The bevel gear (15) meshes with another bevel gear (17) rotatably mounted on a shaft or bearing member (18) which fits within a hole, preferably of square contour, passing through the shaft (8) of the bit at right angles thereto. This bearing member (18) is squared at one end thereof to prevent rotation within the shaft (8) of the bit, and is rounded for the remainder of its extent and provided with threads adjacent its other extremity. The rounded portion of the shaft is provided for the reception and free rotation of the gear (17) and a cam (19) which are retained on the bearing member (18) by a nut (20). In order to assure rotation of the cam (19) with the gear (17) pins (21) are provided. These pins

(21) project from the face of the gear (17) into openings in the cam (19), as illustrated in Fig. 2.

A longitudinally extending plunger (22) is slidably mounted within brackets (23) and (24), said brackets being attached to the shaft, either by members which project through holes provided therein, and which are riveted to the shaft as shown in Figs. 2 and 4, or by any other suitable manner.

The upper end of the plunger (22) is rounded to accommodate it for sliding contact with the cam (19) and the lower end of the plunger (22) is curved at right angles, and this extremity slidably fitted within a slot (25) in a bell crank lever (26). The lever (26) is pivotally mounted to the enlarged lower portion of the shaft (8) of the bit by means of a pin (27). The opposite arm of the lever (26) is provided with another slotted opening (28) in which is slidably mounted a pin (29) projecting from a radially movable cutter (30). It will be noted that the cutter is provided with several holes for the reception of the pin (29), so that various sizes of holes may be drilled. The radially movable cutter (30) is beveled on its upper and lower surfaces and slidably fitted within beveled grooves cut within the enlarged portion of the shaft (8) of the bit (1), preferably at right angles to the longitudinal axis thereof, or at a slight incline to this right angular position, dipping in the direction of the cutting blade (31) which is located at one extremity of the cutter. The cutter is also beveled from the face on the leading or cutting end toward the rear, as shown in Fig. 3.

It will be seen from the description of the construction that when the brace (2) is rotated, and the cup-shaped sleeve (12) held stationary, so as to prevent rotation thereof, that the bevel gear (17) is rotated as it is rolled around the bevel gear (15), by the rotation of the shaft (8) on which the gear (17) is mounted. The gear (17) will revolve the cam (19) in unison therewith, and by the interaction of the cam and plunger (22), and the intermediate bell crank lever (26), the rotary movement of the cam is translated into a reciprocating movement in the cutter (30). The movement of the cutter (30) corresponds to the movement of the cam (19) and cutting blade (31) thus describes a contour similar to that of the edge of the cam, in a plane at right angles to the axis of the bit shaft. If the cam is of square outline as shown in Fig. 1, the cutting blade will describe a square in its movement, or if it is desirable to produce a hole hexagonal in shape, or of any other contour, a cam of the particular shape will cause the cutting blade to move along the desired contour.

The same result may be obtained by forming a cam (32) on the bottom surface of the cup-shaped sleeve (33) so as to produce any desired movement of the cutting blade as shown in the construction illustrated in Fig. 5. In the modified form shown by this illustration it will be seen that when the sleeve is held stationary, a reciprocating movement of the plunger (22) is produced as the bit shaft (8) is rotated, and this reciprocating movement may be transmitted to a lever (28) and cutter (30) (not illustrated in this view) in the same manner as shown in Figs. 1 and 2.

The sleeve (33) is retained on the shaft (8) by means of a collar (34) which is fastened to the shaft by the pin (35). The collar is provided with a rim (36), which is rotatably mounted between the floor (37) of the cup-shaped opening in the sleeve, and an annular ring (38), which is retained within the opening by the screws (39). The use of this type of cam eliminates the necessity of operating the plunger (22) by means of bevel gears, and thus simplifies the construction.

In Figs. 1, 2 and 5, it will be noted that the top of the plunger (22) is kept in constant contact with the cams (19) and (32) by means of the tension spring (40) which is attached at one end to the plunger, and at the other to the upper bracket (23). Fig. 4 shows the improved bit in which a modified form of cam is used, permitting the omission of the spring (40), as the cam is provided with a groove (41) into which the upper end of the plunger (62), which is bent at 90° to the longitudinal axis, is slidably fitted. With this construction the plunger is elevated and lowered as its upper end follows the cam groove (41). The lower end of the plunger is pivotally connected to the bell crank lever (26) which operates the transversely movable cutter as shown in Figs. 1 and 2. The only difference between the two forms of bits, that shown in Fig. 4 and the one shown in Figs. 1 and 2, being the construction of the cam, and the elimination of the spring (40), and 90° bend at the upper end of the plunger, where it fits into the cam groove (41).

Another modified form of bit is shown in Fig. 6. In this construction a sleeve (42) is provided, which extends over the greater portion of the length of the bit shaft (8). The lower portion of this sleeve is of increased diameter to fit the increased diameter of the shaft, and also to permit the formation of a cam groove in its lower surface. The sleeve is provided with radially projecting handles (43), which when held by the operator prevents the rotation of the sleeve with the rotation of the shaft (8).

In this type of construction the shaft (8) is provided with a groove (44) which extends around its circumference and the sleeve (42) is provided with retaining screws (45), the ends of which project within the groove to prevent longitudinal movement of the shaft with respect to the sleeve. The handles (43) are detachably mounted to the upper portion of the sleeve (42) by means of brackets (46), integrally formed with said handles and provided with bayonet openings (47) which fit over pins (48) radially projecting from the outer surface of the sleeve. The lower portion of the bit shaft (8) as mentioned above, is of increased diameter as indicated by the numeral (49) and the internal diameter of the sleeve is also of increased diameter, as indicated by numeral (50), to fit over this lower portion of the shaft. The interior surface of the portion of the sleeve having an increased diameter is provided with a groove (51) into which is fitted a bushing (52). This bushing is adapted to provide a more accurate fit for the shaft within the sleeve, and thus prevent eccentric rotation of the former. The transversely reciprocating cutter (53) is beveled on its upper and lower surfaces, as indicated by the numerals (54) and (55'), to fit a correspondingly cut groove in the enlarged portion of the shaft (8), in the same manner as shown in Figs. 1, 2 and 4, but in this instance, the groove is cut at a slight angle to a plane, normal to the longitudinal axis of said shaft to allow a slight dip of the tool toward its cutting end. This is done to provide ample clearance for the cutting point of said tool. The cutting tool is somewhat similar to that shown in Figs. 1, 2, 3 and 4, except that it is provided with a more extended bevel from

the leading or cutting end toward the rear, and from the point to the face as illustrated in Figs. 6, 7 and 8. The tool is designed to allow for ample strength and also clearance for the cutting edge.

In this modified form of bit the cutting tool is given its reciprocating motion directly from the cam without necessitating any intermediate plunger and lever mechanism as shown in the types illustrated by Figs. 1, 2 and 4. This is accomplished by providing the bottom of the sleeve (8) with a cam groove (64) into which is fitted a roller (55), rotatably mounted on the upper surface of the cutting tool. The upper surface of the cutting tool is drilled with several holes (56) for the reception of a pin (57) on which the roller (55) is mounted; upon revolution of the shaft the roller follows the path of the groove in the lower surface of the sleeve and thus imparts to the edge (58) of the cutter (53) a movement corresponding to the contour of the groove. In order to facilitate the movement of the roller within the cam groove, the sleeve in the plane of the groove is provided with tapped openings for the admission of helical springs (59) and retaining screws (60). The springs (59) react against the free ends of metal strips (61) which are hingeably mounted on the outer walls of the cam groove (64) and which extend partially into the path of said roller. The springs being located at the corners of said groove are compressed by the roller passing over the strips and when the roller has reached the end of an arcuate path the spring in regaining its normal extent, imparts an impulse to the roller which starts it in its new direction in the cam groove. Thus the action of the springs is to prevent sticking or binding of the rollers in the corners of the cam groove as it follows the contour thereof.

The cam groove shown in Fig. 9 is for cutting square holes. This particular shape of groove is required to allow for the movement of the cutter which is in a slightly inclined path as described above. It also provides for sufficient clearance for the beveled blade as the cutting edge describes the desired path.

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

1. A bit of the type described, comprising a central shaft having a chuck shank and a drilling point, a normally non-rotatable sleeve in which said shaft is rotatably mounted, a bearing member mounted on said shaft having its axis normal thereto, a cam rotatably mounted on said bearing member, means in connection with said sleeve and said cam, comprising bevel gears, adapted to rotate said cam upon rotation of said shaft, a transversely movable cutter, slidably mounted on said shaft, and means in connection with said cam and said cutter, comprising a plunger and lever, adapted to produce reciprocating movement of said cutter upon rotation of said cam.

2. A bit of the type described, comprising a central drilling shaft, a normally non-rotatable sleeve in which said shaft is rotatably mounted, a bearing member projecting normally from said shaft, a cam rotatably mounted on said bearing member, means in connection with said sleeve and said cam adapted to produce rotation of said cam with the rotation of said shaft, a transversely movable cutter slidably mounted on said shaft, and means in connection with said cam and said cutter adapted to produce reciprocating movement of said cutter upon rotation of said cam.

3. A bit of the type described, comprising a central drilling shaft, a normally non-rotatable sleeve in which said shaft is rotatably mounted, a bearing member projecting normally from said shaft, a cam rotatably mounted on said bearing member, means comprising bevel gears in connection with said sleeve and said cam adapted to produce rotation of said cam with the rotation of said shaft, a transversely movable cutter slidably mounted on said shaft, and means comprising a pivotally connected plunger and lever, in connection with said cam and said cutter adapted to produce reciprocating movement of said cutter upon rotation of said cam.

4. A bit of the type described, comprising a central drilling shaft, a normally non-rotatable sleeve in which said shaft is rotatably mounted, a bearing member projecting normally from said shaft, a cam rotatably mounted on said bearing member, means comprising bevel gears in connection with said sleeve and said cam adapted to produce rotation of said cam with the rotation of said shaft, a transversely movable cutter slidably mounted on said shaft, and means comprising a pivotally connected plunger and lever, in connection with said cam and said cutter adapted to produce reciprocating movement of said cutter upon rotation of said cam, and adjusting means in connection with said lever and said cutter adapted to vary the extent of transverse movement of said cutter.

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