

[54] **SURGICAL DRILL WITH DETACHABLE HAND-PIECE**

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[58] Field of Search 32/26; 64/4; 128/305; 403/13, 14; 408/132, 238; 173/163

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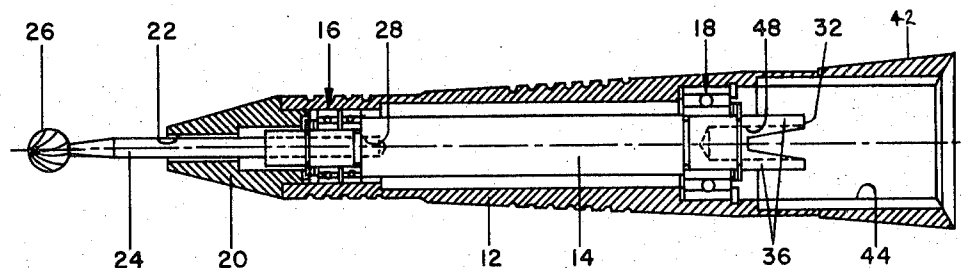
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[57] **ABSTRACT**

A drive housing has a drive shaft with a drive clutch extending therefrom. A detachable hand-piece includes a driven shaft and a claw attached thereto which is adapted to operatively mate with the drive clutch. The operative engagement is effective to drive a cutting element connectable to the driven shaft. The operative engagement can be effected while the drive motor is operating.

3 Claims, 2 Drawing Figures



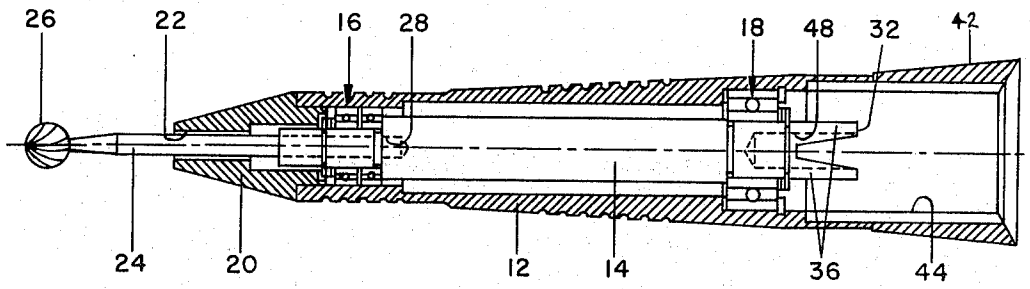


FIG. 1

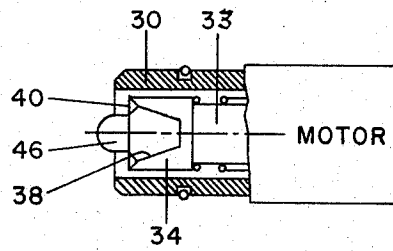


FIG. 2

SURGICAL DRILL WITH DETACHABLE HAND-PIECE

BACKGROUND OF THE INVENTION

The present invention relates to a surgical drill having a detachable hand-piece.

Many surgical procedures require the use of drilling implements for various applications, such as drilling holes in various bones. High speed drills, generally driven by an air motor have been in use for some time, but their performance leaves something to be desired.

Specifically, prior art drills have generally utilized a chuck arrangement to connect a cutting element to a drive shaft. Such arrangements create a problem of centration of the cutting element. It should be appreciated that an uncentered cutting element will produce a larger hole than is wanted which is extremely undesirable in most surgical procedures.

It should be evident that elapsed time during an operation can be a critical factor. The chucks in the prior art drills have been found wanting, in that, to change a cutting element, as is often necessary, the drill must be switched off, the chuck opened, a new cutting element centrally inserted in the chuck, the chuck closed, and then the drill must be switched on. These steps must occupy the attention of at least one person in the operating room and render the drill inoperative for a substantial and perhaps critical time. During this time a surgical wound may remain open without any positive surgery being completed.

The present invention is designed to fill the obvious gaps present in the prior art. The drill embodied in the instant invention need not be shut-off to effect a cutting element change. Detachable hand-pieces each include their own cutting element and are connectable to a drive housing while the drive shaft thereof is rotating. In this manner very little precious time is lost. Moreover, a bearing arrangement in the hand-piece insures accurate centration of the cutting element at all times.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a surgical drill which permits the rapid interchange of handpieces which include different cutting elements.

Another object of the present invention is the provision of a surgical drill in which the interchange of hand-pieces can be effected without switching off the drive means.

Still another object of the present invention is the provision of a surgical drill in which the cutting elements are constantly centered.

In accordance with the above designs the surgical drill embodying the present invention includes a housed drive means and a detachable hand-piece having a cutting element attached thereto. The detachable hand-piece includes a housing having a central shaft. At the end of the shaft, adjacent the drive means housing, is a claw member which has arms extending outwardly toward a drive shaft rotatably mounted within the drive housing.

The drive shaft includes a clutch member which is adjacent to the hand-piece and adapted to mate with the claw. The clutch is generally cylindrical and has at least one notch which is adapted to receive an arm member of the claw so as to drive the same. The claw and the clutch can be coupled while the drive shaft is

rotating so as to conserve time during surgical procedures. The clutch also includes a guide member protruding outwardly therefrom which is received in a guide bore centrally formed in the claw member.

The cutting element is connected to the driven shaft in such a way that it is always accurately centered. This is accomplished by a suitable bearing arrangement in the hand-piece housing.

The above and other objects of the present invention will be apparent as the description continues and when read in conjunction with the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1, illustrates a preferred embodiment of the hand-piece of the present invention partially in cross-section.

FIG. 2, is a partially cross-sectioned view of the clutch member part of the drive means.

DETAILED DESCRIPTION

As illustrated in FIG. 1 the detachable hand-piece is enclosed in an elongated and generally cylindrical housing 12. The shaft 14 is centrally located in housing 12 and is maintained in a constantly centered position by means of the bearing arrangements 16, 18. The bearing arrangements 16, 18 can be of the roller bearing type; however, the details thereof are not pertinent to the instant invention.

The forward portion or nozzle 20 of the housing 12 has a central bore 22 which receives the shank 24 of the cutting element 26. The shank is also received in the bore 28 formed in the shaft 14 and suitably anchored therein.

A drive means (not shown) is situated in the drive housing 30 and is preferably a suitable air motor. However, any prime mover will suffice for the purposes of this invention. The shaft 14 can be coupled to a drive shaft 33 while the latter is rotating. This feature avoids having to switch off the drive means and thus conserves important operating time. Specifically, the coupling is effected by means of the claw member 32 and clutch member 34. The claw member 32 is situated at the rear end of the driven shaft 14 and has arm members 36 which extend outwardly therefrom and which are generally parallel to the axis of the shaft 14. The clutch member 34 is generally cylindrical in shape and is situated on the forward end of the drive shaft 33. The clutch member 34 also includes notches 38 which are adapted to mate with the arms 36 in an operative driving relation. Those notches taper from a wide front part to a narrow rear part. Additionally, the forward base part 40 is slightly rounded. When it is desired to couple a particular hand-piece to the drive shaft 33 the hand-piece housing 12 is urged toward the drive shaft 33. The rear section 42 of housing 12 has a wide bore 44 which is adapted to receive the drive means housing 30 in the vicinity of the clutch member 34. Since the shaft 33 and clutch member 34 are turning, the initial contact of the arm members 36 of the claw 32 does not produce a complete mating engagement; rather the tips of the arm members 36 contact the curved surface 40 and slide therealong until a mating engagement is possible. Upon sufficient sliding, the arm members are received in the notches 38 and will be rotatably driven thereby. To facilitate coupling, the clutch member 34 is provided with a guide member 46 which is received in a central hole 48 formed in the claw member 32.

The hand-piece housing 12 can be releasably attached to the drives means 30. The specific mode of attachment is not pertinent to the instant invention; however, a preferred coupling may comprise a locking slot and detent arrangement.

The instant invention herein described permits the interchange of a variety of hand-pieces during surgery while the drive means continues turning. This feature conserves valuable operating time and in certain surgical procedures this may increase the patient's survival probability. Also, the fact that the cutting elements are in a constant center position ensures that holes of precise sizes can be repeatedly drilled. It is obvious that various changes can be made in the details of the instant invention without departing from the spirit and scope of the appended claims, which changes are intended to be embraced therewithin.

What is claimed is:

- 1. In a surgical drill of the type comprising:
 - a. a drive housing;
 - b. drive means including a drive shaft in said housing;
 - c. a detachable hand-piece comprising a housing, a driven shaft rotatably mounted in said housing, and a cutting element connectable to said driven shaft;

- and,
- d. means to exchangeably and operatively couple the drive and driven shafts;
- e. the improvement which comprises a clutch member attached to said drive shaft, said clutch member being generally cylindrical, having notches thereon and having a central guide member protruding outwardly therefrom; and
- f. a claw member attached to said driven shaft having cooperating arm members extending therefrom toward said clutch member, said arm members adapted to fit into said notches, said claw member having a central guide bore to receive said guide member, said claw and clutch member adapted to mate in operative driving relation when said hand-piece housing is connected to said drive housing while the drive shaft is rotating.
- 2. The surgical drill of claim 1 including means to releasably engage said drive housing to said hand-piece housing.
- 3. The surgical drill of claim 1 further comprising a bearing arrangement within said hand-piece housing to secure accurate centration of the cutting element.

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