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VIBRATORY TOOL FOR OPERATING BONE SETS, BONE
CHISELS, AND BONE NAIL DRIVERS
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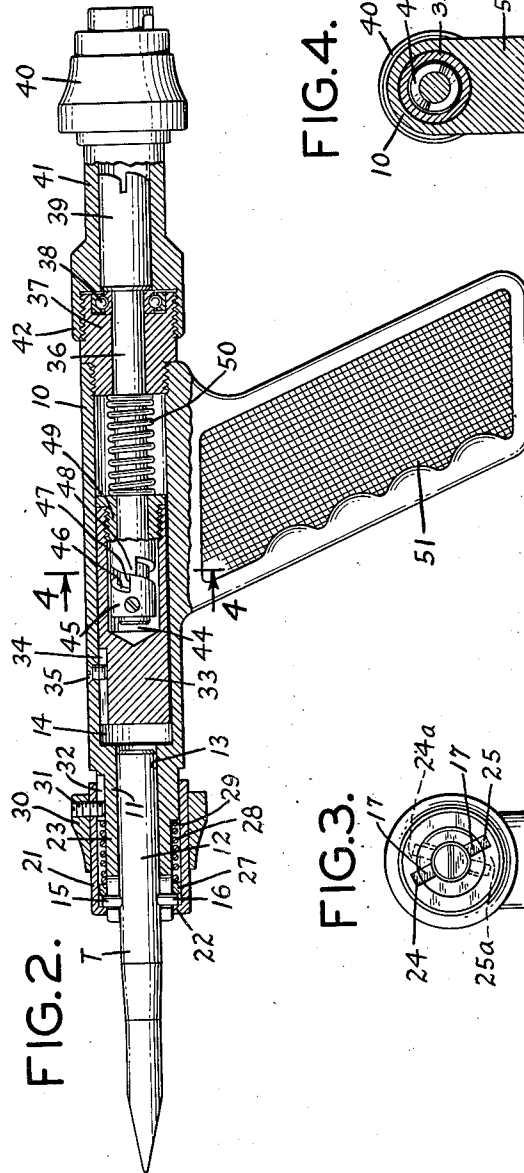
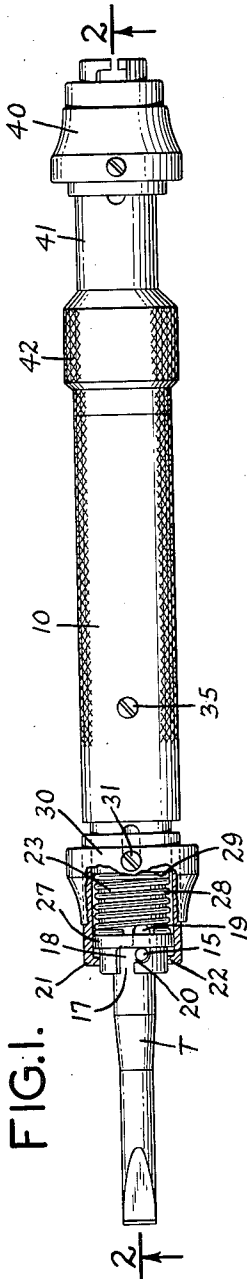


FIG. 4.

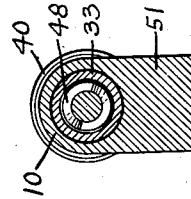
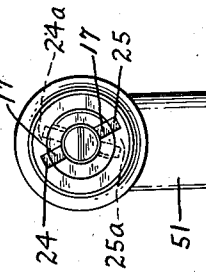


FIG. 3.



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VIBRATORY TOOL FOR OPERATING BONE
SETS, BONE CHISELS, AND BONE NAIL
DRIVERS

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2 Claims. (Cl. 128—305)

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This invention relates to tools for use in bone surgery and it relates particularly to a vibratory tool for operating surgical instruments such as bone sets, bone chisels, bone nail drivers and the like.

The instruments heretofore used in bone surgery have been relatively crude, considering the high development of such surgery. Practically all bone surgery such as bone shaping, cleaning, bone setting and the driving of bone nails, has been accomplished manually with tools much like those used in ordinary woodworking operations. The skill required for the use of such manually operated instruments must be of a very high order and even under the best conditions it is inevitable that the results are not always all that might be desired.

The present invention overcomes to a large degree the lack of manual dexterity in bone surgery by providing a vibratory tool which enables many different operations to be accomplished merely by guiding the tool as it is driven by means of an external power source.

More particularly, the invention comprises a device having a novel chuck arrangement for receiving any one of several different types of cutting, sawing, and hammering tools or the like. The tools are vibrated by means of a power operated hammer which can be driven by a self-contained power source or a power source connected to the instrument by means of a flexible shaft. The chuck used in the instrument is of a type which retains the tool securely but allows the tool to vibrate endwise in response to impact. The tool is normally biased outwardly with respect to the hammer so that it is not vibrated by the hammer until pressure is brought to bear against the end of the tool. When the tool is displaced inwardly by pressing it against a bone, nail or the like it moves into the path of the hammer so that the tool is struck by the hammer and is vibrated endwise to cut, saw or hammer, depending upon the type of tool being used in the instrument.

The provision of the instrument of the type referred to above frees the surgeon of the necessity of controlling the extent of cutting by striking or otherwise manually manipulating the tool and permits him to observe more closely and carefully the actual cuts and other operations being made so that his skill and knowledge may be used to their greatest advantage.

For a better understanding of the present invention, reference may be had to the accompanying drawings in which:

Fig. 1 is a plan view of a typical vibratory tool embodying the present invention with a portion of the chuck broken away to disclose details thereof;

Fig. 2 is a view in longitudinal section taken

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on line 2—2 of Fig. 1 with a handle for the tool shown in full lines;

Fig. 3 is a view in elevation of the tool receiving chuck of the vibratory tool; and

Fig. 4 is a view in section taken on line 4—4 of Fig. 2.

The tool chosen for purposes of illustration may include a tubular barrel or casing 10 which is suitably knurled on its exterior to afford a good grip thereon. The casing 10 has a sleeve or extension 11 of reduced diameter at its left-hand end, the sleeve forming the internal member of the chuck for receiving a tool T, such as the chisel shown in Figs. 1 and 2. The tool T has a cylindrical shank 12 which fits in the bore 13 in the sleeve 11 and is long enough to extend into the larger bore 14 within the casing 10.

The tool T also has diametrically extending pins 15 and 16 near its forward end, these pins being adapted to be received in a slot 17 on each side of the sleeve 11. As shown in Fig. 1, the slot 17 has two parallel portions 18 and 19 connected by a transverse portion 20 thereby making the slot generally of flat Z shape. The portions 18 and 20 of the slot are, in effect, a bayonet slot and the portion 19 is an extension from the laterally displaced end of the bayonet slot.

The sleeve 11 carries a retaining chuck sleeve 21 of tubular formation having an intumed end flange 22 which bears against the exterior of the sleeve 11 at a portion 23 thereof of reduced diameter. The flange 22, as shown in Fig. 3, has diametrically spaced notches 24 and 25 therein to permit the pins 15 and 16 to pass through the notches and enter the lateral extensions 20 of the bayonet slots. The sleeve 21 also has lugs 24a and 25a which partially block the lateral extensions when the sleeve 21 is in a forward position.

In order to attach a tool the sleeve 21 must be pulled back to move the lugs 24a and 25a behind the lateral extensions so that the pin can move along the slot sections 20 into alignment with the notches 24 and 25 and the slots 18. When the sleeve 21 is moved forward into the position shown in Figs. 1 and 2, the lugs 24a and 25a prevent the pins on the tool from rotating out of alignment with the extensions 19 and being released inadvertently from them.

The tool is normally urged outwardly by means of a ring member 27 which is slidable upon the reduced portion 23 of the extension 11 and is urged normally outwardly by means of the helical spring 28 which bears against the ring 27 and the shoulder 29 at the inner end of the reduced section 23. The ring 27 abuts against the pins 15 and 16 and urges them toward the outer ends of the slot extensions 19.

The sleeve 21 is retained on the extension and is made more easily movable by means of a collar

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30 and a screw 31 threaded into openings in the collar and sleeve and extending into a groove 32 in the extension 11.

The tool T can move lengthwise of the extension with the pins 15 and 16 moving along the slot extensions 19 so that when pressure is exerted on the outer end of the tool, the inner end of the shank 12 enters the bore 14 where it may be struck by a hammer 33 slidable lengthwise of the bore 14. The hammer 33 is of cylindrical shape and has a longitudinal groove 34 therein to receive a screw 35 extending from the barrel into the groove to prevent rotation of the hammer.

The hammer 33 is reciprocated by means of a shaft 36 which is rotatably mounted in a bushing 37 threaded into the right-hand end of the casing 10 and carrying an anti-friction bearing 38 to facilitate rotation of the shaft. The shaft is provided with an enlarged coupling 39 for connection with a coupling on the end of a flexible shaft (not shown). The sheath of the flexible shaft may be received detachably in a chuck 40 like the chuck at the opposite end of the casing. The chuck 40 is mounted on an extension 41 having an internally threaded cup shaped end portion 42 which is threaded on the bushing 37 and aids in positioning the anti-friction bearing 38 therein.

The hammer 33 has a central bore 44 into which the end of the shaft 36 extends. The end of the shaft carries a cam member 45 having a helical cam surface 46 interrupted by a step 47. The cam surface 46 faces toward the right-hand end of the tool as viewed in Fig. 2. The hammer carries a complementally shaped cam member 48 on the inner end of a tubular sleeve 49 which is threaded into the right-hand end of the hammer bore 44.

The hammer is normally urged to the left by means of a helical spring 50 bearing against the sleeve 49 and the bushing 37.

In operation, the shaft 36 is connected to a flexible shaft or other power source and rotates continuously. As the shaft rotates, the cam thereon forces the hammer to the right and then releases it for movement to the left by means of the spring 50 as the steps on the cams pass each other. The hammer, therefore, is vibrated continuously during the operation of the tool. Unless pressure is applied to the tool T, the tool is not in engagement with, or in the path of, the hammer and is not vibrated or struck thereby. This affords a safety factor in the operation of the tool because there is much less danger of being cut or otherwise injured by the tool if it is not vibrating when not being actually used in surgical operations.

As shown in Fig. 2, the tool may be provided with a pistol grip handle 51 or the handle may be omitted and the tool or the instrument used like a pen for closely controlled work.

It will be understood that the tool is formed of rust resistant materials such as stainless steel or the like to enable the tool to be sterilized without rusting and that it may be made of a convenient size for the purpose desired.

Therefore, the form of the invention disclosed herein should be considered illustrative and not as limiting the scope of the following claims.

I claim:

1. A vibratory tool for operating bone sets, bone chisels, nail drivers and the like comprising a tubular casing; a chuck at one end of said

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casing to receive a tool detachably with the inner end of said tool extending into said casing, said chuck including a tubular sleeve on said casing having diametrically opposite generally Z-shaped slots extending inwardly and then laterally from the outer end of said sleeve to receive pins projecting radially from a tool shank, said slots having longitudinal extensions at their inner lateral ends to guide said pins and tool for lengthwise movement, a chuck sleeve member slidably mounted on said sleeve and having a peripheral flange engaging said sleeve and notches in said flange in alignment with the outer ends of said slots to admit said pins, a ring member slidably between said sleeve and said chuck sleeve member to engage said pins, and spring means between said sleeve and said chuck sleeve member and engaging said ring and urging it outwardly to bias said tool toward the outer ends of said slot extensions; a hammer member reciprocable in said casing toward and away from said chuck, means in said casing to urge said hammer member toward said chuck, a rotary member in said casing to be driven by an exterior source of power, means on said shaft and said hammer member for moving said hammer member away from said chuck and releasing the hammer member for movement toward said chuck, said urging means in said chuck normally maintaining said tool out of engagement with said hammer and being compressible to bring said tool into a position to be struck by said hammer as it moves toward said chuck.

2. A vibratory tool for operating bone sets, bone chisels, nail drivers and the like comprising a tubular casing; a chuck at one end of said casing to receive a tool detachably with the inner end of said tool extending into said casing, said chuck including a tubular sleeve on said casing having diametrically opposite generally Z-shaped slots extending inwardly and then laterally from the outer end of said sleeve and having longitudinal extensions at their inner lateral ends to receive pins projecting radially from a tool shank and guide said pins and tool for lengthwise movement, a chuck sleeve member slidably mounted on said sleeve and having a peripheral flange engaging said sleeve and notches in said flange in alignment with the outer ends of said slots to admit said pins, means to engage said pins and urge them toward the outer ends of said slot extensions, and means on said chuck sleeve member to releasably retain said pins in said slot extension; a hammer member reciprocable in said casing toward and away from said chuck, means in said casing to urge said hammer member toward said chuck, means in said casing for moving said hammer member away from said chuck and releasing the hammer member for movement toward said chuck, said urging means in said chuck normally maintaining said tool out of engagement with said hammer and being compressible to bring said tool into a position to be struck by said hammer as it moves toward said chuck, and means to connect the hammer moving means to a source of power for actuating it.

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