

United States Patent

Otterstrom

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[54] SURGICAL TOOL

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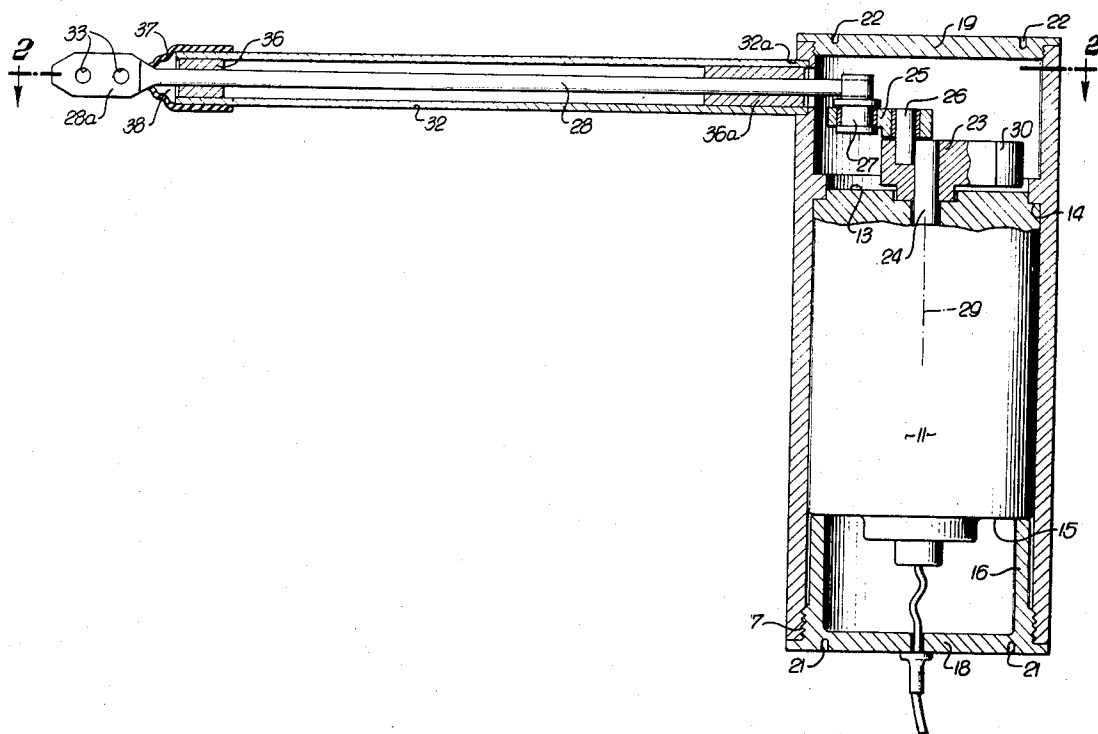
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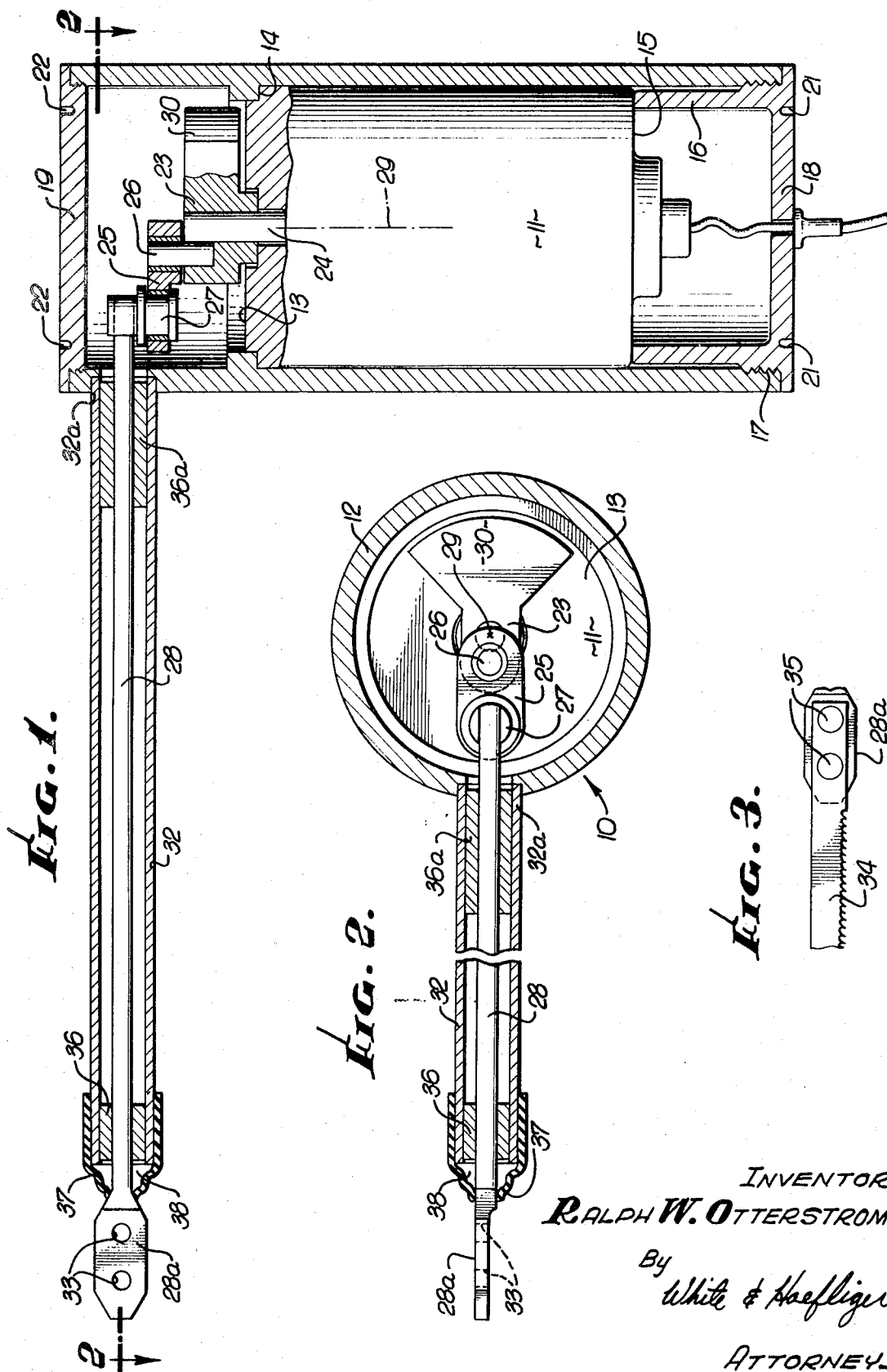
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ABSTRACT

The disclosure concerns a drive for reciprocating a surgical tool at rapid rates, the drive and tool having unusually advantageous construction, particularly as facilitates ease of sterilization, handling and operation.

1 Claims, 3 Drawing Figures





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SURGICAL TOOL

BACKGROUND OF THE INVENTION

This invention relates generally to surgical tools, and more particularly concerns a drive for reciprocating a surgical tool at rapid rates, the tool having an unusually advantageous construction.

Surgical equipment, especially that useful for cutting bone, must satisfy several requirements. Among these are the ability to cut rapidly; lightweight construction; and adaptability to sterilization. The first requirement can be met by providing a power drive, as for example an electrical motor; however, in such event the remaining two requirements are more difficult to meet, since the use of a motor and a drive of sufficient power for cutting bone would normally be of unacceptable size and weight, and need for sterilization is difficult to satisfy due to the exposure of moving parts.

SUMMARY OF THE INVENTION

It is a major object of the invention to provide a surgical tool that will overcome the above-mentioned problems, as well as others encountered in this field. Basically, the tool comprises, in combination, an electrical drive; a shaft having driven connection to the drive to be rapidly reciprocated endwise with short strokes in response to drive operation; a support including a tube within which the shaft extends so that the shaft tip projects from the tube; means on the tip to support a surgical implement to be rapidly reciprocated by the shaft; and a flexible barrier connected across the clearance between the shaft and tube at a location to block passage of bacteria from the tube interior to the exposed implement. As a result, the implements on the tip, barrier and tube may be easily sterilized as by exposure to sterilizing fluid without damage to the tool, and bacteria cannot travel from the tool interior to the implement. Further, the support may include an enclosing housing for the drive, and the tube may be supported by the tube so that the entire tool may be externally sterilized easily and safely.

Additional objects of the invention include the provision of a drive that includes an electrical motor, a rotor driven by the motor and a crank connecting the rotor to the shaft, the housing enclosing all of these elements; the provision of a barrier in the form of a flexible bellows connected between the shaft tip and end portion of the tube; the provision of a fastening element on the exposed shaft tip and adapted to attach to the surgical implement, as for example a saw blade; and the provision of a bearing in the tube mounting the shaft for endwise reciprocation.

These and other objects and advantages of the invention, as well as the details of an illustrative embodiment, will become clear from the following detailed description of the specification and drawings, in which:

DRAWING DESCRIPTION

FIG. 1 is an elevation, taken in section, showing one preferred form of tool incorporating the invention;

FIG. 2 is a top plan view of the FIG. 1 tool, taken in section; and

FIG. 3 is a fragmentary showing of a surgical saw connected to the tool to be driven thereby.

DESCRIPTION OF PREFERRED EMBODIMENT

In the drawings, the tool 10 is shown, to include an electrical drive, as for example includes motor 11 received within an enclosing housing 12 which is cylindrical and completely encloses the motor. One end 13 of the motor shoulders against annular stop 14 within the housing. The opposite end 15 of the motor engages a tubular spacer or sleeve 16 threaded to the housing at 17. The end of the sleeve is enlarged or flanged at 18 to form a housing cap. The opposite end of the cylindrical

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housing is closed by a cap 19 thread connected to the bore of the housing, at 20. Wrench openings in the caps appear at 21 and 22.

The drive also may advantageously include a rotor 23 rotatable by the motor shaft 24 to which it is coupled. A crank 25 is eccentrically and pivotally connected at 26 to the rotor and at 27 to one end of a shaft 28, so that, when the motor armature rotates about axis 29, the rotor will cause the crank to reciprocate the shaft with powerful short strokes, i.e., less than 0.25 inch for example. The rotor 23 may include a counterweight 30 as shown, to reduce vibration to a minimum, the counterweight being axially offset from the crank, and closer to the motor than crank. All of these elements are totally enclosed, facilitating external sterilization of the instrument, with ease and completeness.

The external support, which includes housing 12, also may be considered to include a tube 32 connected to the housing to project radially relative to axis 29, and so as to receive the shaft 28, with the tip 28a thereof projecting from the tube. Means, such as attachment openings 33, is provided on the tip to support a surgical instrument to be rapidly reciprocated by the shaft. One such instrument comprises a surgical saw 34 seen in FIG. 3; other reciprocable instruments such as impacters, etc., may be substituted, by means of attachment to the tip via fasteners 35 receivable through the openings 33. Guidance or centering of the shaft for endwise reciprocation is facilitated by sleeve bearing 36 fitting within the tube and receiving the shaft, and also bearing 36a at tube end 32a.

A flexible barrier, such as bellows 37 is connected across the clearance between the shaft and tube at a location to block passage of bacteria from the tube interior to the surgical implement. In the example, the annular bellows (which may consist of rubber) is connected between the tip 28a and the end of the tube, to completely close off that clearance 38. As a result, the tube, bellows, tip and implement may be externally sterilized very easily, such sterilization being maintainable due to complete isolation of the exterior surfaces from the interior of the tool. In fact, the entire tool may be so sterilized due to complete enclosure and isolation of the drive.

I claim:

1. A surgical tool, comprising

a. an electrical drive,

b. a shaft connected to the drive to be rapidly reciprocated endwise with short strokes in response to drive operation,

c. a tube within which the shaft extends so that the shaft tip projects from the tube,

d. fastener means on the tip supporting a surgical implement to be rapidly reciprocated by the shaft,

e. said drive including an electric motor having an axis, a counterweighted rotor rotated by the motor and a crank pivotally connecting the rotor to the shaft, the endwise direction of shaft reciprocation being at a substantial angle to the motor axis, and there being a casing housing the motor and drive,

f. a flexible barrier sealingly connected across the clearance between the shaft and the tube at a location remote from the casing to block passage of bacteria from the tube interior to said implement, said barrier comprising a flexible annular bellows connected between said tip and the end portion of the tube, and

g. the casing being cylindrical and supporting the tube to extend generally at right angles to said axis, there being a bearing in the tube mounting the shaft for linear endwise reciprocation, and the crank connections to the rotor and shaft being offset from the motor axis and characterized in that the shaft stroke is less than about 0.25 inch, the tube rigidly attached to the casing and the shaft projecting into the casing interior, and the tube length externally of the casing being substantially greater than the diameter of the cylindrical casing.

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