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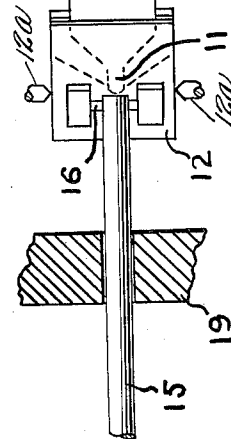
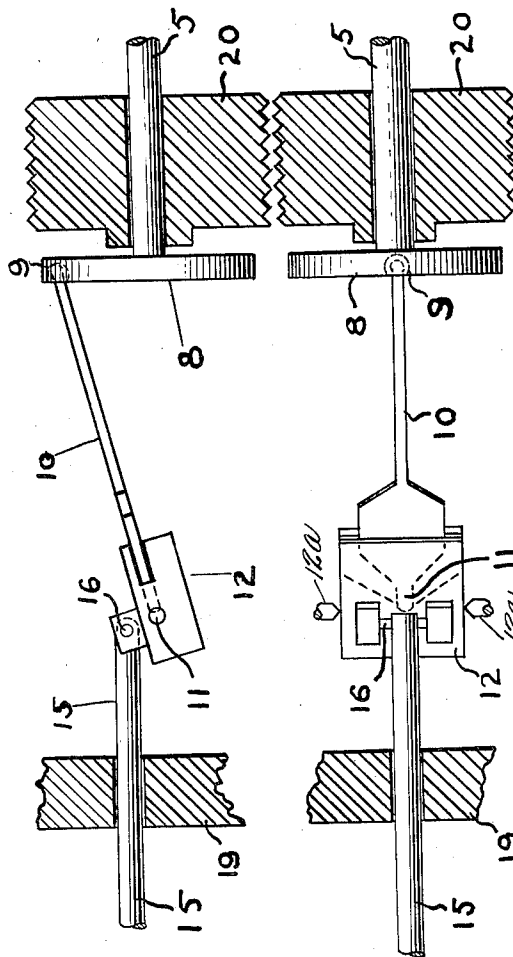
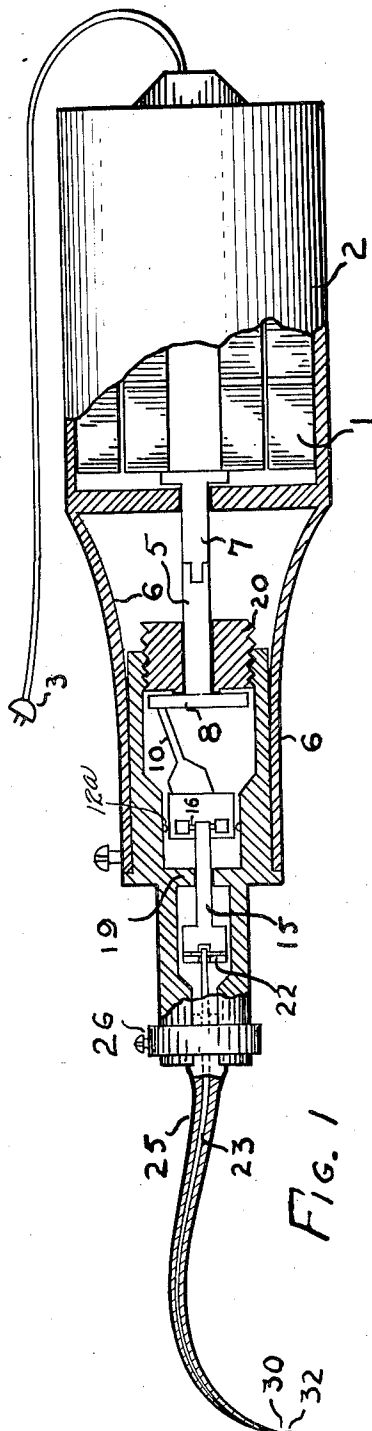
V. LEGGIADRO

2,070,281

SURGICAL KNIFE

Filed July 12, 1935

2 Sheets-Sheet 1



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FIG. 4.

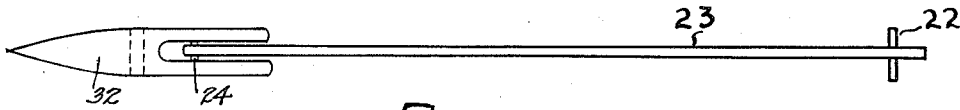
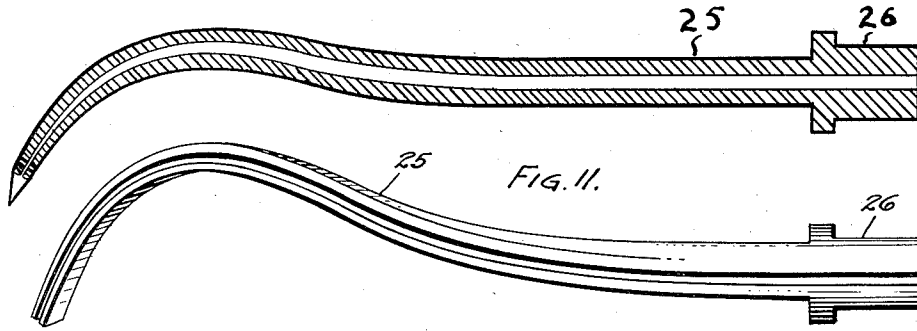
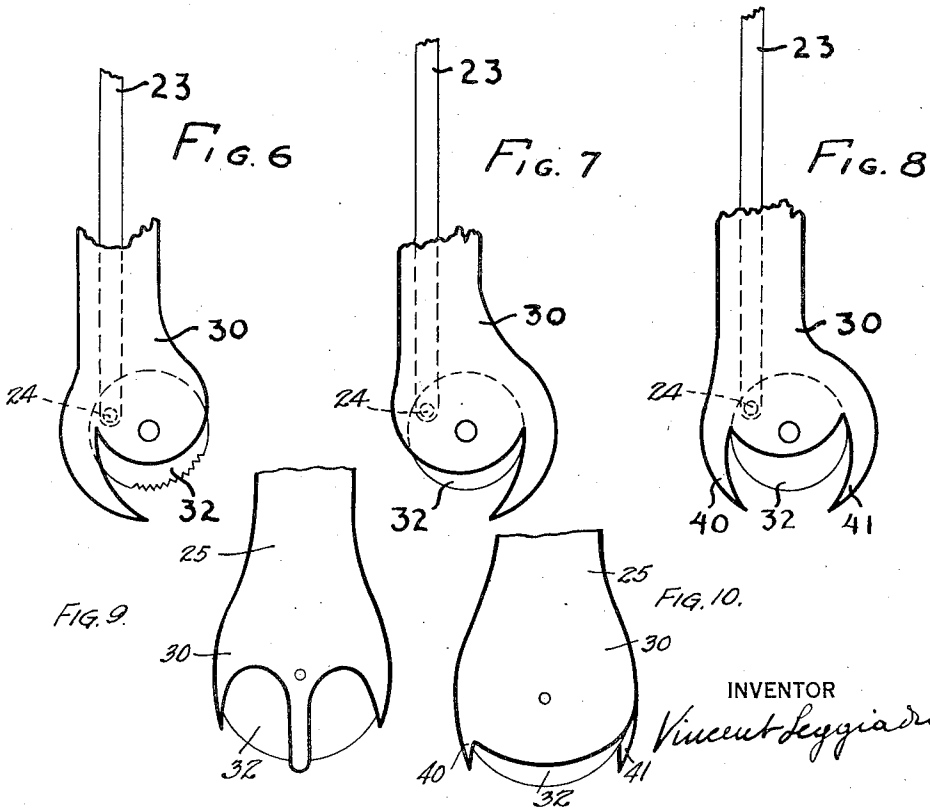


FIG. 5



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SURGICAL KNIFE

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9 Claims. (Cl. 128—305)

The present invention relates to surgical knives and more particularly to a mechanical knife adapted to cut cartilage and other bone matter.

surgical knife which is inexpensive to manufacture, and simple in construction and design.

Other objects and advantages of the present invention will become apparent from the following description and from the accompanying 5 drawings, in which:

Fig. 1 is an assembly view partly in section of an embodiment of my invention;

Fig. 2 is an enlarged fragmentary elevational view of a section of the view in Fig. 1;

Fig. 3 is a plan view of the section in Fig. 2;

Fig. 4 is an enlarged section view of a rod sleeve;

Fig. 5 shows top plan view of my knife blade and actuating rod;

Figs. 6, 7, 8, 9 and 10 illustrate fragmentary elevational views of modifications of my knife blade and blade guide; and

Fig. 11 is a perspective view of a modification of a rod sleeve.

Referring more particularly to the drawings, reference character 1 represents a source of mechanical energy. In the specific embodiment of the drawings, an electrical motor has been shown. The motor 1 is encased in a housing 2 which is preferably air and water tight so that the entire instrument may be immersed in boiling water under pressure for sterilization purposes. It is desirable to construct my instrument of a non-rusting or non-corroding substance such as a stainless steel, non-ferrous alloy, plastic or the like. A plug 3 completes the electrical circuit which may be provided with a conventional foot or hand operated switch.

In order to convert the rotary motion of the motor to a reciprocating motion of short stroke and a large force, I have provided a lever system or linkage which is shown in more detail in Figs. 2 and 3. The shaft 5 located in a housing 6 mates with the motor shaft 7 so that it may be dismantled and assembled easily. At the end of said shaft 7 is a radius rod or crank wheel 8 which coacts with the connecting rod 10 by means of a ball and socket joint 9. A bell crank lever 12 is mounted to the housing 6, between pivot points 12a. Said connecting rod is pivoted at point 11 in the oscillating bell crank lever 12 so that it may oscillate freely as the crank wheel 8 is rotated. The rotary motion of the electric motor is transmitted through the oscillating connecting rod 10 and the bell crank lever to the connecting arm 15. As shown from the drawings, the said connecting arm may be fastened to the bell crank lever by means of pin 16, or other suitable means. It is advisable to allow a bit of play 55

5 In the use of conventional knives, used in surgical operations on the cartilage of the knee joint and other portions of the body, many disadvantages were experienced. Prior knives were generally of the ordinary hand type, having various shapes, some being provided with hooks or snares for the removal of cartilage from the knee joint. With these instruments, the operation was performed with great difficulty, taking considerable time, and rarely was the operation completely successful in the removal of the entire cartilage. In most operations only the anterior or posterior portion was removed, according to what was clinically thought injured. However, various incisions have been attempted as, for example, anterior, lateral or a combination of both, but these did not facilitate the operation. In view of the fact that the space in which the cartilage is located is very narrow and in the form of a half circle, it is impossible to reach the posterior portion hidden behind the internal condyle with a straight knife. In the use of conventional knives, the time to perform this operation was from thirty (30) minutes to one hour, and the cartilage was not removed without traumatizing the surrounding tissue. If the cartilage broke during the operation due to the hard pulling, it was impossible to remove the remaining half because the holding tenaculum occupied the entire field. Other serious shortcomings and disadvantages of the prior art existed which, as far as I am aware, have not been successfully avoided or eliminated.

It is an object of the present invention to provide a surgical knife capable of cutting and removing cartilage or other bone matter in a clean unserrated manner without leaving torn or jagged fragments.

It is another object to provide a mechanical surgical knife which has small and narrow cutting edge which will fit into ordinarily inaccessible places and which does not hide the operator's vision, nor produce a large opening.

It is a further object of my invention to provide a surgical knife which will perform the operation of the complete removal of the cartilage of the knee joint or other operations in a very short time, with little effort and with great accuracy.

It is also contemplated to provide a mechanical

or sliding movement at said pin to provide for the lateral movement of said connecting arm. Bearings or slides 19 and 20 have been provided in the housing 6 to guide the moving arms and to seal the motor from sterilization water.

At the end of connecting arm 15 is a locking means 22 in the form of a bayonet joint, screw thread, hook or other suitable means adapted to receive and lock in a speedy, simple manner any one of a set of reciprocating rods 23. It is desirable to form said reciprocating rod from a flexible spring steel alloy, or from a non-ferrous flexible alloy. Mating with the end of the housing 6 is a rod sleeve or finger 25 which is fastened in place by a simple lock nut 26, a wing screw, gum lock, or the like, so that it may readily be replaced.

The sleeve 25, preferably of metal such as aluminum alloy, is hollow as shown in the section view of Fig. 4, but it also may be slotted as illustrated in Fig. 11. For the purpose of reaching ordinarily inaccessible portions of matter to be cut, it may be curved in any direction and in any amount. At the end of the rod sleeve is a blade guide 30 which may be of various shapes and forms adapted to particular operations. Pivoted on or within the said guide is a thin knife blade 32 which is oscillated by the reciprocating rod 23. The blade may be connected to the reciprocating flexible rod by an eccentric pin 24, or other suitable means. In Fig. 5, the blade is shown to be provided with a slot into which the rod is received. As the motor is revolving at a high rate of speed, say about 4000 revolutions per minute, the knife blade is oscillated at the same speed about its pivot point for approximately a quarter of a revolution. It will be noted that at this high speed the knife blade travel is correspondingly high and is capable of cutting tissues and/or cartilage without much pressure or pushing on the blade. In this manner the material to be cut is truly cut and not torn so as to leave ragged edges.

A great advantage of my instrument having a reciprocating blade is the fact that I may assemble my knife blade in a very narrow space. The entire cutting portion, including the actuating rod, may be encompassed in a space no wider than the knife blade itself. Even the guide itself may be made so as to occupy but negligibly more space than the blade.

By means of a very narrow knife blade, I may perform delicate operations heretofore impossible with conventional knives. In addition, the narrow blade does not hide from the operator's view the subject matter to be cut. Likewise, only a small opening is necessary to perform the operation.

With regard to the curvatures of the rod guide 25, I have found that about a 45° curvature to the left is useful when holding the instrument in the right hand and removing the external cartilage of the right knee or internal cartilage of the left knee. When holding the instrument in the left hand and removing the internal cartilage of the right knee or the external cartilage of the left knee, a similar curvature to the right has been found practicable.

In using these particular curvatures as specified, it is preferable to provide a blade guide 30 at the under side of the blade, leaving the anterior and upper portion of the blade free for cutting purposes, as shown in Figs. 6 or 7.

For use as a universal blade capable of removing the four cartilages of the knees, I have pro-

vided two small guides 40 and 41, as illustrated in Fig. 8, one on top and one on the bottom, leaving only the anterior portion of the blade free for cutting. The operator may hold this instrument in either hand, if necessary, and cut in any direction, at all times keeping a guide at the bottom. The two points of these guides protrude slightly beyond the blade, as little as a thousandth of an inch being sufficient. The purpose of these points is to steady or immobilize the tissue that is to be severed. These protruding points may be applied in different directions as sketched and can be one or several.

In Figs. 9 and 10 special designs of guides are depicted which are adapted for various operations as those skilled in the art would readily understand. Of course, other suitable forms and curvatures may also be substituted. For example, this instrument may be made to cover different curvatures or shapes of abnormal knees and small joints as in children. The curve may be a solid one, or a flexible curve, as by incorporating a segmented or bendable sleeve.

The knife blade likewise may be made of varying sizes or shapes. The cutting edge may protrude upwardly, downwardly, and/or anteriorly. Likewise, fine saw teeth may be provided, as shown in Fig. 6.

Although the present invention has been illustrated and described in connection with specific embodiments thereof, it is to be observed that modifications and variations may be resorted to without departing from the scope and spirit of the present invention. Instead of using a hammer and chisel, my device may be used for cutting bones or superficial bone, for trimming of infected bone cavities, and for cutting stone in bladder. Avoidance of hammering in surgery, especially on the skull, as in operation of mastoids or in surgery of the lower limbs, will lower mortality due to embolism. In place of an oscillating knife blade, a sliding reciprocating blade may be provided.

I claim:

1. A surgical knife which comprises a mover capable of producing a reciprocating motion, a housing therefor, a thin flexible rod connected to and actuated by said mover, a narrow sleeve mounted at one end to said housing and having a recess therein for said flexible rod, and a small knife blade pivoted to the free end of said sleeve and actuated by said flexible rod to reciprocate the cutting edge of said knife blade in a direction substantially transverse to the longitudinal direction of said finger.

2. A surgical knife which comprises a mover capable of producing a reciprocating motion, a housing therefor, a thin flexible rod connected to and actuated by said mover, a narrow sleeve mounted at one end to said housing and having a recess therein for said flexible rod, a small knife blade pivoted to the free end of said sleeve and actuated by said flexible rod to reciprocate the cutting edge of said knife blade in a direction substantially transverse to the longitudinal direction of said finger, and a thin guard secured to said sleeve, said guard juxtaposed to and covering a portion of the edge of said blade.

3. A surgical knife for cutting and removing cartilage or the like, which comprises a mover capable of producing a reciprocating motion; a housing therefor, a thin flexible rod connected to and actuated by said mover, a narrow sleeve mounted at one end to said housing and having a recess therein for said flexible rod, a small knife

blade pivoted to the free end of said sleeve and actuated by said flexible rod, and a thin guard secured to said sleeve, said guard juxtaposed to and covering a portion of the edge of said blade, the said sleeve being slim and elongated and curved to permit said blade to reach into and cut accurately in small spaces.

4. A surgical knife which comprises a motor capable of producing a circular motion, means for translating said motion to a reciprocating motion, a housing for said motor, a thin flexible rod connected to and actuated by said translating means, a narrow sleeve mounted at one end to said housing and having a recess therein for said flexible rod, and a small knife blade pivoted to the free end of said sleeve and actuated by said flexible rod to reciprocate the cutting edge of said knife blade in a direction substantially transverse to the longitudinal direction of said finger.

5. A surgical knife which comprises a motor capable of producing a circular motion, means for translating said motion to a reciprocating motion, a housing for said motor, a thin flexible rod connected to and actuated by said translating means, a narrow sleeve mounted at one end to said housing and having a recess therein for said flexible rod, and a small knife blade pivoted to the free end of said sleeve and actuated by said flexible rod, said translating means including a rotating radius rod actuated by said motor, an oscillating bell crank lever pivoted to said housing, a connecting rod pivoted to said lever and connected to said radius rod by a ball and socket joint, said lever being secured to and reciprocating said flexible rod.

6. A surgical knife which comprises a thin elongated finger having a longitudinal groove therein, a flexible rod passing through said groove, a small knife blade pivoted at one end of said finger and arranged substantially parallel to said finger at said end, a guard attached to said finger, the guard being juxtaposed to and extending beyond a portion of said blade, and electrical means for reciprocating said rod, the said rod adapted to oscillate said blade in a direction transverse to

the longitudinal direction of said finger and cause said blade to cut matter in line with and adjacent to said finger.

7. A surgical knife which comprises a thin elongated finger having a longitudinal groove therein, a flexible rod passing through said groove, a small knife blade pivoted at one end of said finger and arranged substantially parallel to said finger at said end, a guard attached to said finger, the guard being juxtaposed to said blade, electrical means for reciprocating said rod, the said rod adapted to oscillate said blade in a direction transverse to the longitudinal direction of said finger and cause said blade to cut matter in line with and adjacent to said finger, and extensions on said guard projecting beyond the lateral edges of said blade, whereby only the end of said blade opposite said finger is exposed.

8. A surgical knife which comprises a thin elongated finger having a longitudinal groove therein, a flexible rod passing through said groove, a small knife blade pivoted at one end of said finger at said end, a guard attached to said finger, the guard being juxtaposed to said blade, electrical means for reciprocating said rod, the said rod adapted to oscillate said blade, and an extension to said guard extending outwardly beyond the edge of said blade in a lateral direction.

9. A surgical knife particularly adapted to cut cartilage and similar matter, said knife comprising a thin elongated and curved finger having a longitudinal recess therein, a rod passing through said recess, a small knife blade mounted at one end of said finger and actuated by said rod, a guard attached to said finger juxtaposed to a lateral edge of said blade, said blade having a cutting edge exposed at its end opposite said finger, means for reciprocating said rod from the end opposite said blade and causing said cutting edge to reciprocate in a direction transverse to the longitudinal direction of said finger and thereby cut matter lying adjacent to and in line with said finger, said guard adapted to steady said matter during the cutting action.

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