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DEVICES FOR SURGICAL

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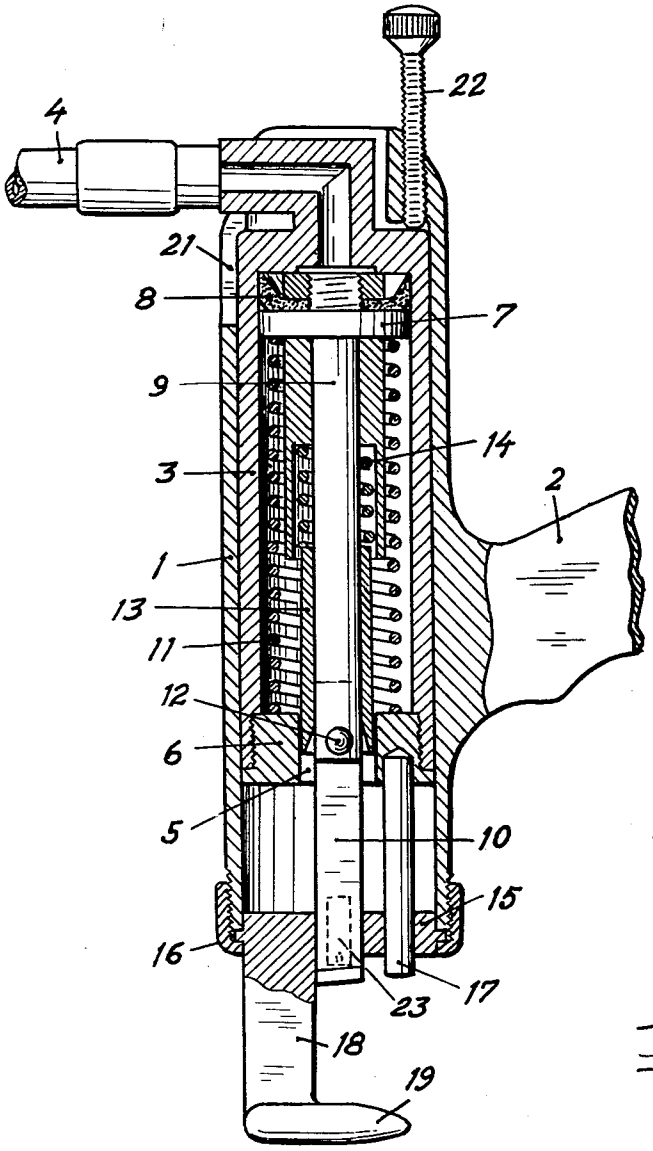


FIG. 1

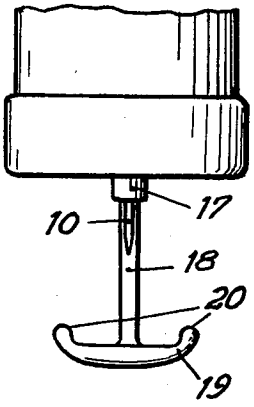


FIG. 2

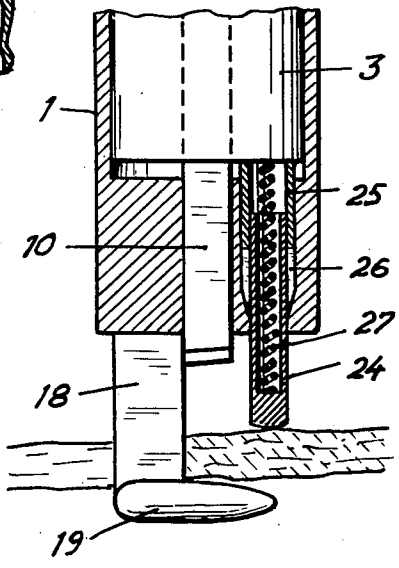


FIG. 3

Inventors:
Gustaf Erik Björklund
Svante Roland Edvardsson
By James Wheeler
Their Attorney

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DEVICES FOR SURGICAL WORK

Gustaf Erik Björklund, Stockholm, and Svante Roland Edvardsson, Solna, Sweden, assignors to Aktiebolaget Dentatus, Hagersten, Sweden, a corporation of Sweden

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7 Claims. (Cl. 30—272)

Tools and apparatuses used in surgical work should be easy to sterilize and should preferably function noiselessly. These conditions are difficult to fulfill as regards electrically driven hand tools, whether they are driven directly or by a flexible shaft.

The present invention has reference to a device for such surgical work in which a movement to and fro of the working tool is desired and which presents palpable advantages in the above respects. According to the invention the device consists of a hand tool containing a hydraulic pressure operated working member being arranged to move to and fro and carrying a working tool e. g. cutter, saw, chisel or the like, and of a source of pressure impulses connected with the hand tool through a pressure conduit transmitting the pressure impulses to the working member.

The device according to the invention is particularly suited for cutting plaster bandages or casts. Hitherto, in some cases ordinary scissors adapted to cut plaster and operated by hand, and in other cases machine operated saws of different construction have been used for this purpose. The scissors require application of strong force by the hand of the user, and therefore they are very burdensome to the doctor or the nurse, while the machine driven saws usually are heavy to handle, are easily damaged, tend to get stuck in the plaster bandage and cause heating and dust formation. All these disadvantages are avoided by using a plaster cutting apparatus according to the invention. By this apparatus, plaster bandages, hard as well as soft i. e. bandages not quite dry, and of varying thickness may be cut rapidly and easily, without the patient being hurt or given discomfort in any other way.

The invention will be made more clear in the following description with reference to the accompanying drawing in which:

Fig. 1 shows in longitudinal section a hand tool constructed as a plaster cutting apparatus and intended for a device according to the invention,

Fig. 2 shows the lower part of the hand tool seen from a direction at right angles to the sectional view of Fig. 1, and

Fig. 3 shows an alternative embodiment of the hand tool according to Fig. 1.

The hand tool shown in the drawing has a casing **1** provided with a cylindrical bore, a portion of said casing being shaped as a handle **2**, only partly shown in Fig. 1. A cylinder **3** travels in the bore and to the upper part of the cylinder a conduit **4** for pressure fluid is attached which connects the hand tool with a source of such fluid, not shown. At its lower end the cylinder is closed by a base **6** provided with a central opening **5**. In the cylinder a piston **7** which is sealed against the inner surface of the cylinder by means of a sealing ring **8** is connected to a piston rod **9** running through the opening **5** of the base **6**, a cutter **10** being secured to the lower end of the piston rod. In the cylinder betwen the piston and the base **6** a coil spring **11** is arranged which tends to push the piston to the upper end of the cylinder.

In order to make the cutter readily changeable, its upper portion is inserted in a slot made in the lower portion of the piston rod, and it is provided with a hole with which two balls **12**, arranged in a transverse bore of the piston rod, engage. The balls are arranged one on each side of the cutter and are pressed against this by a sleeve **13**, the lower portion of which is tapered, said sleeve being displaceably arranged on the piston rod and pressed downwardly by a coil spring **14**.

At the bottom, the cylindrical bore of the casing is closed by a closure **15** which is secured by means of a threaded cap **16** and is provided with a central opening through which the cutter **10** is guided. The closure **15** has an additional opening through which an upper supporting or clamping tool in the form of a pin **17**, attached to the base **6**, projects. On the under side of the closure a lower clamping tool **18** is also arranged which is provided with a part **19** projecting beneath the cutter, said part being shaped with ridges or shoulders **20** on its upper side and on both sides of the path of travel of the cutter i. e. the center line of the hand tool.

In the upper end the casing of the hand tool is provided with an opening **21** through which the connection of the pressure conduit is passed, the opening having such dimensions that it admits the movements of the cylinder in the cylindrical boring of the casing. In the casing an adjusting screw **22** is also arranged by means of which the upward movement of the cylinder is limited.

The source of fluid may consist of any suitable pumping device by means of which a pressure fluid, oil under pressure by way of example, may be supplied to the cylinder **3** of the hand tool. The pumping device may be made electric motor driven and may either be in the form of a plain reciprocating piston or with a high pressure oil pump from which pressure fluid is supplied to the hand tool regulated by a valve arrangement governed by the pressure. However, the apparatus for supplying pressure fluid is suitably provided with a hand- or foot-actuated piston that travels in a cylinder connected with the pressure conduit. Thus, this cylinder together with the pressure conduit and the cylinder of the hand tool forms an outwardly closed system which is filled with a liquid power transmission medium, for instance oil.

As the piston of the apparatus for supplying pressure fluid is pushed inwards, oil is forced into the cylinder of the hand tool, so that the piston **7** is forced downwardly and the cutter **10** is pressed into the plaster bandage lying between the cutter and the part **19** of the lower clamping tool. On account of the shoulders **20** the plaster bandage is subjected, in addition to the cutting effect of the cutter, to a simultaneous bending load. The plaster bandage breaks on account of the bending stress, by the binding between the plaster mass and the sheathing giving way. The force on the cutter necessary to cut the plaster bandage will then be considerably less than it should have been in case of plane support of the bandage. During the downward movement of the piston the cylinder **3** is pressed against the upper end of the cylindrical bore of the casing or against the adjusting screw **22**, possibly screwed down, because of the reaction force resulting from the application of pressure fluid to the piston.

The cutter having penetrated the plaster bandage, a comparatively great force is necessary to withdraw it from the bandage. As the oil pressure in the cylinder ceases or decreases, the cylinder **3** is therefore forced downwardly entirely or partially through the action of the spring **11**, while the upper clamping tool **17** is moved to rest against the bandage, and the cutter is loosened and is withdrawn. Then, the piston returns to its original position in the upper end of the cylinder. Through the pressure of the upper clamping tool on the bandage, the lower clamping tool **18**, **19** is prevented from being pressed against the part of the body disposed within the plaster bandage.

During the continued cutting operation the hand tool is pushed in the cutting direction and is thus advanced automatically a length equal to the with of the cutter on every piston stroke.

When the cutter **10** is to be changed, a screw **23** is screwed in, so that it will be located in the path of the sleeve **13**, as the latter accompanies the piston rod on its downward movement, after which the piston is forced to its lower position by means of the hydraulic actuation. Then, the sleeve hits the screw and is pushed upwardly relatively to the piston rod, thus compressing the spring **14**, whereby the balls **12** can be pushed somewhat aside out of engagement with the hole of the cutter. The cutter may then be pulled out and changed for a new one. As the piston moves upwardly again, the sleeve will be free to return to its original position, so that the balls are pushed into the hole of the new cutter by the conical surface of the sleeve. A push button operated stop, by way of example, may be substituted for the screw **23**.

In Fig. 3 which shows another embodiment of the upper clamping tool, the cylinder **3** is in its lowest position and is not shown in section. The clamping tool **24** is movable in longitudinal direction in a bore made in a sleeve **25**, movably supported by the casing **1**, and is not connected with the cylinder. The bore as well as the sleeve **25** have tapered lower portions, and the sleeve is slotted at the lower end by longitudinal slits **26**. The clamping tool is hollow, and in its cavity a coil spring **27** is arranged which rests against the cylinder **3** and presses the clamping tool downwardly against the bandage, so that it follows the upper surface of the bandage during the cutting operation.

As the cutter is pressed downwardly into the material, the cylinder **3** is forced to its upper end position, while the slotted sleeve **25** is expanded and leaves the clamping tool freely movable. After the cutter has been set fast in the material and is to be withdrawn, the cylinder **3** moves to its lowest position, as described above, and is then pressed against the top of the sleeve **25**, so that the lower slotted and tapered end of the sleeve is pressed against the tapered portion of the bore, whereby the clamping tool **24** is locked due to the compression of the sleeve. Afterwards, when the cutter is drawn upwardly, the plaster bandage is thus held in unchanged position in relation to the casing of the hand tool by the upper clamping tool **24**, and the lower clamping tool is prevented from being pressed downwardly against the part of the body lying beneath the bandage.

Obviously, the construction of the hand tool may be modified in many ways, without the bounds of the invention being exceeded. It is also evident from the foregoing description that the described plaster cutting apparatus is to be regarded as an example only, and that the invention is not limited to devices for cutting plaster bandages but may be applied also to other surgical and similar devices where a movement to and fro of the working tool is desired.

What we claim is:

1. A hand tool for surgical work comprising a casing having a bore, a cylinder movable axially in said bore, said cylinder including connecting means for connection of a pressure fluid conduit, a hydraulic pressure operated piston movable axially to and fro in said cylinder and carrying a working tool intended to penetrate into material worked upon as the piston moves in one direction, and an upper clamping tool actuated by said cylinder intended to hold the material as the working tool is withdrawn during the movement of the piston in the opposite direction.

2. A hand tool as defined in claim 1 in which the connecting means for the pressure fluid conduit is located at one end of the cylinder, said cylinder being closed at the other end, a piston rod connects the working tool with the piston, said piston rod being guided through a hole in said other end of the cylinder, and a spring is arranged in said cylinder between said piston and said other end of the cylinder.

3. A hand tool as defined in claim 1 in which the working tool consists of a cutter provided with an edge at its free end, and a lower clamping tool attached to the casing of the hand tool is provided with a part projecting beneath the cutter.

4. A hand tool as defined in claim 3 in which the projecting part of the lower clamping tool is provided with shoulders located on both sides of the path of travel of the cutter, whereby a body of material lying between said projecting part and said cutter and exposed to the cutting action of said cutter is simultaneously subjected to a bending stress.

5. A hand tool as defined in claim 1 in which the upper clamping tool is attached to the cylinder and carried through an opening in the casing of the hand tool.

6. A hand tool as defined in claim 1 in which the upper clamping tool is biased by a spring which keeps the tool pressed against the material worked upon, and the cylinder is arranged to actuate in one end position a locking arrangement for said upper clamping tool, so that the latter is locked in relation to the casing of the hand tool.

7. A hand tool as defined in claim 6 in which the locking arrangement consists of a slotted sleeve surrounding the upper clamping tool which sleeve is tapered at one end.

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