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2,436,538

ELECTROMAGNETIC SURGICAL PROBING INSTRUMENT

Filed July 14, 1944

Fig. 1

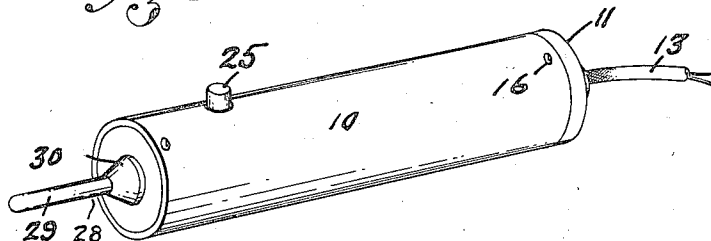


Fig. 2

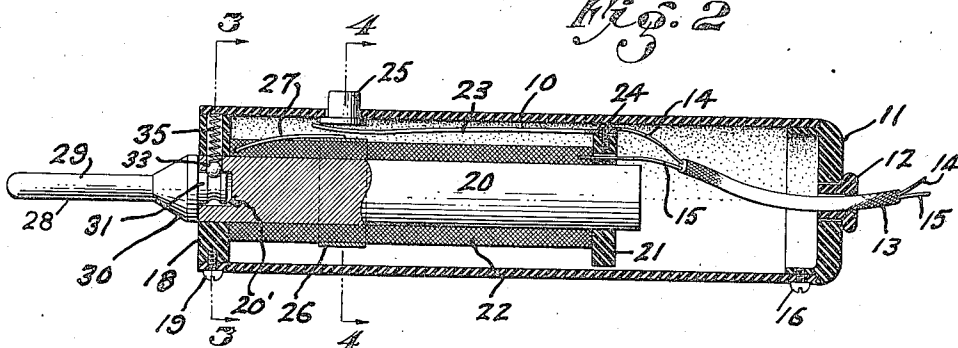


Fig. 3

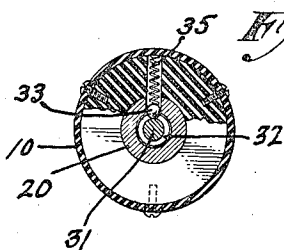


Fig. 4

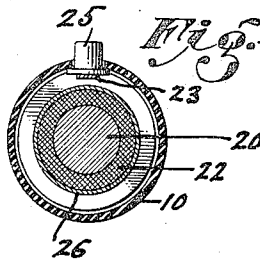


Fig. 5

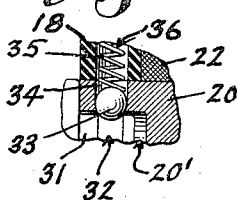


Fig. 6

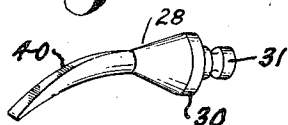
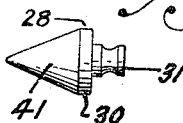


Fig. 7



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ELECTROMAGNETIC SURGICAL PROBING
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This invention relates to surgical instruments and particularly of the class which are used for extracting small particles of magnetically permeable metal from the body.

Surgical instruments of the class referred to have been used to some extent but ordinarily such instruments are large and clumsy and require both hands of the operator for holding the instrument during the manipulation of the instrument in locating and extracting small fragments of metal. This instrument, while it may be used for passing over the surface of the body for extracting metal fragments from the eye or other tissue in which the fragments may be visible, is particularly designed for the purpose of exploring cuts and wounds below the surface and the removal of fragments of metal therefrom.

It is one of the objects of this invention to provide a surgical instrument of the class described which may be readily manipulated by holding the same in one hand of the operator, leaving the other hand free for work in the wound, such instrument being constructed in such a manner that the energizing of the instrument may be readily controlled by the thumb or finger of the hand holding the instrument.

Another object of this invention is to provide an instrument of the character described which may be of simple form and construction, light weight, and which may be used on either alternating or direct current and which when used on alternating current has a tendency to vibrate the foreign matter which is to be removed, thereby loosening the foreign matter from the tissue in which the same is embedded.

Another object of the present invention is to provide an instrument of the character described of small size and compact form having substantial lifting properties as, for instance, about 8 ounces, and is particularly useful for removing particles of metal fragments which are so small that they cannot be removed with tweezers or other surgical instruments.

Another object of the present invention is to provide an instrument of the character described in which various forms of blades or heads may be quickly inserted and which blades or heads may be rotated into desirable position.

Other objects and advantages will appear hereinafter from the following description and the accompanying drawings.

In the drawings, which are for illustrative purposes only:

Fig. 1 is a perspective view of an instrument embodying a form of my invention;

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Fig. 2 is an enlarged longitudinal sectional view of the instrument shown in Fig. 1;

Fig. 3 is a cross sectional view on line 3-3, Fig. 2;

Fig. 4 is a cross sectional view on line 4-4, Fig. 2;

Fig. 5 is an enlarged fragmentary sectional view of the yieldable securing means for the head or blade;

Fig. 6 is an elevational perspective view of a modified form of blade or head; and

Fig. 7 is a side elevation of a further modified form of blade or head.

Referring more particularly to the drawings, 10 indicates a cylindrical casing or cover, preferably of insulating material, which is closed at the outer end by a plug indicated at 11, which plug is provided with a bushing indicated at 12 through which the cable 13 containing two lead wires indicated at 14 and 15 enter the instrument. The plug 11 is secured in the end of the casing or cover 10 by means of screws indicated at 16. The opposite end of the cover or casing 10 is closed by a disk 18 of insulating material secured therein by means of screws indicated at 19. The disk 18 is provided with a central aperture which receives one end of a core indicated at 20, such core being of soft iron as in the common forms of electro-magnets.

The other end of the core 20 extends into a disk of insulating material indicated at 21. Wound upon the core 20 is a coil of wire indicated at 22, there being a great number of convolutions of such wire about the core and one end of the coil being connected to one of the lead in wires indicated at 15. The other lead in wire indicated at 14 is secured on a flat metal leaf spring indicated at 23, both the end of the wire 14 and one end of the leaf spring being secured to the disk 21 by means of a screw indicated at 24.

The free end of this leaf spring 23 extends under a push button indicated at 25 which protrudes through an opening in the casing or cover 10 in a position to be operated by the thumb or finger of the hand of the operator which is holding the instrument. Upon depression of the button 25 the free end of the leaf spring 23 is pushed down into contact with the metal band 26 mounted on the coil 22, such band 26 being joined to the end wire 27 of the coil thereby closing the circuit and energizing the coil.

In Figs. 1 and 2 I have shown a blade or head indicated at 28. In this form of head the point of the head is shown as cylindrical as indicated

at 29 and it is provided with an enlarged flange indicated at 30. Extending from the flange 30 oppositely to the point 29 is a stud indicated at 31 which is received in a socket 20' in one end of the core 20. This stud is provided with a circular groove indicated at 32 which receives a ball 33 supported in a hole 34 formed in the end of the core 20. (See Fig. 5.) The inner end of the hole 34 is of less diameter than the ball 33 to retain the ball in the hole. The ball 33 is yieldingly held in the groove 32 by means of a coiled spring 35 mounted in a hole 36 in the disk 18 corresponding with the hole 34 in the core 20.

This manner of mounting the blade or head permits a ready change of various blades which can be used in the instrument and also during the manipulation of the instrument permits axial adjustment of the blade regardless of the position in which the instrument is held during the operation. It is apparent that if the magnet coil is energized while a blade is being inserted, the magnetized core will exert a solenoid action on the blade, thereby drawing it quickly and forcibly into its socket, and by forcibly holding the blade against an endwise disposed portion of the handle a frictional engagement will be had between the blade and the handle. This holds the blade firmly in adjusted position and against rotation as long as the coil remains energized, while upon de-energizing the coil the blade is free for easy rotative adjustment in either direction, or for easy withdrawal as required.

In Figs. 6 and 7, modified forms of blades or heads are shown. In the form shown in Fig. 6 the blade is curved downwardly as indicated at 40 and it is particularly when using such blade or head that it may be desirable to change the axial position of the blade. In the form shown in Fig. 7 the blade or head is merely conical in shape as indicated at 41. These forms of blades are merely illustrative of the various blades which may be provided and used.

It will be understood that in using the instrument the coil need not be energized and the blade of the instrument merely used for the purpose of probing the wound and that when the blade has reached the vicinity of the fragment the core is then energized by pushing the push button 25 which closes the circuit through the coil and the blade being also a magnetically permeable metal, though it may be covered with chromium or some other surface metal if desired, is energized and acting as a magnet withdraws the fragment from the tissue in which the fragment is embedded.

It will be understood that with a small compact instrument of the character described herein a very delicate probing of the wound may be continued over an extended period without fatigue of the operator such as that which occurs with the larger cumbersome instruments which have heretofore been used for such purpose.

While I have shown and described a particular form of my surgical instrument, it is to be understood that it is desired that such modification as may come within the scope of the appended claims is contemplated.

I claim as my invention:

1. A surgical instrument comprising: a hollow casing; a closure at each end of the casing; a soft magnetically permeable metal core in said casing; a normally open circuited coil of wire on said core within the casing; said core extending through the closure at one end of the casing and having a socket formed in such end; means

mounted on the casing for closing the circuit of the coil; a magnetically permeable blade seated against the socketed end of the core; the inner end of the blade extending into the socket in the core normally to be freely rotatable therein and having a groove formed in such inner end; a ball mounted in the casing and spring means yieldably holding said ball in said groove.

2. A surgical instrument comprising: a hollow casing; a plug in one end of the casing having an opening therethrough; a soft metal core mounted in said casing; a normally open circuited coil on said core; lead in wires extending through the opening in said plug; a leaf spring mounted in said casing having one of the lead in wires connected thereto; the other lead in wire being connected to one end of the coil; a push button mounted in said casing engageable with the other end of the coil to energize the coil; a disk closure at the other end of said casing from the plug, the disk having an opening therethrough to expose an end of the core; said core having a socket formed in the exposed end of the core; a magnetically permeable blade seated against the end of the core, a stud on said blade extending into the socket to have relatively full contact with the walls of the socket to be freely rotatable in the socket, the plug having a circumferential groove therein; and yieldable means mounted in the casing and engageable in the groove in the stud, releasably to retain the stud in the socket in rotatably adjustable position therein.

3. A hand-held surgical magnet having a handle member of a size and weight to be readily manipulated with one hand, said handle member comprising a magnetically permeable core and a normally unenergized coil wound thereon, means for energizing the coil, an insulating casing enclosing the electro-magnet to leave a core end exposed, the exposed end of the core having a cylindrical socket therein, a spring-pressed blade-retaining element mounted in the socket; and a blade member having a cylindrical plug portion of magnetically permeable metal of a size to fit snugly but rotatably within the socket, the plug portion having an annular circumferential recess adapted to receive the spring-pressed blade-retaining element, normally to retain the plug portion releasably in the socket, the plug portion being of a length to have endwise engagement with the magnet core, and a magnetically permeable integral blade extension projecting from the plug portion, the entire blade member being normally freely rotatable in and removable from the socketed handle portion, and being securely and relatively non-rotatably retained therein on energizing the coil.

4. A hand-held surgical magnet comprising a handle member of a size and weight to be readily manipulated with one hand, said handle member having a magnetically permeable core and a normally unenergized coil wound thereon, means for energizing the coil, an insulating casing enclosing the electro-magnet to leave a core end exposed, the exposed end of the core having a cylindrical socket therein; and a blade member having a cylindrical plug portion of magnetically permeable metal of a size to fit snugly but rotatably within the socket to have a portion thereof in endwise engagement with a handle element, releasable means normally retaining the plug rotatably in the socket, and a magnetically permeable integral blade extension projecting from the plug, the entire blade member being normally freely rotatable in and removable from the socketed

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handle portion, and being securely and relatively non-rotatably retained therein on energizing the coil.

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