

Aug. 1, 1950

L. KALOM
ELECTRICAL PROBE

2,516,882

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Fig. 1.

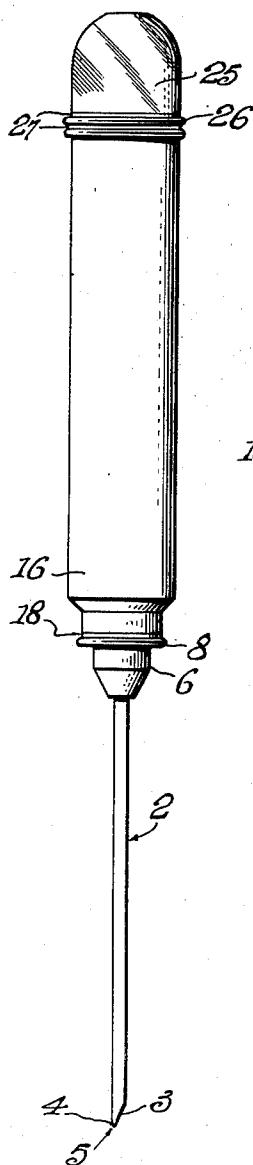


Fig. 2.

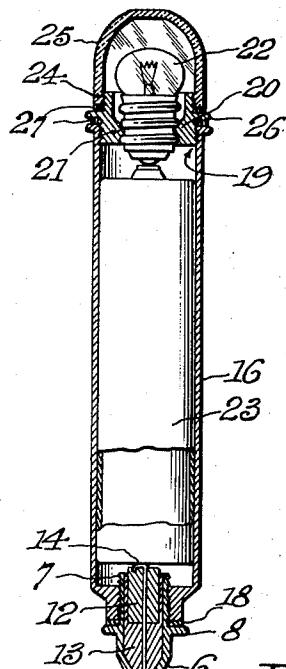


Fig. 3.

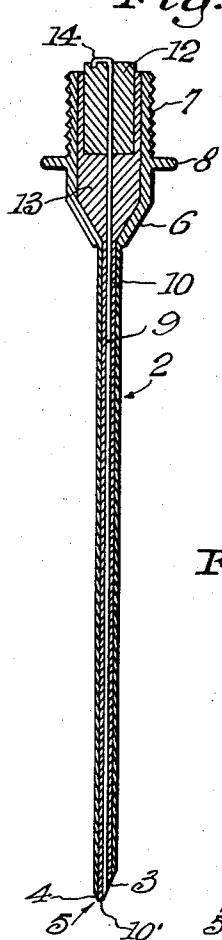


Fig. 4.

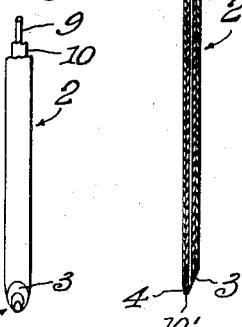
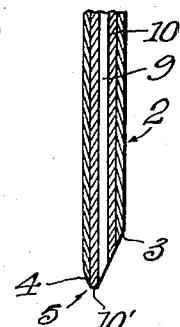


Fig. 5.



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UNITED STATES PATENT OFFICE

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ELECTRICAL PROBE

Lawrence Kalom, Chicago, Ill.

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2 Claims. (Cl. 128—2.1)

(Granted under the act of March 3, 1883, as
amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government, for governmental purposes, without payment to me of any royalty thereon.

This invention relates to surgical probes and more particularly to electric probes.

In surgery, it is well known that foreign metal objects such as bullets, fragments of shrapnel, pieces of hypodermic needles, etc., are difficult to locate; and continued probing frequently endangers the health, if not the life, of the patient.

Often the surgeon does not know whether he is striking the metal object or bone that may be adjacent to it, since they may both give the same feeling of resistance. This confuses the surgeon, and necessarily delays the operation. Another undesirable condition which frequently arises is a tendency on the part of the metal object to slide along the tissue planes, thus making necessary an unusually large incision.

It has hitherto been proposed to construct surgical probes of a pair of elongate electrically-conductive elements which are electrically insulated from each other and connected through an electrical circuit with a signal instrumentality such as a bell. So far as I am aware, these and similar prior art devices, which are known as "electric probes," have never been very successful. One reason for their failure is that they have made use of electrodes of such type as to provide an excessive diametral dimension with the result that as the penetrating portion of the probe progressed beyond the subcutaneous tissue in search of the metal object, it did not readily cut through the fascia, fatty tissue, fibrous tissue and muscle. This condition is aggravated in cases where the metal object has been within the body for a considerable period of time and has therefore become encapsulated in a thick, fibrous sheath.

Another reason for the failure of the prior art devices referred to is that the construction and arrangement of their electrodes is such that they must be contacted by the metal object at a precise angle before their function is complete.

It is among the objects of the present invention to provide an electric surgical probe with improved penetrating qualities, whereby probing is rendered less dangerous to the patient and less difficult for the surgeon.

Another object is the provision of an electric surgical probe whose electrodes are so constructed and arranged as to permit of their functioning over a relatively wide range of angles,

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thereby enabling the comparatively easy location of a foreign metal object.

Still another object is to provide a device of the class described which comprises a handle portion containing the signal instrumentality and the operating means therefor, whereby the said device becomes unitary, or entirely self-contained.

A further object is the provision of a device of the class described which lends itself to sterilization as a unit; and one which also permits of the ready removal of the probe per se for the purposes of replacement and/or separate sterilization.

15 A still further object is the attainment of the foregoing objectives by a device which is simple and inexpensive to manufacture and operate.

The invention, then, comprises the features hereafter fully described, and as particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail a certain illustrative embodiment of the invention, this being indicative of but one of a number of ways in which the principle of the invention may be employed.

In the drawing:

Figure 1 is a side elevational view of the complete device of the present invention;

30 Figure 2 is a view generally similar to that of Figure 1 but showing most of the elements in section, certain other elements being shown in elevation;

Figure 3 is an enlarged longitudinal sectional view of the penetrating instrumentality or probe per se;

35 Figure 4 is an enlarged fragmentary elevation of the lower portion of the showing of Figure 1, taken at right angles with respect to the latter; and

Figure 5 is a longitudinal sectional view showing fragmentarily, and in enlarged detail, the lower portion of the instrumentality of Figure 3.

The device described below is an improvement on my patent which was granted for an Electrical Probe. This Patent No. 2,437,697 was granted March 16, 1948.

The instant device differs from the patent in that the construction shown herein is much simpler than that shown in the patent particularly with respect to the manner of arrangement for the contact with the battery of the inner electrode.

Referring more particularly to the drawing, the numeral 2 generally designates the penetrating instrumentality, or probe per se, of the device of

the present invention. More specifically, this element comprises a small cylindrical tube which is composed of a hard electrically-conductive substance such as iridio-platinum, hardened silver, steel, etc. This tube 2 corresponds in size and shape with a conventional hypodermic needle; that is, its external diameter may be in the magnitude of approximately 15 mils, with walls approximately 3 mils in thickness and, accordingly, a bore which is approximately 9 mils in diameter. One end of the tube 2 is beveled, as at 3, in the manner of conventional hypodermic needles, thereby providing a sharp cutting extremity. In addition to the bevel 3, the invention comprehends the provision of a corresponding oppositely-disposed bevel 4 which contributes to the sharpness of the cutting extremity, as shown at 5; and has an additional function which will be later described.

The opposite end of the tube 2 is provided with an enlarged tubular head 6 which is exteriorly screw-threaded as at 7 to permit of ready attachment to, and detachment from, a carrying and indicating instrumentality which will be described hereinafter. For assisting such attaching and detaching functions, there is provided a radial flange 8 the periphery of which may be knurled (not shown).

Concentrically disposed within the tube 2 is a round rod 9 which is coextensive therewith. The rod 9 is also composed of a hard electrically-conductive substance which may be of the type described in connection with the tube 2. However, it is to be understood that both of these elements may be formed of other and even respectively different substances; it being only essential that the same be electrically-conductive and comparatively hard.

For use within a tube 2 of the size specifically set forth hereinbefore, the rod 9 may be approximately 5 mils in diameter, the two elements being maintained in concentric and fixed relationship by an electrical insulating medium 10. This electrical insulating medium may be resinous in nature and applied in the form of one or more coatings; and for this purpose I have found "Formvar" to be satisfactory. This is the trademark of a polyvinyl formyl resin product of Shawinigan Products Corporation, New York, New York. This product belongs to a class of resins known as polyvinyl acetal resins which are prepared by effecting partial or complete hydrolysis of a polyvinyl acetate, followed by or simultaneously with reaction of the hydrolysis product with an aldehyde. Such compositions possess high dielectric strength, and are commercially obtainable in both plastic and strip form. The rod 9 is given a light coating of plastic "Formvar," which is permitted to dry, then a second and similar coating is applied and before the second coating dries the rod is inserted in the tube 2. For the insulating material specifically designated, I have found it efficacious to accomplish the drying of the second coating by subjecting the assembled elements (i. e., rod 9 and tube 2) to a temperature of approximately 175° F. for a period of approximately 10 minutes. In addition to insulating the rod 9 from the tube 2, the "Formvar" cements the said rod in question.

As previously mentioned, the rod 9 is coextensive with the tube 2, and the invention contemplates that these elements, and also the electrical insulating medium 10, be so formed as to provide flush surfaces at the oppositely beveled portions 3 and 4 of the tube. This may be accomplished

by simple grinding operations. The tube 2 may, as in the case of a conventional hypodermic needle, be provided with a preformed bevel 3 in which event it would only be necessary to correspondingly grind down the exposed portions of the rod 9 and insulating medium 10. Accordingly, then, only the opposite bevel 4 would require any substantial grinding down of the material of the tube 2; and such an operation may be reduced to a minimum by increasing the angle of the bevel 4 over that of the preformed bevel 3.

The preparation of the corresponding surfaces of the elements in the manner stated immediately hereinbefore provides what would be a common point formed by the tube 2 and rod 9 except for the minute thickness of insulating medium 10 which separates them. The coextension of the sharpened extremity of the rod 9 with the cutting extremity 5 of the tube 2 enables them to bridge a metal object disposed in end-on relationship; while the beveled and flush surfaces disposed inwardly thereof promote sensitivity in cases where the metal object is just outside the range of the relationship stated.

Concentrically disposed in the enlarged tubular head 6, and projecting slightly therefrom, is a preformed round plug 12 which is composed of any suitable electrical insulating medium. The plug 12 is maintained in position by an electrical insulating medium 13 which may correspond in substance to the insulating medium 10 and be introduced into the enlarged tubular head 6 while in plastic state and subsequently be permitted to harden. The inner end of the rod 9 extends through the plug 12 and is provided on the exterior thereof with a hooked end 14, the extremity of which is embedded in the outer face of the plug.

As described earlier herein, the present invention contemplates the carrying of the tube 2 and associated instrumentalities by a handle portion containing the signal instrumentality and the operating means therefor. Accordingly, there is provided a tubular metallic flash-light case 16 having a screw-threaded opening therein for receiving the exteriorly screw-threaded portion 7 of the enlarged tubular head 6 of the tube 2.

Between the end of the flash-light case 16 and the adjacent surface of the radial flange 8 of the enlarged tubular head 6 there is disposed a gasket 18 for providing a water-tight connection. The other end of the flash-light case 16 is interiorly screw-threaded, as at 19, to receive an exteriorly screw-threaded ferrule 20. This ferrule 20 is centrally bored and screw-threaded, as at 21, to receive the screw-threaded shank of the usual flash-light bulb 22.

Within the case 16 is a flash-light battery 23 which is in electrical relation at its opposite ends with the hooked-end 14 of the rod 9 and the metallic contact element of flash-light 22. The slight projection of the outer end of the plug 12 beyond the end of the enlarged tubular head 6 insures the spacing of the latter from the adjacent end of the battery 23, thereby eliminating possibility of short-circuiting at this point.

This application is a continuation-in-part of my previous application Serial No. 658,725, filed April 1, 1946, which application has matured into the aforesaid Patent No. 2,437,697 issued March 16, 1948. In this patent, the tubular portion of the probe contacts a slidably movable pin which is connected conductively to the battery by a spring, whereas in the present construction there is direct contact between the central electrode,

that is the rod 9, and the battery 23, there resulting herein a simplified construction as compared with the arrangement of parts shown and described in the said patent.

The ferrule 20 is also provided with an exteriorly screw-threaded portion 24, of reduced diameter, which enables the attachment thereto of an interiorly screw-threaded cap 25 of translucent material. Either the flash-light bulb 22 and/or the translucent cap 25 is so colored as to cast a light which is readily distinguishable in the bright, white light of a surgical operating room. Intermediate its ends the ferrule 20 is provided with a radial flange 26 between which and the adjacent ends of the flash-light case 16 and the cap 25 are gaskets 27 for providing water-tight connections.

In operation: Electric current flows from the battery 23 to the bulb 22; down the side of the flash-light case 16; and down the tube 2 to the sharpened extremity thereof. Current cannot get back to the base of the battery 23 to complete the circuit until the contact surfaces of the tube 2 and the rod 9 are bridged by an electrically conductive object; at which time the bulb 22 will be illuminated.

The end of the needle is beveled approximately at 45° to its longitudinal axis and terminates in a probing point 5 disposed off-center from the longitudinal axis, with a portion 10' of the insulation 10 being brought to a common point with the point 5. With this construction there is formed a highly sensitive point which will respond when striking a metallic foreign body in the tissues being probed at a substantially vertical angle. In operation, the operator rotates the instrument in opposite directions with his fingers, through about an eighth of a turn for increasing the sensitivity of the tip. In practice it is found that approximately .003 inch thickness of insulation is sufficient.

Other modes of applying the principles of the invention may be employed, changes being made as regards the details described, providing the features stated in any of the following claims, or the equivalent of such, be employed.

Having thus described my invention, what I claim as new and wish to secure by Letters Patent is:

1. A surgical probe comprising an interiorly insulated tubular handle portion adapted to

retain a source of electrical energy therein, a signal lamp operated by said source of energy and positioned at one end of said handle, a tubular tapered head fitted within the opposite end of said tubular handle, said head extending into a slender needle-shaped probe, tapered at its end to form an insertion point, an insulated central electrode contained within said probe, tapered at one extremity flush with the tapering of the probe, and at its opposite end extending within the enlarged tapered portion of the head, a plug of insulating material surrounding said extremity of the central electrode and a retaining body of insulating material partially surrounding said plug and a portion of said central electrode to retain them in desired position within the tapered head.

2. A surgical probe comprising an interiorly insulated tubular handle portion adapted to retain a source of electrical energy therein, a signal lamp operated by said source of energy and positioned at one end of said handle, a tubular tapered head fitted within the opposite end of said tubular handle, said head extending in a slender needle-shaped probe, tapered at its end to form an insertion point, an insulated central electrode contained within said probe, tapered at one extremity flush with the tapering of the probe, and at its opposite end extending within the enlarged tapered portion of the head, a plug of insulating material surrounding said extremity of the central electrode, the said electrode having a hook formed at its upper end which is bent into the upper surface of the plug, and a retaining body of insulating material partially surrounding said plug and a portion of said central electrode to retain them in desired position within the tapered head.

LAWRENCE KALOM.

REFERENCES CITED

The following references are of record in the file of this patent:

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Number	Name	Date
2,437,697	Kalom	Mar. 16, 1948

FOREIGN PATENTS

Number	Country	Date
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