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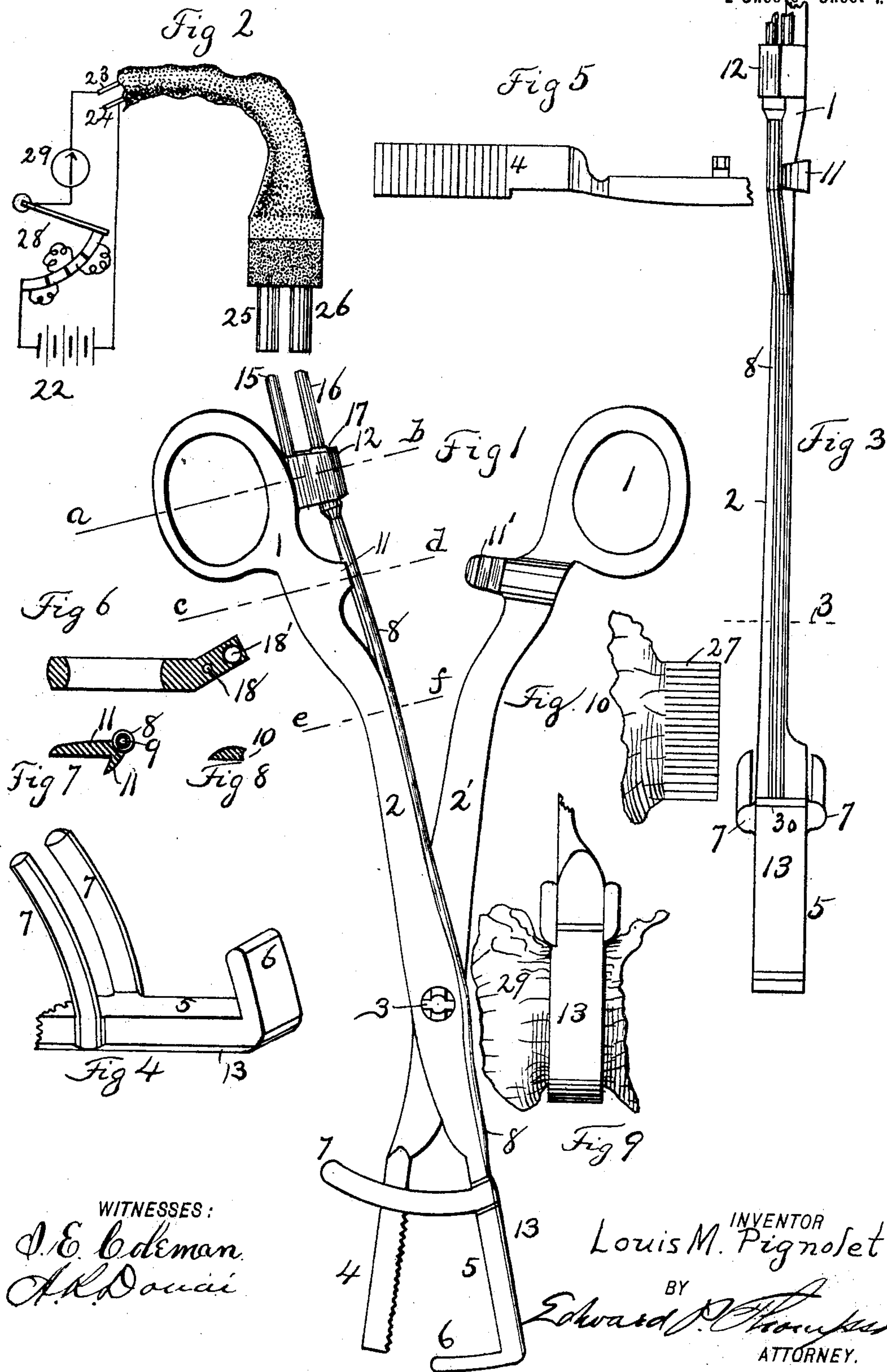
Patented June 17, 1902.

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SURGICAL FORCEPS.

(Application filed Aug. 8, 1898.)

(Model.)

2 Sheets—Sheet 1.



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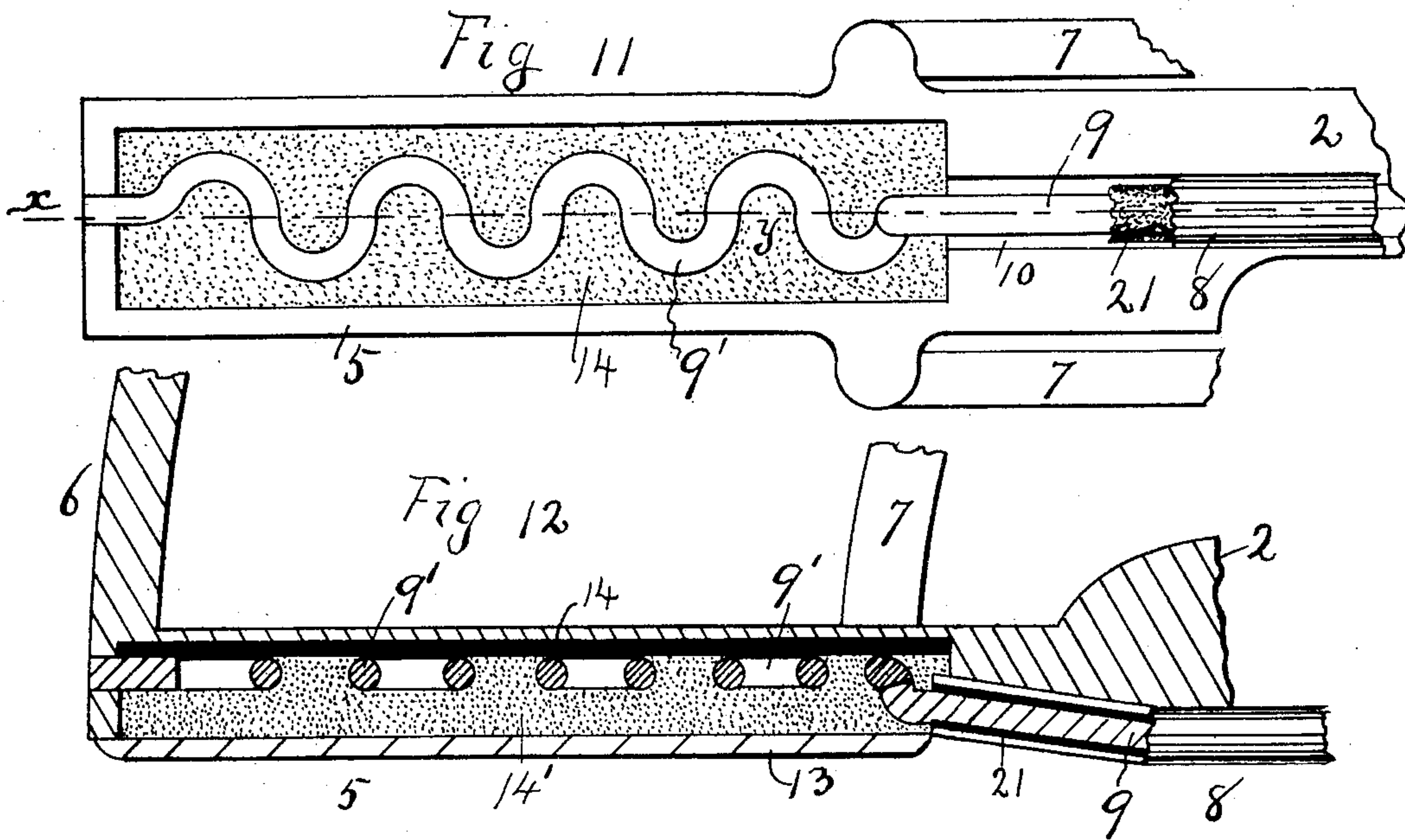
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UNITED STATES PATENT OFFICE.

LOUIS M. PIGNOLET, OF ORANGE, NEW JERSEY.

SURGICAL FORCEPS.

SPECIFICATION forming part of Letters Patent No. 702,472, dated June 17, 1902.

Application filed August 8, 1898. Serial No. 688,072. (Model.)

To all whom it may concern:

Be it known that I, LOUIS M. PIGNOLET, a citizen of the United States of America, and a resident of Orange, county of Essex, and State of New Jersey, have invented a new and useful Improvement in Surgical Forceps, of which the following is a specification.

The invention relates to the construction of a surgical instrument for removing tumors, for closing arteries, and for similar purposes where it becomes necessary to check the issue of blood. In the case of a tumor, for instance, the jaws of the forceps grasp the pedicle, one of the jaws is electrically heated, and the tissues and muscles become desiccated and the duct effectually sealed.

The invention embodies means for carrying out the conception of electrically heating the jaw or jaws instead of heating them by means of a soldering-iron, as heretofore sometimes practiced.

Referring to the drawings, Figure 1 is a front elevation of the complete instrument having its jaws partially open. Fig. 2 is a similar view of the socket for connecting the forceps to the source of electric energy. Fig. 3 is a side elevation of that shown in Fig. 1, except for a small portion at the upper end broken away. Fig. 4 is a perspective view of one of the jaws of the instrument by itself, this jaw being the one which contains the electric heating devices. Fig. 5 is plan of the other jaw, being that one which contains the corrugations or teeth. Fig. 6 is a cross-section of one of the handles at the line *a b* in Fig. 1 looking toward the top of the page. The insulator and conductors are omitted. Fig. 7 is a cross-section of one of the shanks at the line *c d*, including also the cross-section of the conductor and its conduit. Fig. 8 is a cross-section of the same element at the line *e f* in Fig. 1. The conductor is, however, omitted from the groove which is cut on the shank. Fig. 9 illustrates the instrument in use in the operation of desiccating the pedicle of the tumor, all but the jaws being omitted. Fig. 10 shows the desiccated and crumpled stump, from which the tumor has been cut off, the part represented in this figure that was shown in Fig. 9 being turned around. Fig. 11 shows the inside of the electrically-heated jaw, with the cover removed

and also the plaster insulator omitted. Fig. 12 is a longitudinal section of the jaw which is electrically equipped, the section being at line *x y* in Fig. 11. Fig. 13 is a view, partly in section, of the electric terminals of the instrument. Figs. 11, 12, and 13 are about three times the scale of the other figures, which are about full size.

The dotted portions should be considered as representing insulation, and the solid black as indicating the same material.

The forceps and adjuncts consist of the combination of the handles 1, having shanks 2 and 2', which are pivoted together at 3, a toothed jaw 4 on the shank 2', the teeth being but little larger than those on a coarse file, a jaw 5, having at its outer end the turned-up extension 6 at such an angle as to overlap the free end of the jaw 4 when the forceps are closed, and having the tines or prongs 7 located, respectively, on opposite edges of the jaw at or near the inner end of the jaw, and both the said extension 6 and extensions 7 being arcs about the pivot 3, an electric conduit 8, of metal, inclosing an electric insulated conductor 9, passing from the interior of the jaw 5, passing along a groove 10 in the shank 2, to which the conduit is soldered, being soldered also to the catch 11, which forms part of the shank 2, a metallic terminal block 12 obliquely attached to the handle 1 of the shank 2 and being at a sufficient angle to hold the conduit away from the table when the instrument is laid down, (for if not at an angle the conduit would soon wear through by repeated jams and knocks by throwing upon the table by the surgeon,) and other elements, mostly internal, as now to be set forth.

13 is a cover soldered to the back of the jaw 5, and the same is shown removed in Fig. 11.

14 is a sheet of mica, micanite, or similar plate of insulation placed in the bottom of the recessed jaw and fitting snugly therein for separating the resistance 9' from the metal of the jaw. One end of the resistance-conductor 9', which is of platinum, but may be of German silver or other material, of such size as to be heated by the current while the conductor 9 remains cool, is electrically connected to the free end of the jaw 5 conven-

iently by solder, so as to form a hermetical closure at the joint, while the other end is soldered to the conductor 9, so as to be a continuation of it. The heater-conductor 9' is zigzag, so that the maximum length may be inclosed in the rather small allotment of space in the jaw and is retained in position and at the same time effectively insulated from surrounding parts and its heat accumulated by the use of some plaster-of-paris, which upon hardening in the space between the conductor 9' and the cover 13 completely fills said space. Care should be taken at this end of the conductor 9', as well as at the other end, to make the exit of the same perfectly hermetical, so that the instrument may be sterilized without injuring the non-metallic materials of the device, and so, also, that the blood poison may not touch anything other than metal.

The terminal-block 12 has two holes, one of which, 18, is threaded to receive the electric terminal 15, which became one terminal of the heater-conductor 9' because both the terminal 15 and the conductor 9' are electrically connected to the metallic shank 2. The terminal 16 is held in an insulator-tube 17, which fits tightly the other hole 18' in the block 12. The constructor should remember to make this tubular insulator of some hard substance, like ivory, to withstand sterilizing, and the joint should be tight to prevent leakage for similar reasons. The conductor 9 in the tube 8 is soldered at its end tightly and hermetically in the end of the tubular terminal 16 at 19. Consequently no liquids nor steam can enter the tube 16.

20 is a shoulder upon the tube 16 to adjust the distance to which the tube 16 is thrust into the tube 17. The insulation 21 around the conductor 9 should preferably extend all the way from the tube 16 to the jaw 5—that is, throughout the length of the tube 8.

The operation will be explained in regard to its use on a tumor. An electric current is caused to flow from the battery 22 through the conductors 23 and 24, thence to the sockets 25 and 26, and thence when they are applied to the terminals 15 and 16 through the conductor 9, the conductor for heating 9', the shank 2, and the terminal 15, and consequently, the wire 9' becomes hot in about two or three minutes, and the flesh, tissue, and muscle, one or all firmly compressed between the two jaws, which are held together by the catch 11, and the teeth 11' on the shank 2', are bound together into a dry corrugated and sealed joint, which retains all blood and other liquids throughout its length, the material of the tissues being cut off to separate the tumor 27 along the edge of the jaws before the forceps are opened. The best results are obtained at a temperature of 180° or 190° Fahrenheit, which is sufficiently high to desiccate the tissues without charring them. When thoroughly desiccated, the tissues are

of a whitish color and are translucent. The operating surgeon or electrician should be moderately careful in regulating the current by means of the rheostat 28, through which the current passes. A few tests on raw meat will enable him to ascertain from the readings of the ampere-meter 29 what is the strength of current which gives the desired temperature. The indications of the ampere-meter will enable the current to be regulated to suit whenever the forceps are used subsequently to the operation, though it is possible to dispense with the ampere-meter to judge of the temperature by touching the forceps; but this requires considerable experience on the part of the operator, and the results are not so certain.

The object of the prongs 7 and the extension 6 is to prevent the tissues from spreading too thinly over the surface of the jaws 4 and 5. It is found advisable to apply a coating of sterilized vaseline over said surface, so that the desiccated tissues will not stick to the jaws and perhaps tear more or less in pulling it off of the jaws.

At the point where the shank 2 joins the jaw 5 the conductor extends through a groove 10 in the shank and enters a hole in the said jaw. The joint is tight and is hermetically sealed also with solder. The cover 13 fits tightly over the recessed jaw, and the joint should be carefully soldered, so as to be water-tight and make the joint hermetically closed. The joint between the conduit 8 and the terminal block 12 should be made hermetically tight conveniently by soldering.

I claim as my invention—

1. In a pair of surgical forceps, the combination of an electric resistance contained within one of the jaws, a terminal-block on one of the handles, an electric conductor passing from the resistance within the jaw, to and through the said block, and a tube of material impervious to fluids surrounding the said conductor, and having fluid-tight joints with both the interior of the jaw and the interior of the said block.

2. In a pair of surgical forceps, the combination of a hollow jaw, an insulated electric conductor therein extending along the outside of the shank of said forceps, a metallic tube containing said conductor and extending from said hollow jaw to near the end of said conductor along and fastened to the said shank, insulation within the tube and surrounding said conductor, an enlarged end 16, on said conductor out of contact with said metallic tube, and insulation 17, surrounding said conductor and between said tube and said enlarged end.

3. Surgical forceps consisting of the combination of shanks, pivoted together, handles thereon, an electrical resistance carried by one of the jaws and insulated therefrom, a terminal-block 12, attached to one of the handles obliquely to the plane of the handles,

a tubular conduit secured in a groove formed along one shank and extending from said jaw to said block, and containing an insulated conductor which is connected to said resistance, the other end of which is electrically connected to the jaw, a terminal 16 for receiving a socket 26 and forming a continuation of said conductor, and a second terminal 15 extending from said block for receiving a socket 25, both of said sockets being adapted to be connected up with a source of electricity.

4. In a pair of surgical forceps, the combination of a hollow jaw having a hole at one end where it joins the shank an insulated electric resistance within the jaw, a metallic conduit hermetically passing through the hole and carrying an insulated electric conductor connected to one end of said resistance, the other end of the resistance being connected to the jaw, a terminal-block upon the handle of the forceps and having a passage-way for said conductor, and hermetically connected to said tube, and a terminal forming the end of said conductor, sealed hermetically within said passage-way, and insulated from said block, the other electric terminal of the forceps being attached electrically to said block, which is connected metallically to said hollow jaw.

5. In a pair of surgical forceps having a hollow jaw, an insulated electric resistance therein, one end being connected hermetically and electrically to the jaw and the other

to an electric conductor passing hermetically through and being insulated from said jaw. 35

6. A pair of surgical forceps consisting of the combination of jaws and handles pivoted together, one of the jaws being provided with a cover applied, to the back of the jaw, an insulating-sheet lying inside of the said jaw, a bare conductor lying on and along the said insulator, a second insulator on said conductor, a tube hermetically connected to the jaw and communicating with its interior, and connected with the same and containing an extension of said conductor, the other end of which is connected electrically with the jaw, as and for the purpose set forth. 45

7. In a pair of electrical surgical forceps, a terminal-block formed upon a handle thereof, and having a hole extending through the same, lined with an electrical insulating-tube, a tubular electric conductor 16, fitting hermetically within one end of the said insulating-lining, a conduit 8, terminating in hermetical contact with the said terminal-block, and a wire, 9, passing through the said conduit and extending into the said lining, and terminating in the conductor, 16, hermetically and in electric contact therewith. 55

Signed this 5th day of August, 1898.

LOUIS M. PIGNOLET. [L. S.]

Witnesses:

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