(No Model.)

W. E. DOW.

ELECTRICAL APPARATUS FOR SURGICAL PURPOSES.

No. 591,160. Patented Oct. 5, 1897.

Fig: 1.

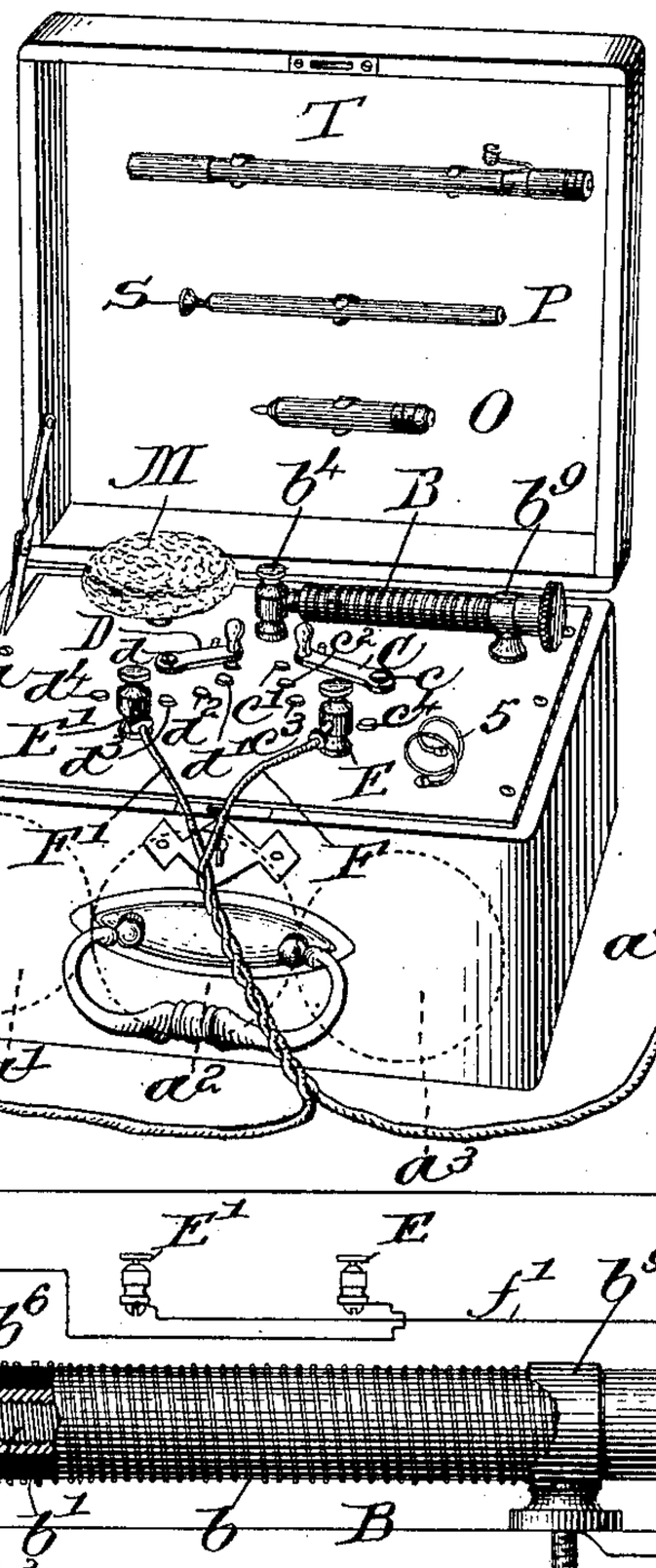


Fig: 2.

Fig: 3.

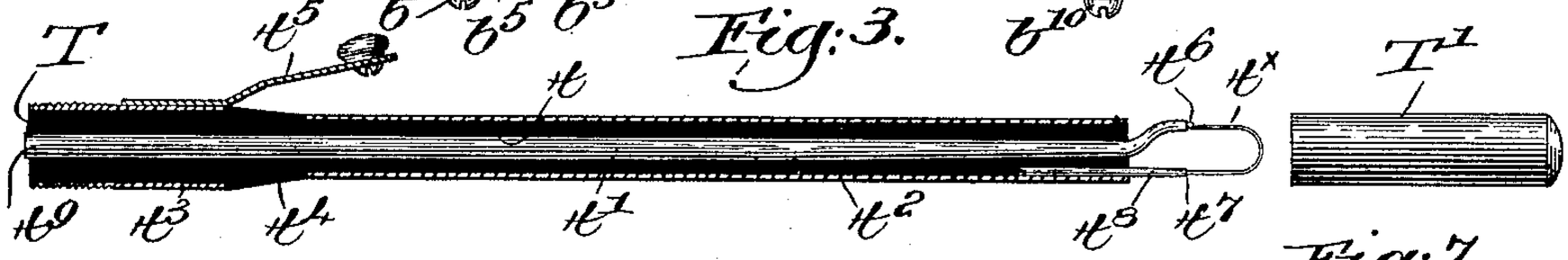


Fig: 4.

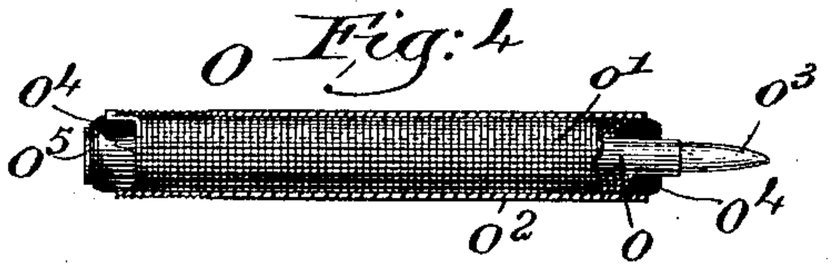


Fig: 7.

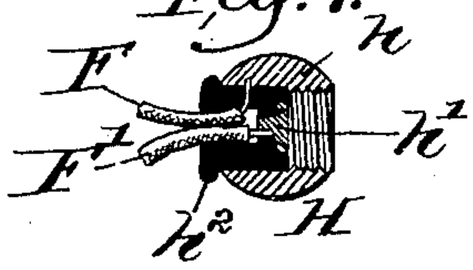


Fig: 5.

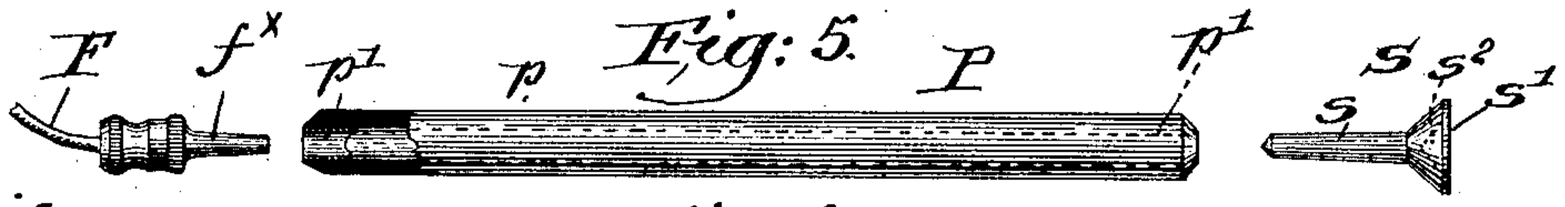
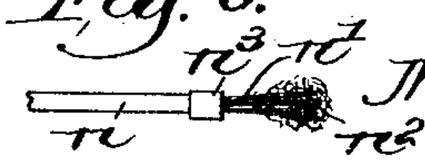


Fig: 6.



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UNITED STATES PATENT OFFICE.

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ELECTRIC APPARATUS FOR SURGICAL PURPOSES.

SPECIFICATION forming part of Letters Patent No. 591,160, dated October 5, 1897.

Application filed August 16, 1897. Serial No. 648,350. (No model.)

To all whom it may concern:

Be it known that I, WILLARD E. DOW, of Braintree, county of Norfolk, State of Massachusetts, have invented an Improvement in Electrical Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

The rapid development within a comparatively recent period of cataphoresis as applied in dental surgery has necessitated the use of instruments capable of delicate manipulation and adjustment for the administration of anesthetics by the electric current, and existing means having been found unsuited to the exigencies of the new methods of treatment it is the object of my present invention to specially constructed and arranged to meet present in a compact form electrical apparatus the requirements of dental surgery in particular, but also of allied electrosurgical treatment in general wherever unusual nicety of construction and adjustment is demanded.

The various features of my invention will be fully described and illustrated in the accompanying drawings and specification and set forth in the claims.

Figure 1 shows in perspective the various instrumentalities of my improved apparatus in their preferred form assembled in a convenient case. Fig. 2 is a view in side elevation, partly in section, of a rheostat constructed in accordance with my invention, including a diagram of the preferred form of connections, Figs. 3, 4, 5, and 6 showing, respectively, in elevation, partly in section, the various instrumentalities composing my novel apparatus, while Fig. 7 is a view in section of a universal socket illustrated to aid in the understanding of the manner of operating certain of the instrumentalities.

In the embodiment of my invention selected for description and illustrated in the drawings the various instrumentalities are contained within a suitable case A, in the bottom of which is inclosed a suitable source of electricity, shown as three cells of dry battery (indicated in dotted lines in Fig. 1) and lettered, respectively, a' a^2 a^3, their poles being respectively connected by wires (not shown) to suitable terminals mounted on a base a, preferably in accordance with the diagram of connections shown in Fig. 2 and to be described later.

An important feature of my invention is the means to permit the administration of the electric current in constantly-increasing volume, but with such minute graduations of intensity as to avoid the slightest possibility of shock even in treating the nerve of a tooth, at its best the most sensitive organism of the human body and almost invariably rendered hypersensitive when diseased.

The ordinary rheostat is not sufficiently delicate in adjustment for the purpose, inasmuch as its resistance is usually cut into or out of the circuit coil by coil, while rheostats in which provision is made for longitudinal insertion or withdrawal of resistance are, so far as I am aware, of such complicated construction as to preclude their use in apparatus of the class under description.

My improved rheostat, the preferred form of which, B, is best illustrated in Fig. 2, consists, essentially, of a resistance medium b, mounted upon the periphery of a support b' of suitable contour, preferably cylindrical in form and of hard rubber or other insulating material in substance, although any suitable means may be used if the resistance medium be properly insulated, and as I have selected for illustration as a convenient medium a helix of wire wound in continuous transverse coils upon the cylinder the insulation may be accomplished merely by leaving sufficient space between the convolutions of the spiral. This body portion of the rheostat with its resistance-coil is, in accordance with my invention, arranged to be carried bodily past and in electrical engagement with one contact-piece to bring into contact different points in the length of the resistance-wire composing the coil, while one end may be maintained constantly in engagement with another contact-piece, thus permitting a greater or less length of the wire to be included in the circuit, as desired, with consequent regulation in the resistance of the circuit and the strength of the current. That the introduction or withdrawal of resistance may be gradual to secure the advantages to which reference has already been made the rheostat is rotated while moving longitudinally, and any suit-

able means may be adopted to effect this, but as a convenient and simple mode of causing such concurrent double motion by a single actuating movement the cylinder b' is shown as having a longitudinal bore b^2, the walls whereof are threaded to receive and engage operatively a threaded rod b^3, preferably of substantial equality in length with the cylinder and suitably supported at its outer end, as in a binding-post b^4. The rod is thus adapted to serve as supporting means for the body or support proper of the resistance medium and may also be utilized as a conductor or contact-piece in providing for constant connection with one end of the resistance, and to accomplish this a suitable bushing b^5 of electroconductive material is in this instance inserted in the end of the bore b^2 and the end b^6 of the resistance-wire brought into fixed electrical contact with it. This bushing is preferably of metal and threaded internally in order that it may take the chief wear of the engagement with the rod b^3, which in the instance illustrated is fixed in the binding-post b^4 by the binding-screw b^7, movement of the body of the rheostat being effected by manual rotation of the same, to facilitate which a milled head b^8 may be provided.

The contact-piece past which the body is to be moved may be of any suitable construction and arrangement, but I prefer to make it in the form of a fixed spring-clip, substantially as shown at b^9, split at its top, as indicated in Fig. 1, and embracing the body of the rheostat intermediate the ends, affording a wide bearing or region of contact with the bare resistance medium, thus insuring electrical contact, and also serving as a brace or bearing physically for the rheostat-body to relieve the rod or its equivalent of undue lateral strain by accident or otherwise. Suitable attaching means, as the screws b^{10} b^{11}, may be provided to secure the binding-post and clip in about the relative position shown on a suitable base, and the wires of the circuit may also be brought into electrical contact with these and secured by them.

I prefer to connect the rheostat in the circuit in series, and will now proceed to describe the preferred manner of connecting up the various contacts, &c. (Shown in perspective in Fig. 1 and diagammatically in Fig. 2.)

C is a switch-lever pivoted at c and adapted to swing over and contact with points c' c^2 c^3 c^4, while D is a similar switch pivoted at d and adapted to coöperate with points d' d^2 d^3 d^4.

E E′ are respectively the negative and positive main terminals of the apparatus, and F F′ the conductors of a flexible double conducting-cord connected at one end to E E′ and at its other end either directly to any desired electrodes, as those shown at M P N, or to a universal socket H, preferably of the form shown in Fig. 7, in section, h being the metallic head, to which one of the conductors is connected, and h' a conducting-piece within the head, from which it is insulated in suitable manner, as by the bushing h^2, and connected with the other conductor of the cord. Interchangeable electrodes may be fitted in the socket H as desired, and thus included in the circuit, and different conductors may similarly be joined to the terminals. The terminal E′ (see Fig. 2) is connected by conductor f' to the negative pole of the battery-cell a', and the positive pole of the latter is connected to the switch-point c', while the cell a^2 is connected in between the points c' c^2 and the cell a^3 between the points c^2 c^4, a length of resistance r being connected in between the points c^3 c^4. From the switch-lever pivot c a connection $c^\times$ runs to the rheostat-clip b^9, and the binding-post b^4 is wired by conductors c^5 c^6 to the terminal E. The switch-lever pivot d is connected by conductor $d^\times$ to the switch-point c^4, and thus to the positive pole of the battery, while between the swicth-points d' d^2 d^3 d^4, respectively, are connected in resistance-units r' r^2 r^3, and the point d^4 is connected to the conductor c^6, leading to the terminal E. To illustrate the operation of these connections in a typical instance, the electrode M, which is an ordinary sponge-electrode of a well-known type, is applied to the surface of the patient's body at a convenient region, and one cell a' of the battery cut in by placing the switch-lever C on the point c'. The other electrode, as that shown at N, is then applied to the organ to be electrically treated—as, for example, a tooth in a cavity of which it is desired to introduce an anesthetic by cataphoresis. The electrode N and its handle P have been specially devised by me for this purpose, and the latter comprises an elongated support p, of insulating material, (see Fig. 5,) provided at each end with a contact-socket p', the two being electrically connected and adapted, respectively, to receive interchangeably any one of a series of electrodes of suitable shape, as the electrode N or S, each of which preferably has a stem-like contact-piece or shank n s, respectively, adapted to enter either of the sockets p'. In its simplest and most desirable form the handle P is composed simply of a plurality of coaxially-arranged tubes, the outer, p, of insulating material and the inner of electroconductive material, with open ends exposed, as illustrated, to constitute the sockets described. The handle P is preferably used in connection with a flexible conductor F, having at its end a contact terminal, piece, or pin of the very common type, (shown at $f^\times$,) which serves equally well to enter the hole of a binding-post or one of the contact-sockets p', opposite which it is shown in Fig. 5 ready for assemblage.

The electrode N consists, essentially, of a split member or portion n', preferably composed of a bundle of fine wires united to the shank n in suitable manner and adapted to receive and embrace a pellet or flock of cotton or other suitable vehicle n^2 for the anesthetic.

By a sliding ring n^3 or its equivalent, preferably a glass bead or beads, the degree of separation of the wires may be regulated to permit the insertion of the electrode in cavities or other recesses of different sizes.

The electrode S, Fig. 5, consists simply of a shank or stem s, having an enlarged head s' to cover a wider surface than the electrode just described, and its face may be flat or recessed, as indicated by dotted lines.

The electrode N having been inserted in the cavity or otherwise applied, the circuit is thereby completed through it, the conductor F′ to the terminal E′, thence by the conductor f' to the negative pole of the battery a', through the point c', lever C, pivot c, and conductor $c^\times$, to the rheostat-clip b^9, resistance b', and binding-post b^4, from which it is led by the conductors c^5 c^6 to the terminal E and back to the body of the patient through the flexible conductor F′ and sponge-electrode M.

Should the strength of current when all the resistance of the rheostat is in circuit be insufficient, the head b^8 is grasped and rotated—to the left in the instance illustrated—and the cylinder is forced by screwing it on the rod bodily out through the clip b^9, the convolutions of the resistance medium b' gradually passing into the clip, not coil by coil, but longitudinally of the spiral, so that the decrease of resistance and increase of current strength at the point of application is without shock to the patient. If one battery without resistance proves insufficient after returning the cylinder to normal innermost position another battery may be introduced by throwing the switch-lever C onto the point c^2 and the rheostat-cylinder again screwed out gradually. As the strength of three batteries is usually excessive for ordinary cases I insert between the points c^3 and c^4 a length of resistance r, so that when the switch-lever C is moved to point c^3 the resistance r is thrown in, as well as the three cells, but when the lever is moved to point c^4 the entire strength of the battery is on without resistance r.

For use when a lamp is connected up between the terminals E E′ and in analogous instances I have provided the extra resistance-units r' r^2 r^3, connected between the points d' d^2 d^3 d^4, and the operation of this circuit will be readily understood from the diagram in Fig. 2 by those skilled in the art. Where this circuit is used, by throwing the switch C on one of its points the rheostat B will be included in the circuit of the switch D as a shunt and its operation will affect the resistance thereof accordingly.

In Fig. 3 I have shown a cautery for the operation of which the circuit of the switch D is peculiarly suited, and which is specially adapted for use in connection with the socket H, to which reference has been made. The body T of this instrument is preferably formed of an elongated rod or support of insulating material having a central longitudinal bore t, through which is extended a conductor t' of suitable material and form, while the rod is incased in a bipart electroconductive sheath, the members t^2 t^3 whereof are slightly separated and so insulated, while the insulating-gap t^4 is bridged by a spring contact-arm t^5, suitably placed to enable the operator to depress it when grasping the handle for operation. Between the outer end of the conductor t' and sheath member t^2 a loop $t^\times$, of platinum or other electroconductive material of high resistance, is extended outwardly, a convenient manner of attachment being to wedge the ends of the loop, as at t^6, into a recess in the extended end integral or otherwise of the conductor t', and similarly at t^7 into an arm t^8, soldered or otherwise connected to the sheath t^2. The sheath member t^3 is preferably externally threaded, and the end t^9 of the conductor t' slightly extended to engage respectively the metallic head h and contact-piece h' when the instrument is screwed into the universal socket H. A cap T′ may be provided to cover the cautery loop when not in use.

The instrument O (shown in Fig. 4 in section, partly in elevation) is especially designed for magnetic exploration of shallow but confined portions of the body, particularly the eye, from which it is adapted to withdraw magnetic bodies. It consists of an elongated core o, of magnetizable material, upon which is wound a helix of insulated wire o', surrounded in turn by a metallic protecting-sheath o^2, adapted to serve as a handle and substantially coextensive with the helix o', but beyond which is extended a reduced conical continuation o^3 of the core o in position to be readily presented to the foreign substance in the eye or like part of the body where such a "magnetic electrode" would be of utility.

The ends of the sheath are preferably closed by bushings o^4, of insulating material, thus permitting one end of the helix to be connected to the sheath and the other to the core, which is headed at o^5, the diameter of this end of the "electrode" and its external construction being suitable to permit its connection with the universal socket H in the same manner as that described with reference to the cautery. A spring-clasp 5 serves to receive the socket H when not in use and to prevent it from swinging around in the case.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a rheostat, a resistance coil or helix; a contact-piece in constant electrical engagement with the convolutions thereof; and means, acting upon rotation of said coil, to cause axial movement of the latter, substantially as described.

2. In a rheostat, a rotatable body or support; a helix or resistance-wire mounted thereon; a contact-piece in constant electrical en-

gagement with one or more of the coils of said helix; and means engaging said body and acting upon rotation of the same to cause axial movement thereof, substantially as described.

3. In a rheostat, a rotatable cylindrical body of insulating material having a longitudinal bore; resistance-wire wound on said body in the form of a helix with separated coils; a contact-piece in constant electrical engagement with said helix; a rod entering the bore of said cylinder, and means intermediate said rod and cylinder, acting upon rotation of the latter to cause axial movement thereof, substantially as described.

4. In a rheostat, a rotatable tubular body of insulating material, provided with a peripherally-mounted resistance-helix, and threaded interiorly; a threaded member entering and in operative engagement with said tubular body, and electrically connected with one end of said helix; a clip or contact-piece embracing said body and in electrical contact with said helix; means to rotate said body; a support for said threaded member; and a base upon which said clip and support may be fixed in adjusted relative position, substantially as described.

5. An insulating-handle of the class described, comprising an elongated support of insulating material provided at its ends with similar contact-sockets electrically connected with one another and adapted to receive interchangeably any of a series of electrodes having similar contact pieces or shanks, substantially as described.

6. A universal electrode support or handle composed of a plurality of coaxially-arranged tubes, the outer of said tubes being formed of insulating material, and the inner of conductive material arranged to present open ends respectively adapted to receive any of a series of interchangeable electrodes, substantially as described.

7. An electrode of the class described, comprising a contact-shank adapted to enter a suitable contact-socket and having a split portion or member adapted to receive a pellet of fibrous material or other suitable vehicle for an anesthetic, substantially as described.

8. An electrode of the class described, comprising a shank or contact-piece; a bundle of wires secured thereto; and a ring or the like to regulate the degree of separation of the wires in said bundle, substantially as described.

9. An electrode consisting of a contact piece or shank, adapted to enter and be supported by a suitable contact-socket, said shank being provided with a head, or laterally-extended member, substantially as described.

10. An electrode, or cautery, of the class described, comprising an elongated tubular support of insulating material; a conductor arranged longitudinally within said support; a bipart sheath of conductive material mounted externally on the support, the members of the sheath being insulated from each other; a cautery-loop between and electrically connecting said conductor and sheath at one end; means to connect the members of said sheath electrically at will; said electrode having its parts arranged at its end distant from the cautery-loop to enter a suitable contact-socket, substantially as described.

11. A magnet or magnetic electrode, comprising an elongated core of magnetizable material, an insulated helix of wire surrounding the same and a metallic sheath for said helix and core; said electrode presenting at one end a reduced continuation of the core, beyond said helix and sheath, and means to connect said helix in circuit with a suitable source of electricity, substantially as described.

12. An electrode of the class described, comprising a nail-like core of magnetizable material; an exciting-helix therefor and having one end of its wire connected thereto; a metallic protecting-sheath for the intermediate portion of the core, and electrically connected to the other end of the helix-wire; said core extending at its point beyond said sheath and helix, and arranged at its head to enter and engage with one contact member of a suitable contact-socket, while the portion of the sheath adjacent the head of the core is adapted to engage with the other contact member of said socket, substantially as described.

13. An electrode of the class described, comprising a shank or contact-piece; a split portion or member adapted to receive a pellet of fibrous material or other suitable vehicle for an anesthetic; and a bead or beads of insulating material to regulate the diameter of said split portion, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLARD E. DOW.

Witnesses:
FREDERICK L. EMERY,
ALEXANDER COWPER PROUDFIT.