No. 776,062. PATENTED NOV. 29, 1904.

W. HIRSCHHORN & F. LOWENSTEIN.

ELECTROMEDICAL APPARATUS.

APPLICATION FILED NOV. 11, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 8

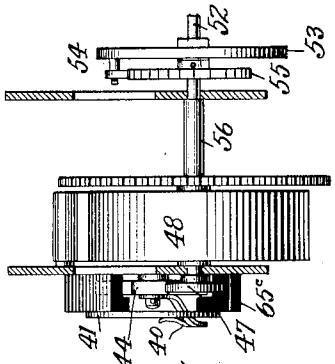

Fig. 10

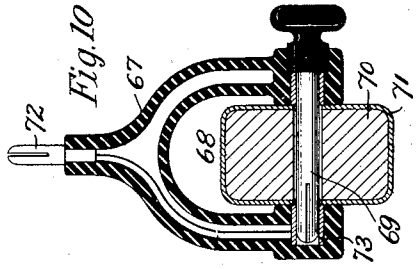

Fig. 7

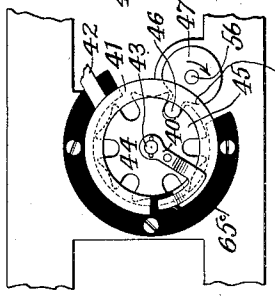

Fig. 5

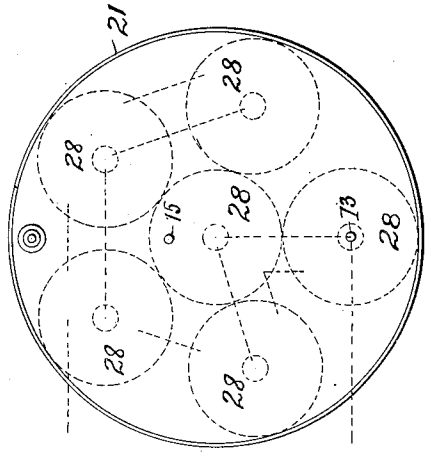

Fig. 1

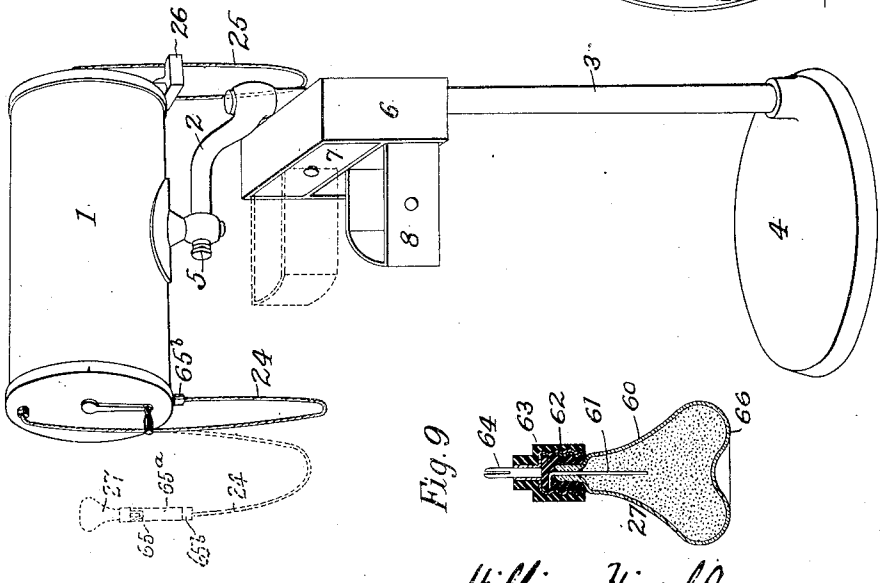

Fig. 9

Witnesses:
Raphael Netter
Joseph Hartmann

William Hirschhorn, Inventors
Fritz Lowenstein
by Kerr Page & Cooper Attys.

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NO MODEL. 2 SHEETS—SHEET 2.

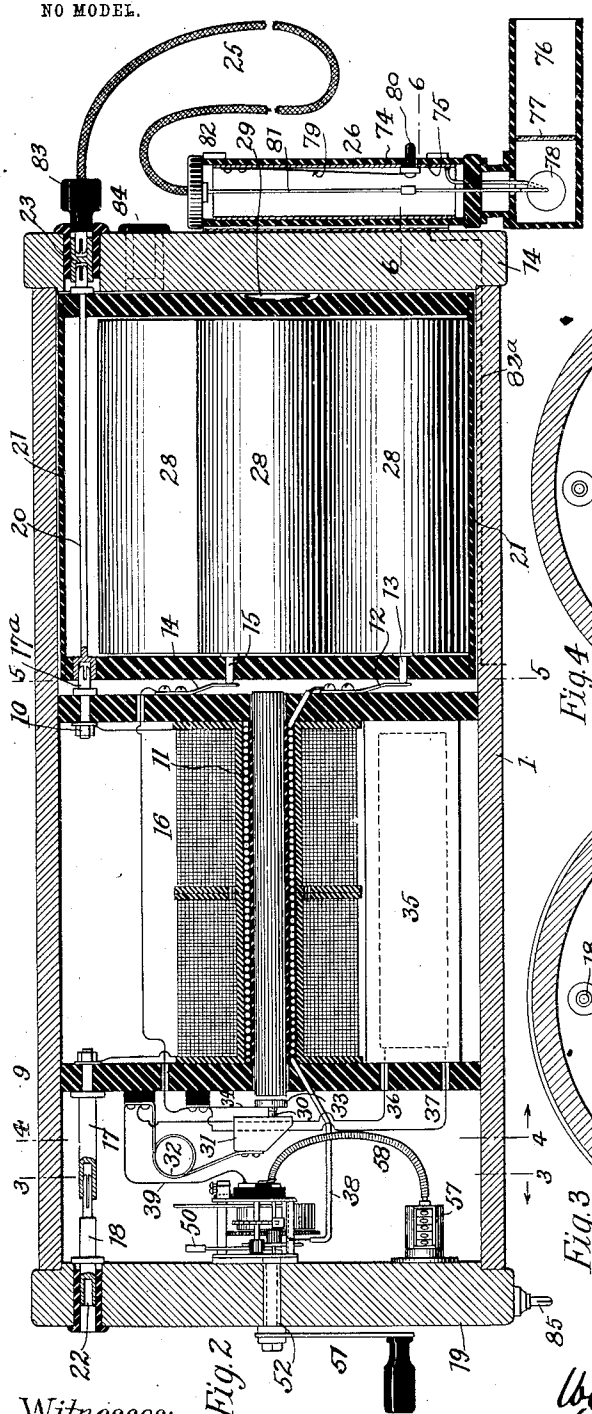

Fig. 2

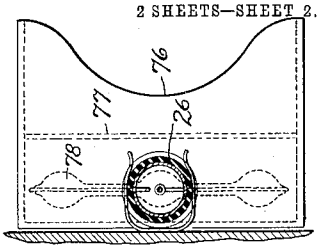

Fig. 6

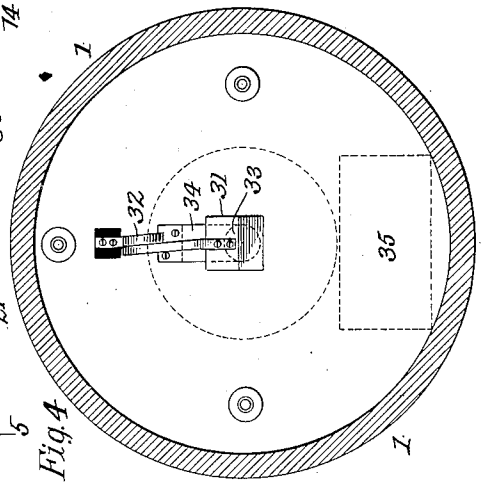

Fig. 4

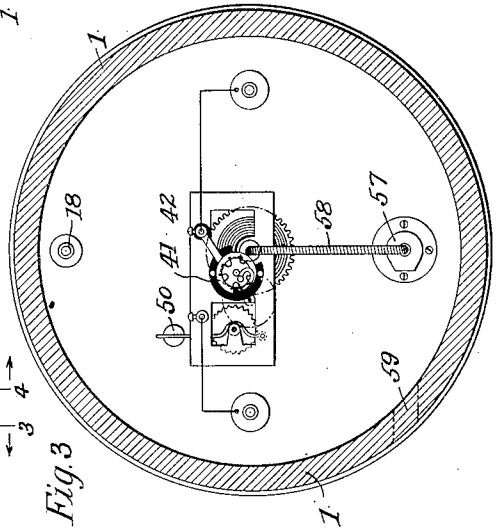

Fig. 3

Witnesses:
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No. 776,062. Patented November 29, 1904.

UNITED STATES PATENT OFFICE.

WILLIAM HIRSCHHORN AND FRITZ LOWENSTEIN, OF NEW YORK, N. Y.

ELECTROMEDICAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 776,062, dated November 29, 1904.

Application filed November 11, 1903. Serial No. 180,786. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM HIRSCHHORN, a citizen of the United States, and FRITZ LOWENSTEIN, a subject of the Emperor of Austria, (the said Lowenstein having declared his intention of becoming a citizen of the United States,) both residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Electromedical Apparatus, of which the following is a specification, reference being had to the drawings accompanying and forming part of the same.

Our invention relates, broadly, to apparatus for applying electric currents or oscillations to the body for their well-known beneficial effects; but we contemplate certain advantages which, so far as we are aware, are not found in existing devices. For example, certain more or less harmful (or at least non-beneficial) currents are excluded in our apparatus, as will be explained hereinafter. Again, our device is self-contained and is so designed that it may be handled, used, and maintained by inexperienced persons without likelihood of deranging its operative parts.

To these ends the invention consists of the novel features and combinations hereinafter described, and more particularly set forth in the claims.

Referring now to the drawings, Figure 1 shows a convenient embodiment of the invention in perspective. Fig. 2 is a longitudinal section of the cylinder containing the electrical devices. Figs. 3, 4, and 5 are sections on lines 3 3, 4 4, and 5 5, respectively, of Fig. 2 looking in the directions of the arrows. Fig. 6 is a detail section on line 6 6 of Fig. 2. Figs. 7 and 8 are detail views of the automatic switch mechanism for putting the device out of operation. Figs. 9 and 10 are detail views in section of two electrodes for use with the apparatus.

The operative parts are all contained in a suitably-shaped case 1, preferably cylindrical, as shown, pivotally mounted on arm 2, carried by the standard 3 on a weighted base 4. A set-screw 5 enables the cylinder to be clamped in any desired position. A cabinet 6 may be supported on the standard, containing one or more swinging drawers or compartments 7 8, in which the electrodes or other detachable parts of the apparatus may be conveniently kept. By the arrangement shown, in which the drawers are pivoted at their outer corners, they may both be open and accessible at the same time.

Inside the cylinder is an induction-coil secured to insulating-disks 9 10, Fig. 2, fitting closely the inner contour of the casing. The primary 11 of the coil is at one end connected to a spring 12, adapted to make contact with the battery terminal or electrode 13. The outer end of the primary is connected, through devices explained hereinafter, to a similar spring 14, contacting with the other battery-terminal, 15. The secondary 16 is connected to terminals 17 17^a, which engage, respectively, with a plug 17, carried by the removable disk or head 19, and a conductor 20, extending through the removable battery-case 21. At the outer end of each of the last-mentioned parts of the secondary circuit is a socket, (indicated at 22 23,) into which may be inserted the terminal plugs of the conducting-cords 24 25, to which the operating-electrodes, as 26 27, are connected.

The primary current is supplied by dry cells 28, preferably six in number, arranged, as shown in Fig. 5, in the cylindrical box 21, which is removable from the casing 1, a loop or other handle 29 being provided for that purpose.

While within the spirit of our invention any suitable device for interrupting the primary current may be employed, we have devised novel mechanism for this purpose which possesses a marked advantage over existing devices in that it is self-adjusting. Heretofore it has been customary to mount the stationary contact on a screw, by which wear on the platinum point may be taken up; but this necessitates frequent adjustment by the user. When the user is inexperienced, he is not likely to make the adjustment properly, with the result that the primary current is not economically utilized, or he may even not know the cause of the machine's failure to operate.

In our device we mount the relatively stationary contact 30, Fig. 2, on a weighted carrier 31, suspended by a slow-acting spring 32, by which the carrier and contacts are held with light pressure against the contact on the vibrating armature 33. The latter is mounted on a quick-acting spring 34.

The operation of the device is as follows: The armature is attracted by the magnet-core of the coil and breaks contact at 30. The carrier 31 tends to follow; but the armature by reason of its stiff spring returns to its original position too quickly to permit the carrier to move appreciably, while at the same time the inertia of the latter's comparatively great mass prevents it from being driven backward by the blows of the vibrating armature. In fact, the heavy carrier is practically, if not actually, stationary. However, as the platinum points wear away the carrier follows the shortening contacts, so that their relative adjustment is always maintained. By providing contact-points of sufficient length the apparatus will operate for years without readjustment, as will be readily seen. The terminals of the condenser 35 are connected with the carrier and armature by wires 36 37, as shown.

For the purpose of timing the operation of the apparatus and automatically stopping the same at any predetermined instant we have devised novel mechanism (illustrated in Figs. 2, 3, 4, 7, and 8) in circuit with the primary coil and battery through wires 38 39. The former is connected to the frame of the clockwork and therethrough to the brush 40, bearing on the insulated ring 41 in contact with a connector 42, to which the wire 39 is connected. The ring 41, which is carried on the insulator 65°, is not continuous, but has a gap therein, as shown, and it is therefore obvious that so long as the revolving brush is in contact with the metallic ring the primary circuit will be closed, but when the brush moves on the insulating-gap the circuit will be opened. The brush is carried on a shaft 43, on which is secured a toothed wheel 44. The broad teeth of the latter are all concave on their outer edges except tooth 45, which is convex. Coacting with the toothed wheel 44 is a finger 46 on a disk 47, rotated in the direction of the arrow, Fig. 7, by a coiled spring 48. As the disk rotates it will successively engage the notches in the toothed wheel 44 and revolve the same until the convex tooth 45 arrives at the position shown in Fig. 7, whereupon the shoulder 49 of the disk strikes the convex part of the tooth. The motion of the disk is thereby checked, and the brush 40 being so arranged that it is at this instant moved off the ring 41 onto the insulating-gap the primary circuit is broken. To put the apparatus again into operation, the disk is rotated backward by winding the spring 48, thereby carrying the brush 40 backward over the ring 41. By means of an escapement device having an adjustable pendulum or balance 50 the speed of the rotation of the disk 47, and consequently of the toothed wheel 44, may be accurately regulated. The spring 48 is wound by a crank 51 on a shaft 52, on the opposite end of which is a disk 53, carrying a pawl 54. The pawl engages a ratchet 55, rigidly secured to the spring-shaft 56, on which is also mounted the disk 47. The escapement devices mentioned are so proportioned and arranged that the disk makes one complete rotation in a unit period of time, as one minute. Consequently a complete rotation of the crank 51, carrying the wheel 44 backward a distance equal to one tooth, will close the primary circuit for one minute. Two revolutions of the crank will retract the disk 47 two rotations, and so close the primary for two minutes, and so on. Similarly less than a complete rotation of the crank will close the primary circuit for a period proportionally less than a minute. It will thus be seen that the operation of the machine is accurately timed and automatically stopped at the end of a predetermined period, which period is fixed by the winding-revolution of the crank 51. The attention of the operator is therefore not interrupted by the necessity of observing a timepiece and manipulating a switch when the prescribed duration of applicatian has expired.

The average rate of speed of the brush is uniform throughout its path; but by reason of the form and proportions of the wheel 44 and disk 47 the motion of the former is intermittent. It rotates, and with it the brush 40, with a succession of quick steps, and by properly arranging the brush and wheel relative to each other the brush may be made to move off the contact at the instant of its greatest speed. This makes the breaking of the circuit practically instantaneous and prevents sparking between the brush and contact as they separate. Corroding of the parts and impairment of the electrical contact at that point by arcing is thereby avoided.

Since the rotation of the disk 47 requires a definite and known period of time, the actual time during which the apparatus is used may be ascertained by counting the revolutions of the disk. For this purpose we provide a registering device 57, Figs. 2 and 3, connected with the disk-shaft 56 by means of a flexible shaft 58. A window 59 permits reading of the register without removal of the closure 19. The register may record simply the number of rotations of the disk 47 and fractions of rotations or the hours, minutes, and seconds during which the apparatus is in operation.

The electrodes used with the secondary circuit may be of any of the well-known types; but we prefer to use those in which the surface to be placed in contact with the body is

a dielectric, such as glass, "enamel," rubber, &c. These may be of various forms. In Fig. 9 is shown an electrode of this character consisting of a pear-shaped bulb of glass (or other dielectric) 60, lined or filled with conducting material, to which is connected a terminal 61 in contact with the screw ferrule 62. The latter screws into a socket 63, and so makes contact with the plug 64, which may be inserted in a socket 65, carried by the handle 65^a, which in turn is inserted into the socket 65^b of the conductor 24.

The flexible conductor 24, as before mentioned, connects with one end of the secondary coil 16, Fig. 2. The electrode may have an annular or nodular surface 66, as shown, so that by kneading and rubbing or rolling the same on the flesh a massage effect may be had simultaneously, if desired, with the application of the secondary current.

Another form of massage-electrode is shown in Fig. 10. This comprises an insulating-carrier 67 and a roller 68, mounted on a removable conducting-spindle 69. The body 70 of the roller is metallic and is covered with dielectric material 71, preferably enamel. The plug 72 is adapted to fit the socket 65 and is connected to the conducting-bushing 73, into which the shaft 69 extends. The action of these electrodes is that of a condenser, the inner elements being the metallic foil and roller, the outer elements being in each case the human body. The result of there being no continuous metallic connection between the secondary and the body is that only the high-frequency oscillations are transmitted. The low-frequency oscillations, the so-called "faradic" current, require a circuit made up of conductors. Of course other forms of electrodes than those specifically described may be used, if desired. The other flexible conductor, 25, carries an electrode 26, which since it is intended merely to be held in the hand of the person receiving the application and not to be manipulated upon his body may be termed the "passive" electrode. It also is a condenser and consists, preferably, of a non-conducting tube 74, having a metal lining 75. On one end of the same, preferably at right angles thereto, is an open-sided box 76, containing behind a glass partition 77 a resistance in the form of a "Geissler" tube 78 in circuit with the flexible conductor 25 and the lining 75, as shown. A short-circuiting switch 79, operated at will by pressing the knob or button 80 with the thumb or finger, makes contact with the wire 81, and so cuts out the resistance 78 to deliver a stronger current to the person receiving the application. The play of colors in the Geissler tube 78, which may be seen by holding the box 76 to the eyes, is an attractive feature of the apparatus and also indicates to some extent the intensity of the secondary current which is received.

Of course the greatest intensity of current will be received when both active and passive electrodes are in contact with the body. If lower intensity is desired, the passive terminal may be placed in its supporting-clips 82, which are metallic, and therefore serve as the outer element of the condenser. These clips 82 are connected by a wire 82^a to the metallic stand 3. Similarly the current may be varied by the holder varying the surface of the hand in contact with the tube 74, as by changing from the entire palm to the thumb and one, two, or more fingers. If the least intensity of current is desired, the passive electrode may be entirely cut out by removing the plug 83. To conveniently hold the plug at such times, an idle bushing or socket 84 is provided. To support the disengaged end of the conductor 24 when the apparatus is not in use, an idle plug 85 is provided on the closure 19 or other suitable part of the apparatus.

The effects produced on the human body by the currents delivered by our apparatus are, among others, stimulation of the circulation without abnormally increasing the work of the heart and restoration of nervous energy to the exhausted nerve centers. These beneficial effects by reason of avoiding the so-called "faradic" currents are not accompanied by the harmful and unpleasant shocks which produce violent and spasmodic contractions of the muscles. Such contractions frequently rupture the walls of the muscle-cells. The electrodes preferably have no metal in contact with the flesh. Consequently there is no sparking there, and the stinging pain caused by sparks is not experienced. The outer surface of the electrodes is easily kept clean and antiseptic. This outer surface being a dielectric, ozone is developed wherever the electrode touches the skin, thus producing at the very point of application one of the most powerful antiseptics known and that, too, in its most active state—namely, the "nascent" state.

The machine itself is self-contained, of attractive appearance, and simple in construction. While it may be readily taken apart and reassembled, the novel contact-breaker makes it unnecessary to open the case for years after adjustment except at the other end to renew the battery. This contact-breaker also insures an economical use of the battery and a constant efficiency.

The form herein described we consider the most convenient embodiment of our invention; but it should be understood that the invention may be embodied in numerous other forms without departure from its proper scope.

What we claim is—

1. In an apparatus of the character described, the combination of a standard or support, a casing carried thereby and distinct therefrom, induction devices located wholly

inside the casing, and means for delivering currents from the induction devices to the body, as set forth.

2. In an apparatus of the character described, the combination of a portable standard or support, a cylindrical casing rotatably carried by the standard or support, induction devices and a source of electric current located wholly inside the casing, means for delivering electric currents to the body, and means for causing the induction devices to operate at will, as set forth.

3. In an apparatus of the character described, the combination of a cylindrical casing, a removable battery-box conforming to the inner contour of the casing, a battery in said box, terminals projecting from one end of the box and connected with the poles of the battery, an induction-coil supported between disks removably conforming to the inner contour of the casing, spring-contacts on one of the disks in circuit with the primary of the coil and arranged to make contact with said battery-terminals, a primary-circuit breaker supported on the other disk, and a condenser supported by and between the disks of the induction-coil, connected with the primary coil, as set forth.

4. In an apparatus of the character described, the combination of a cylindrical casing, a removable battery-box conforming to the inner contour of the casing, a battery in said box, terminals projecting from one end of the box and connected with the poles of the battery, an induction-coil supported between disks removably conforming to the inner contour of the casing, spring-contacts on one of the disks in circuit with the primary of the coil and arranged to make contact with the said battery-terminals, a primary-circuit breaker supported on the other disk, a condenser supported by and between the disks of the induction-coil, connected with the primary coil, secondary terminals on the said disks extending outwardly therefrom, a conductor extending through the battery-box and making contact at one end with one of the secondary terminals, a socket in the adjacent head of the cylindrical casing in contact with the other end of the said conductor, and a socket in the other head of the casing in contact with the adjacent secondary terminal, as set forth.

5. In an apparatus of the kind described, the combination with a closed casing, induction devices and a primary source of electricity and connections therefor located wholly inside the closed casing, of time-controlled means for putting said primary source out of operation at a predetermined instant, as set forth.

6. In an apparatus of the character described, the combination with a closed casing, induction devices and a primary source of electricity and connections therefor located wholly inside the closed casing, of manually-operated means extending outside the casing to put the primary source in operation, and time-controlled means for putting the same out of operation after a predetermined period, as set forth.

7. In an apparatus of the character described, the combination of a closed casing, induction devices and a primary source of electricity and connections therefor located wholly inside the closed casing, of time-controlled means for putting the primary source out of operation after a predetermined period, and mechanism for registering the duration of the period or periods, as set forth.

8. In an apparatus of the character described, the combination with a closed casing, induction devices and a primary circuit and contacts therefor located wholly inside the closed casing, of self-adjusting mechanism, inside the casing, for rapidly opening and closing the contacts, and adapted to automatically compensate for wear between the contacts, as set forth.

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