

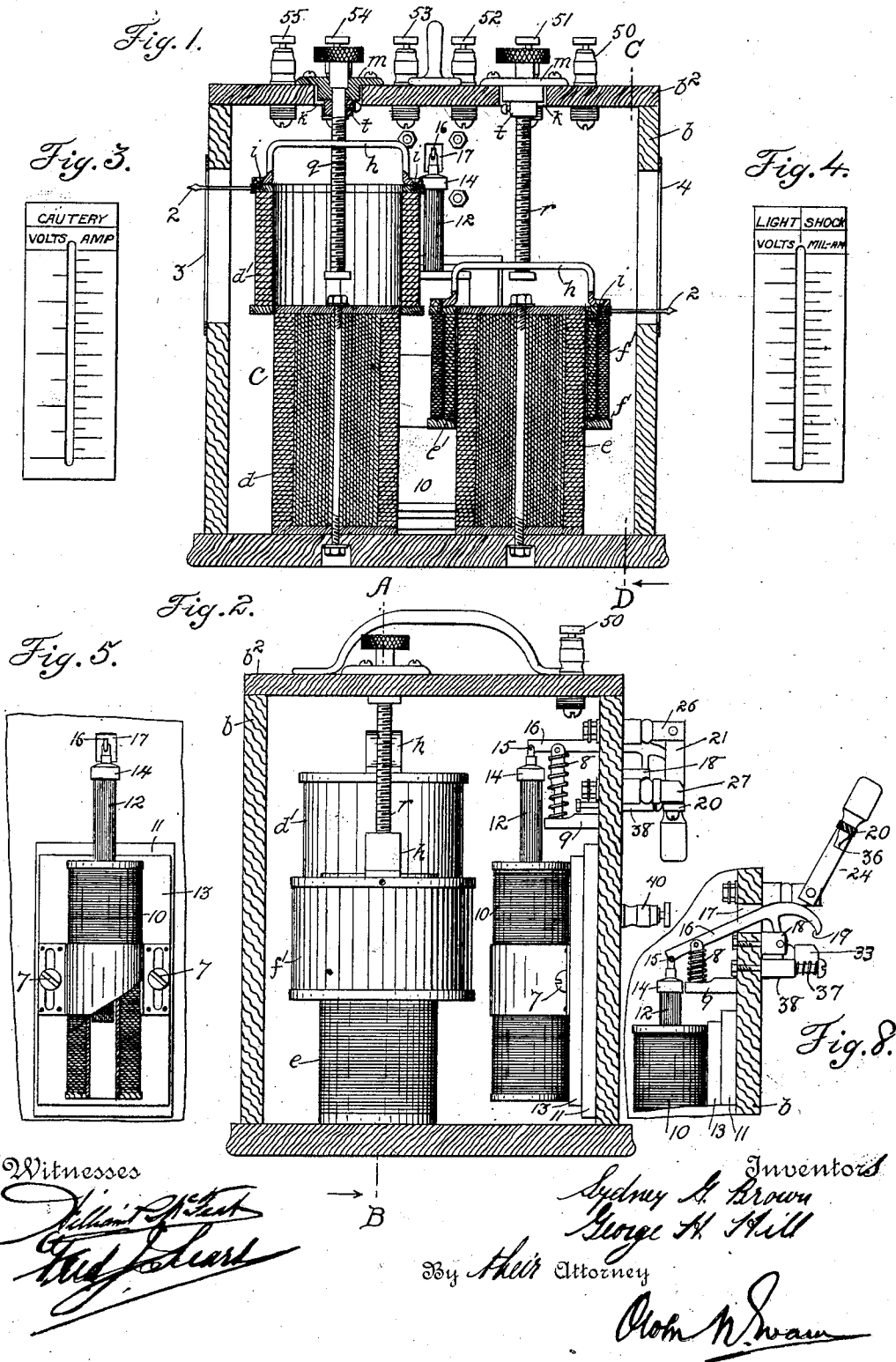
G. H. HILL & S. G. BROWN.

TRANSFORMER.

APPLICATION FILED JUNE 7, 1902.

NO MODEL.

2 SHEETS--SHEET 1.



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2 SHEETS—SHEET 2.

Fig. 6.

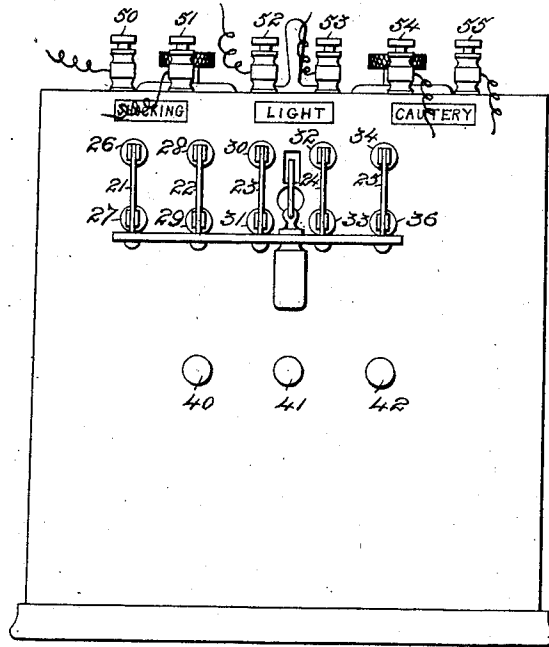
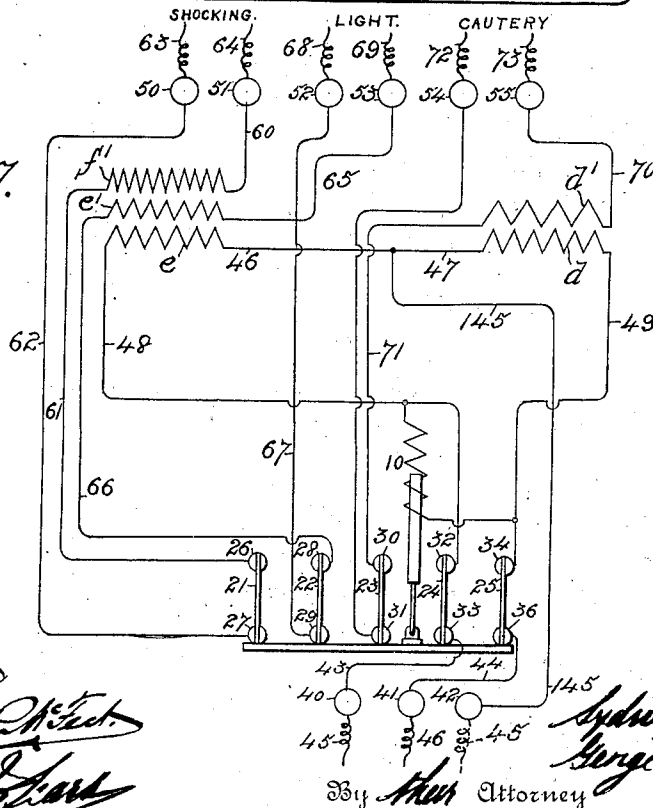


Fig. 7.



Witnesses

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TRANSFORMER.

SPECIFICATION forming part of Letters Patent No. 728,575, dated May 19, 1903.

Application filed June 7, 1902. Serial No. 110,640 $\frac{1}{2}$. (No model.)

To all whom it may concern:

Be it known that we, GEORGE HAGAR HILL and SYDNEY GEORGE BROWN, doctor of medicine, both of the city of Montreal, district of Montreal, and Province of Quebec, Canada, have invented certain new and useful Improvements in Transformers; and we do hereby declare that the following is a full, clear, and exact description of the same.

Our invention relates particularly to transformers for use in the treatment of diseases; and it has for its object to increase the scope of the usefulness of transformers for this purpose, to enable the currents flowing therefrom to be more accurately regulated, and to obviate any chance of a current of greater electromotive force than a predetermined degree to reach the parts of our improved transformer or the patient undergoing treatment. The invention may be said briefly to consist in, first, providing in conjunction with the light and cautery coils usually employed a third coil adapted to administer electric shocks to the human system; secondly, providing special means for adjusting these coils to regulate minutely the current passing therethrough and supplementing said special means of adjustment with scales to indicate in the case of the light and shocking coils the voltage only and in the case of the cautery-coil both voltage and amperage, and, thirdly, providing a safety device adapted to open the circuit upon the pressure in the leading-in wires increasing above a predetermined degree.

For full comprehension, however, of our invention reference must be had to the accompanying drawings, forming a part of this specification, in which like symbols indicate the same parts, and wherein—

Figure 1 is a transverse vertical sectional view of a transformer constructed according to our invention, the view being taken on line A B, Fig. 2. Fig. 2 is a similar view thereof, taken at right angles on line C D, Fig. 1. Figs. 3 and 4 are detail views of the gage-plates for indicating the current available upon the adjustment of the coils. Fig. 5 is a detail plan view, partly in section, of our improved safety switch-operating device.

Fig. 6 is a rear elevation of our transformer. Fig. 7 is a diagrammatical view illustrating the circuits of our transformer, and Fig. 8 is a detail view illustrating the end of the safety device with the switch open.

The box *b*, in which our improved transformer proper and safety device are carried, may be of any approved design and has a removable top *b*². On the bottom of this box are secured the primaries *d* and *e* of a simple induction-coil and a compound induction-coil, respectively, the simple coil being for voltage and the compound coil for amperage. The secondary of the simple induction-coil is indicated at *d'*, and the pair of independent coils constituting the compound secondary are wound one upon the other and indicated at *e'* and *f'*. These secondaries are adjustable longitudinally of their primaries to vary the intensity of the current being taken off, and to this end we secure a metal bridge-piece *h* (preferably of iron or steel) across the upper ends of the simple and compound secondaries and secure it thereto by screws *i* or otherwise, as desired. We bore the cover *b*² of the box, as at *k*, in line with the core of each primary coil. The bridge-pieces *h* are each bored in the axial lines of the coils, and their borings are screw-threaded. A series of milled-headed adjusting-screws *g* and *r*, respectively, for adjusting the respective simple and compound secondary coils and having collars *t* are supported upon a plate *m* on the top of the box, while the screw-threaded end portions thereof are threaded through the bridge-pieces, and the milled heads project a short distance above the cover. The sides of the box are slotted in line with each coil, and each secondary has an index-finger 2 projecting therefrom (preferably from the upper end thereof) through the slot adjacent thereto, while a pair of graduated slotted plates 3 and 4 are secured to the box with their slots coinciding with the slots adjacent to the respective coils *d* and *e*.

The induction-coil *f*, with its compound secondary, is used for lighting purposes and for administering currents, and its gage-plate is graduated to indicate volts for the lighting and milliamperes for the administering sec-

ondaries, and the induction-coil *c* is for cauterizing, and its plate is graduated to indicate amperes. In order to obviate any chance of a current of greater electromotive force or current than a predetermined degree reaching the coils, we provide a safety cut-out consisting of a solenoid connected in shunt to the leads of the primary coils in a manner to, with the cooperation of a switch and upon an abnormal increase of voltage in said leads, open the switch and by sequence cut out both primaries and secondaries simultaneously, as will be presently set forth. The solenoid consists of a coil 10 and an armature in the form of a core 12 of laminated type. This solenoid is mounted upon a vertically-adjustable base 13, which is adjustably secured to a rigid base 11 upon the inside of the back of the box, (see Fig. 2,) the means for securing said bases together consisting of screws 7 and slots in the movable base 13. The end of the core is furnished with a cap 14, pivotally connected, as at 15, to the inner end of a lever 16, projecting through a slot 17 in the back of the box and fulcrumed to a post 18 upon the exterior of said back below the slot 17, the outer end of this lever being downwardly curved and hooked, as at 19, to engage and detachably retain a spring switch-arm, and an expansile helical spring 8 upon a bracket 9 maintains said lever 16 normally in a position to have its hooked end in engagement with the switch-arm. This switch-arm comprises an insulated bridge 20, having a series of preferably five blades 21, 22, 23, 24, and 25, which are pivoted to the respective terminals 26, 28, 30, 32, and 34 and adapted when the switch is closed to engage terminals 27, 29, 31, 33, and 35. The hooked end 19 of lever 16 engages a stud 36 upon the switch-bridge and retains the switch closed, and when in such position it bears upon and compresses an expansile helical spring 37, localized in a tubular post 38, said spring being of sufficient strength to throw the switch-arm full open when the hooked end of the lever is moved away from the stud 36.

Three binding-posts 40, 41, and 42 are mounted on the back of the box, and six binding-posts 50, 51, 52, 53, 54, and 55 upon the top thereof.

The wiring of our improved transformer, including the safety device, is as follows:

45 and 46 represent the house-leads, taken from the secondary of the usual converter. (Not shown.) These leads may be connected to binding-posts 40 and 41 if the current available in the house-leads is one hundred and ten volts and to binding-posts 40 and 42 or 42 and 41 if the current is fifty-two volts. A wire 43 is taken from binding-post 40 to switch-terminal 33, and a wire 44 leads from binding-post 41 to switch-terminal 36, while a wire 45 leads from binding-post 42 direct to the primary coils, to one end of each of which it is connected by branches 46 and 47, and a pair of wires 48 and 49 lead from the opposite ends

of the primary coils to switch-terminals 32 and 34, respectively. This wiring, with switch-blades 24 and 25, completes the primary circuits.

The secondary circuits are wired as follows: The shocking-coil *f'* is connected at one end by a wire 60 to one, 51, of the binding-posts upon the top of the box and at its other end by a wire 61 to switch-terminal 26, a direct wire 62 leading from switch-terminal 27 to binding-post 50. The switch-blade 21, the administering-leads 63 and 64, and the instrument (not shown) whereby the current is administered complete this secondary circuit.

The light-coil *e'* is connected at one end by a wire 65 to the binding 53 upon the top of the box and at its other end by wire 66 to switch-terminal 28, a direct wire 67 leading from switch-terminal 29 to binding-post 52. The switch-blade 22, light-leads 68 and 69, and the usual lamp (not shown) complete this secondary circuit. The cauterizing-coil *d'* is connected at one end by a wire 70 to the binding-post 55 and at its other end by a wire 71 to switch-terminal 30, a direct wire leading to binding-post 54 from switch-terminal 31. The switch-blade 25, cauterizing-leads 72 and 73, and usual cauterizer (not shown) complete this secondary circuit.

Upon the closing of the switch our improved transformer will be ready for use. By lowering the cautery, secondary or compound light and administering secondaries, and by rotating the screw of either a variation in the induced current flowing therefrom will be caused in proportion to the extent to which said secondary is brought within the magnetic field of its primary. This variation can be regulated to a minute degree, and the precise degree is indicated by means of the index-fingers and the gage-plates and the exact amperage or voltage ascertained before the circuit is closed. If a current above the standard voltage should happen to reach the house-leads, it will be cut off by the safety device, as follows: The solenoid is wound to not energize its laminated core except upon the passage thereof of more than a current of one hundred and twenty volts. When such takes place, its armature is drawn in, thereby releasing the switch-arm and allowing its spring to open it and completely cut out both primary and secondary coils, and thus obviating any danger of a lamp being burned out or a current of excessive voltage reaching a patient through the cauterizing or administering coils.

What we claim is as follows:

1. A device for use in the treatment of diseases, comprising a "light-coil" having a pair of leads; a "cautery-coil" having a pair of leads; a "shocking-coil" having a pair of leads; means including a safety cut-out for electrically connecting all of said coils to the source of energy, substantially as described and for the purpose set forth.

2. A device for use in the treatment of dis-

cases, comprising a pair of primary coils, means for connecting said primary coils to the source of energy, a single secondary coil encircling one of said primary coils, a pair of secondary coils wound one upon the other and encircling the other of said primary coils, a pair of leads connected to each of said secondary coils, and means for adjusting said single and compound secondary coils longitudinally of said primary coils, substantially as and for the purpose set forth.

3. In a device of the type described comprising an induction-coil the secondary coil whereof is movable into and out of the magnetic field of the primary coil, the combination with the secondary coil of a screw and a threaded connection between said secondary coil and screw for adjusting said secondary coil into and out of the magnetic field of the primary coil, substantially as described and for the purpose set forth.

4. In a device of the type described comprising an induction-coil the secondary coil whereof is movable into and out of the magnetic field of the primary coil, the combination with the secondary coil of a screw in the axial line thereof, means for rotatably supporting said screw and retaining same against longitudinal displacement, and a cross-piece secured rigidly to said secondary coil and threaded upon said screw, substantially as described and for the purpose set forth.

5. In a device of the type described, comprising an induction-coil the secondary coil whereof is movable into and out of the magnetic field of the primary coil, the combination with the secondary coil of a screw in the axial line thereof, means for rotatably supporting said screw and retaining same against longitudinal displacement, a cross-piece secured rigidly to said secondary coil and threaded upon said screw, an index-finger projecting from said secondary coil, a gage-plate, and means for supporting said gage-plate adjacent to said index-finger, substantially as described and for the purpose set forth.

6. A device for use in the treatment of diseases, comprising primary and secondary coils adjustable one relatively to the other, a multipolar switch comprising a series of pairs of terminals, contact-blades connecting the terminals of each pair, the circuit of each of said primary and secondary coils including one pair of terminals and their contact-blade, and means for opening said switch upon abnormal voltage occurring in said transformer, substantially as described and for the purpose set forth.

7. In a device of the class described comprising a box having a cover, an induction-coil within said box the secondary coil whereof is movable into and out of the magnetic

field of the primary coil, the combination with said box, of a cross-bar secured to and having a threaded perforation in the axial line of said secondary coil, a rotatable screw having a shoulder and a milled head at its upper end and projecting downwardly through said socket and threaded into the perforation in said cross-bar, an index-finger projecting from said secondary coil through a slot in the adjacent side of said box, and a slotted gage-plate coinciding with the said slot, substantially as described and for the purpose set forth.

8. The combination with a circuit to be protected, of a safety device consisting of an electromagnet, and an automatic switch in multiple with the circuit to be protected, said electromagnet being wound to attract its armature only upon voltage occurring in said circuit to be protected in excess of the maximum voltage desired said electromagnet being in shunt with said circuit to be protected and an operative connection between the armature of said electromagnet and said switch whereby upon the attraction of said armature the switch will open, for the purpose set forth.

9. The combination with a circuit to be protected, of a safety device consisting of an electromagnet, an automatic switch in multiple with the circuit to be protected said electromagnet being wound to attract its armature only upon voltage occurring in the circuit to be protected in excess of the maximum voltage desired, said electromagnet being in shunt with said circuit to be protected, a spring tending to open said switch, means retaining said switch closed against said spring, and an operative connection between the armature of said electromagnet and said retaining means whereby upon the attraction of said armature the switch will open, for the purpose set forth.

10. The combination with a device for the treatment of diseases, of a safety device consisting of a solenoid, a base-plate, means for securing said solenoid adjustably to said base-plate, an automatic switch in the primary circuit of said transformer, a laminated core within said solenoid, and an operative connection between said laminated core and said switch whereby upon the attraction of said core and drawing in thereof by the solenoid the switch will open, substantially as described and for the purpose set forth.

In testimony whereof we have affixed our signatures in presence of two witnesses.

GEORGE HAGAR HILL.
SYDNEY GEORGE BROWN.

Witnesses:

WILLIAM P. McFEAT,
FRED J. SEARS.