No. 668,389. Patented Feb. 19, 1901.

W. F. RICHARDS.

ELECTRIC SWITCH.

(Application filed Nov. 23, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

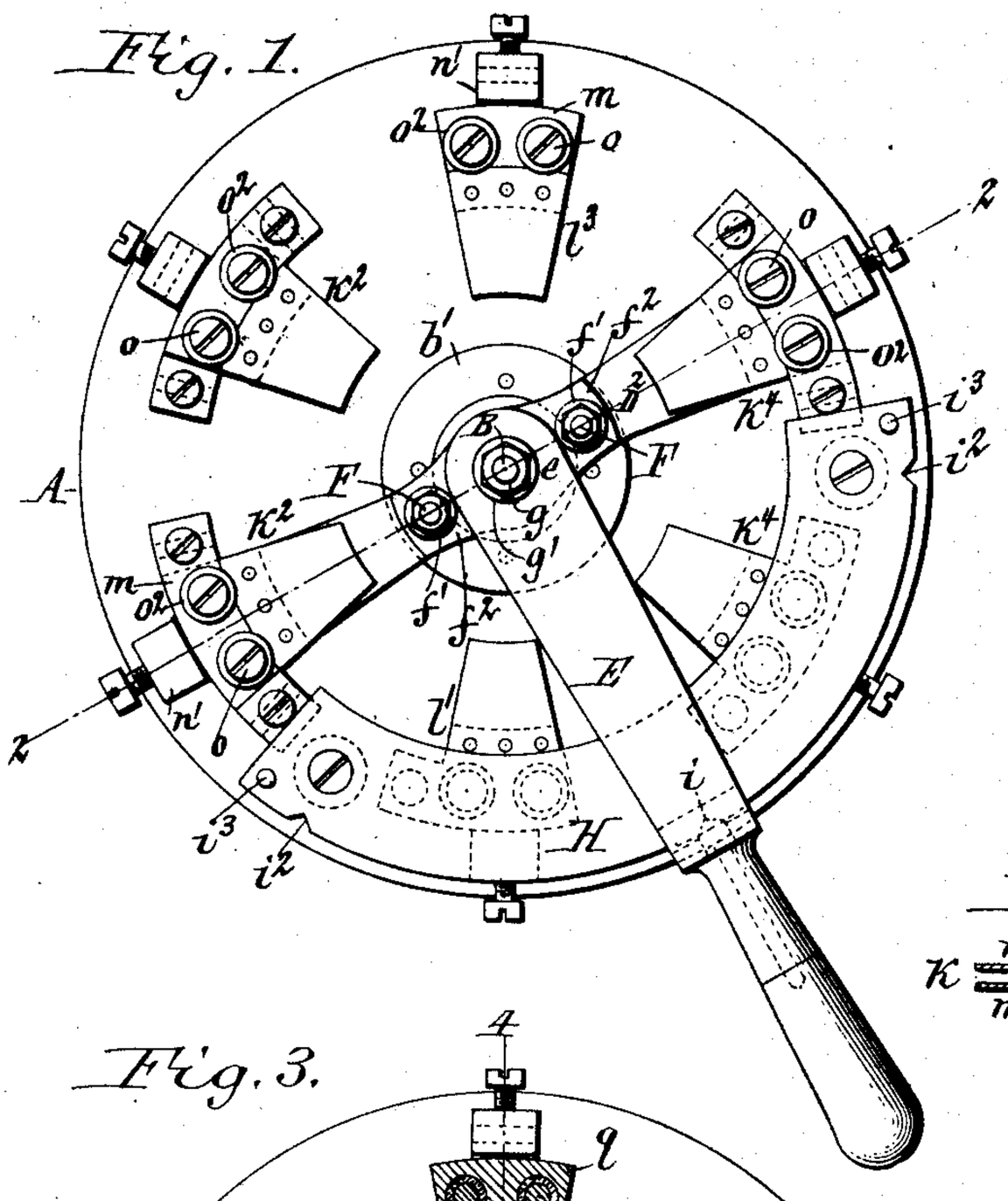


Fig. 2.

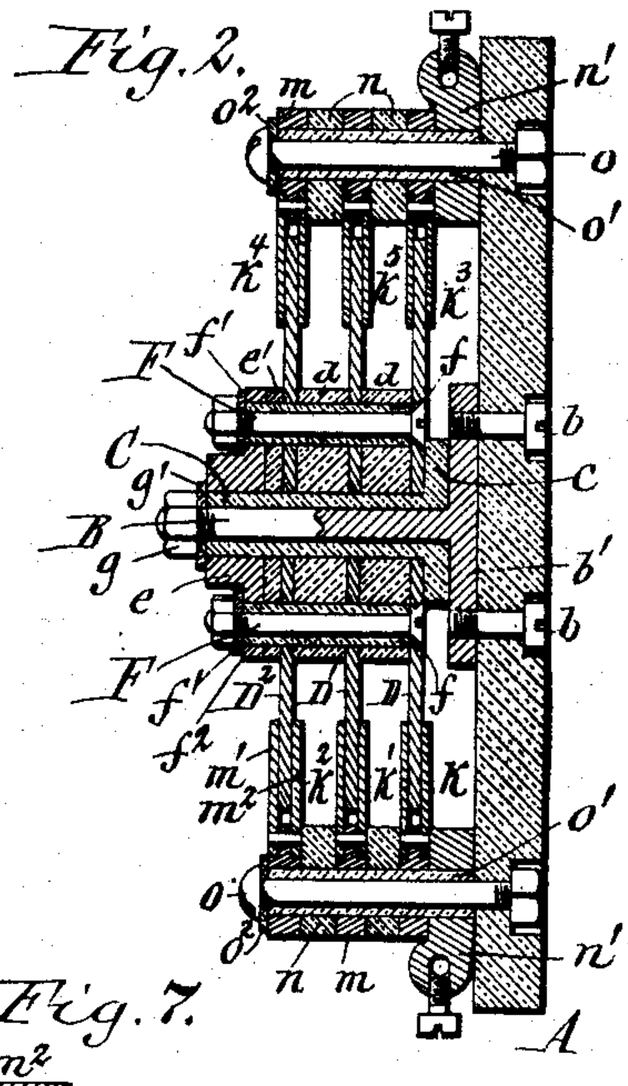


Fig. 7.

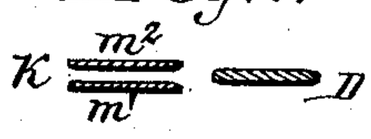


Fig. 3.

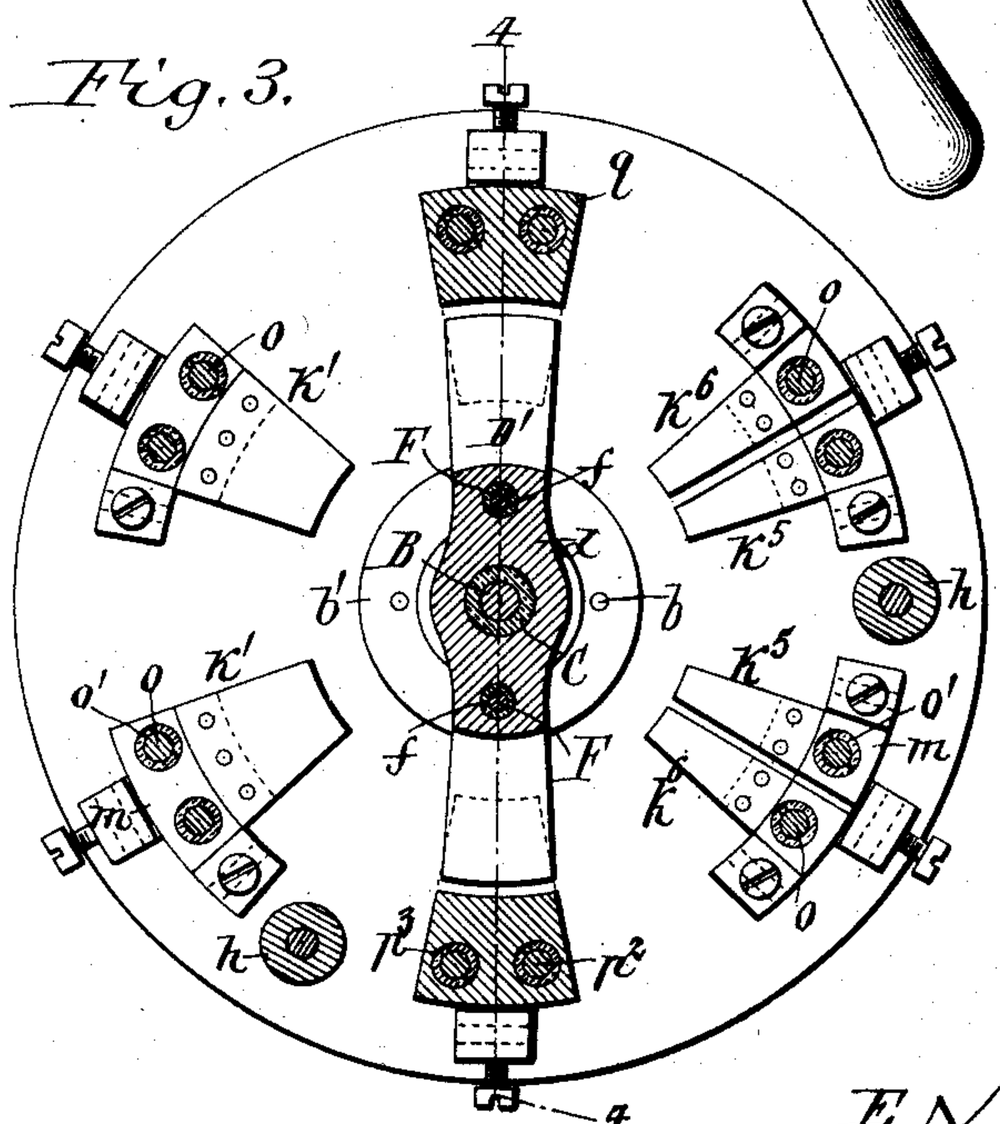


Fig. 4

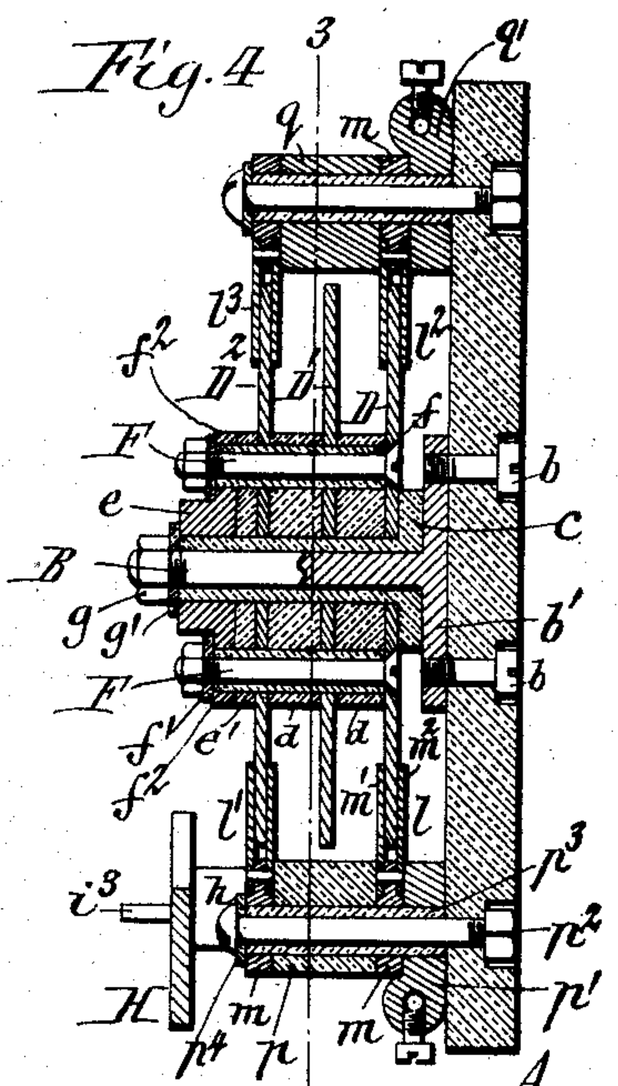


Fig. 5.

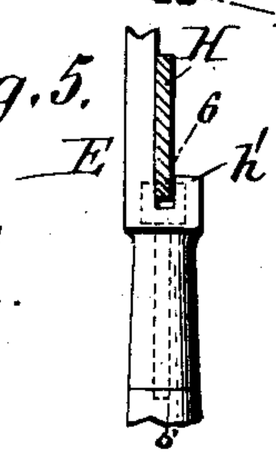
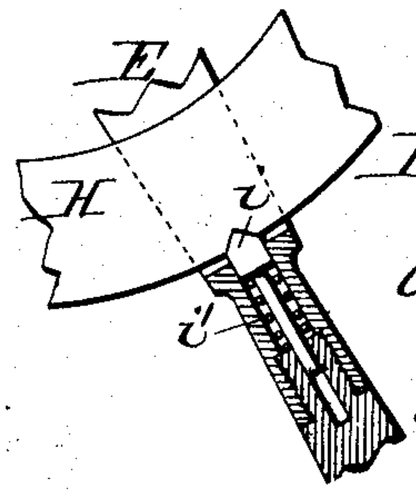


Fig. 6.



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No. 668,389. Patented Feb. 19, 1901.

W. F. RICHARDS.

ELECTRIC SWITCH.

(Application filed Nov. 23, 1899.)

(No Model.) 2 Sheets—Sheet 2.

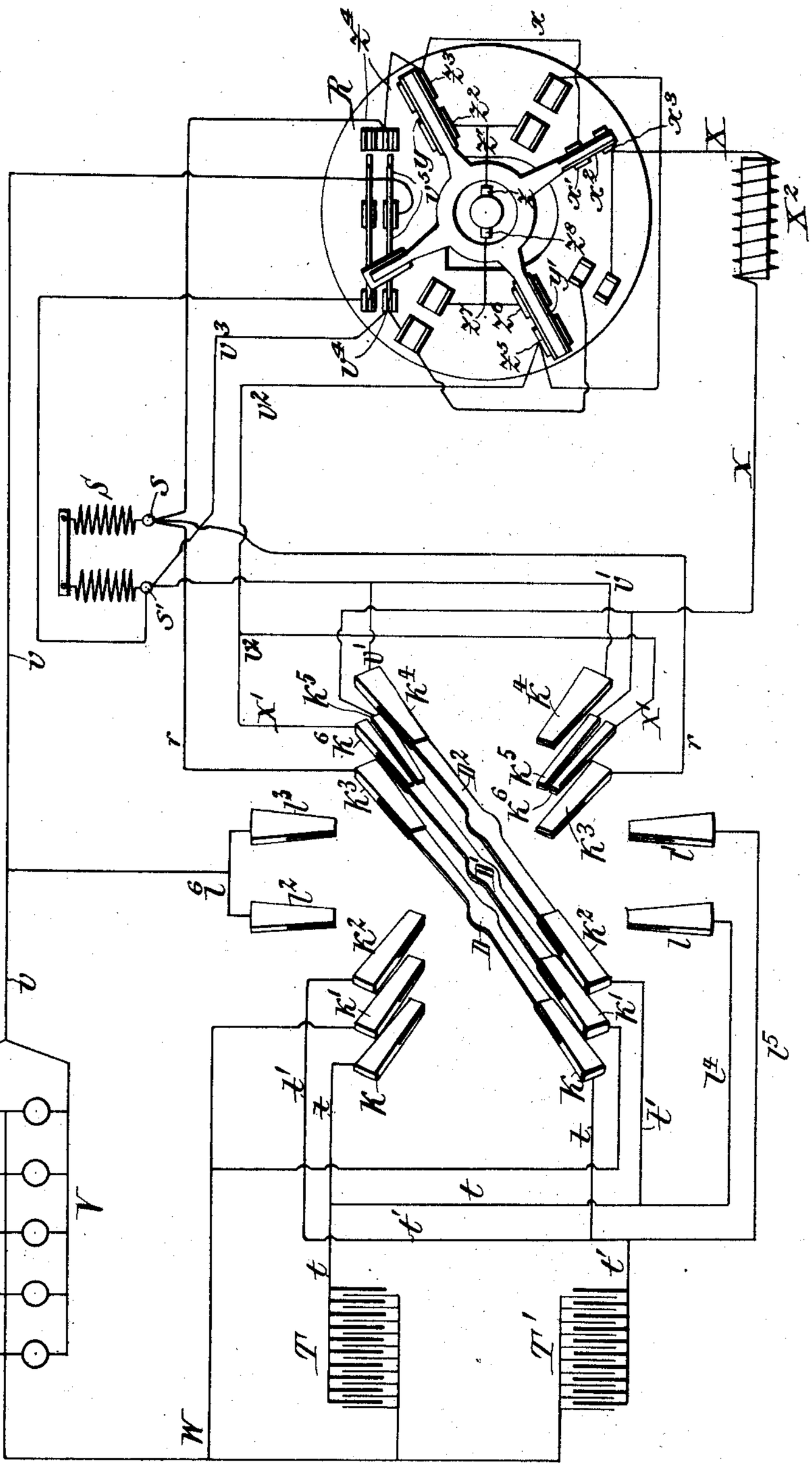

Fig. 8.

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UNITED STATES PATENT OFFICE.

WILLARD F. RICHARDS, OF BUFFALO, NEW YORK, ASSIGNOR TO CHARLES M. GOULD, OF NEW YORK, N. Y.

ELECTRIC SWITCH.

SPECIFICATION forming part of Letters Patent No. 668,389, dated February 19, 1901.

Application filed November 23, 1899. Serial No. 738,021. (No model.)

To all whom it may concern:

Be it known that I, WILLARD F. RICHARDS, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Electric Switches, of which the following is a specification.

This invention relates to a switch which is so constructed that the switch-lever is shifted from one set of contacts to the other and is brought into contact therewith by a rotary movement in a plane parallel with the face of the switch board or base.

The principal object of this invention is to adapt the switch-lever to make contact with several superposed contacts which are arranged at different distances from the base. To that end the switch-lever is provided with two or more contact-blades, which are arranged at different distances from the base corresponding with the location of the different contacts.

In the accompanying drawings, consisting of two sheets, Figure 1 is a face view of a switch embodying my improvements. Fig. 2 is a section at right angles to Fig. 1 in line 2 2, Fig. 1. Fig. 3 is a sectional face view in line 3 3, Fig. 4. Fig. 4 is a section at right angles to Figs. 1 and 3 in line 4 4, Fig. 3. Fig. 5 is a fragmentary side elevation of the handle of the switch-lever, showing the fixed adjusting-segment in section. Fig. 6 is a sectional view of the handle of the switch-lever in line 6 6, Fig. 5. Fig. 7 is a cross-section of one of the contacts and the blade of the switch-lever, showing the lever out of contact. Fig. 8 is a diagrammatic view showing my improved switch embodied in an electric-lighting apparatus.

Like letters of reference refer to like parts in the several figures.

A represents the switch board or base, which is preferably circular in outline and constructed of any suitable insulating material, preferably slate. This base is provided centrally on its front side or face with a forwardly-projecting arbor or post B, which is secured to the base by screws *b*, passing through the base and the base-flange *b'* of the post.

C represents an insulating supporting-sleeve, of vulcanized fiber or other suitable material, which surrounds the post and is provided with a base-flange *c*, which rests against the base-flange of the post.

D D' D² represent the double-armed blades of the switch-lever, which are pivoted on the insulating-sleeve C at different distances from the base. In the switch shown in the drawings three of these switch-blades are employed. These blades are insulated from each other by insulating-washers *d*, of vulcanized fiber or other suitable material. The innermost or rearmost switch-blade bears against the base-flange of the insulating-sleeve.

E represents the metallic handle of the switch-lever, which turns with its hub *e* on the outer end of the insulating-sleeve C and which forms, together with the switch-blades, the switch-lever. This handle is arranged at right angles to the switch-blades and is separated from the outermost switch-blade by an insulating-washer *e'*. The several switch-blades and the handle are connected by coupling-bolts F, so as to turn together, but are insulated from each other by insulating sleeves and washers *f f'*. Each of the insulating-sleeves *f* passes through coinciding transverse openings in the washers *d e'* and switch-blades and through a perforated ear *f²* on the hub of the handle and abuts with its inner end against the front side of the innermost switch-blade D, as shown in Figs. 2 and 4. Each of the coupling-bolts F is arranged in one of the sleeves *f* and bears with its head against the rear side of the innermost switch-blade. Each of the washers *f'* is mounted on the outer end of a coupling-bolt between the screw-nut of this bolt and an adjacent perforated ear *f²*, projecting from the hub of the handle. The switch-lever is confined on the central insulating-sleeve C by a screw-nut *g*, arranged on the outer threaded end of the post and bearing against an insulating-washer *g'*, which in turn bears against the outer ends of the central sleeve C and the hub of the handle. The handle overhangs a guide-segment H, which is supported at its ends by posts *h* on the base. The handle is prevented from being pressed inwardly or toward the base by the main or body portion of the handle engaging against the outer side of the segment, and the handle is prevented from

being pressed outwardly or away from the base by a lip h', arranged on the inner side of the handle and overhanging the inner side of the segment, as shown in Fig. 5.

The switch-lever is yieldingly held in its adjusted position by a bolt or catch i, which is arranged in a socket in the handle and pressed toward the segment by a spring i'. The segment is provided in its outer edge with V-shaped notches i^2, adapted to receive the double-beveled head of the bolt. The latter holds the lever yieldingly in position on the segment, but allows the lever to be shifted by the application of sufficient force to release the spring-pressed bolt from the notch. The segment is provided at its ends with stops i^3, which limit the movement of the lever.

Upon turning the switch-lever each of its blades may be engaged with either of the contacts which are arranged around the pivot-post of the switch-lever or concentrically and in the same plane at right angles to the pivot-line of the switch-lever.

The switch represented in the drawings is more particularly designed for use in an electric-car-lighting apparatus, in which this switch is interposed between the generating-circuit and the battery and lighting circuits for the purpose of providing means whereby the attendant can connect the generating-circuit with one of the batteries and the other battery with the lighting-circuit and can alternate the battery connections or can cut out the generating-circuit and connect two batteries in multiple with the lighting-circuit and will also cut the field-circuit in cutting out the generating-circuit. For that purpose the base of the switch is provided with two multiple sets of battery alternating contacts, a multiple set of emergency-contacts, and also with field-contacts, which are arranged side by side with the battery-contacts. Each set of contacts consists of two groups arranged on diametrically opposite sides of the pivot-line of the switch-lever.

In the diagrammatic representation, Fig. 8, my improved switch is shown as applied to an electric-lighting system. R represents a dynamo; S, a resistance; T T', two storage batteries, and V a set of electric lamps or other electric translating device. One group of each set of battery alternating contacts consists of three like contacts K K' K^2, which are arranged side by side and at different distances from the switch-base. The inner and outer contacts K K^2 of this group are connected with the like poles of two storage batteries T T' by wires t t'. The intermediate contact K' is connected with the main line W, connecting with the opposite poles of both storage batteries. The opposite or companion group of each set of battery alternating contacts consists of an inner and an outer like contact K^3 K^4 and two intermediate contacts K^5 K^6. The latter are arranged edge to edge in the same plane circumferentially. The inner and outer contacts K^3 K^4 are connected, respectively, with one side of the generating-circuit by a wire r and with the service-circuit v by a wire v'. The intermediate contacts K^5 K^6 are connected, respectively, with the field-circuit by a wire X and the opposite side v^2 of the generating-circuit by a wire X'. The third set of contacts on the switch-base is designed for the purpose of connecting both storage batteries in multiple with the service-circuit and for breaking the field-circuit and armature or generating circuit in case of an emergency when the generator gets out of order. One group of emergency-contacts consists of an inner and an outer contact l l', which are connected with the like poles of the two storage batteries, respectively, by wires l^4 l^5. The other group of emergency-contacts consists of an inner and an outer contact l^2 l^3, which are connected with each other and with the service-circuit by a wire l^6.

Each of the several contacts above mentioned consists of a supporting-plate m and two inwardly-projecting spring-jaws m' m^2, which are secured to opposite sides of the plate by any suitable means—for instance, by solder and pins. The several contacts in each group of battery alternating contacts are separated from each other by insulating-washers n. A metallic binding-plate n' is interposed between the innermost contact of each of these groups and the base. The several contacts in each group of battery alternating contacts are connected with each other and with the base, but are insulated from one another by coupling-bolts o and insulating sleeves and washers o' o^2. Each insulating-sleeve passes through openings in the base, binding-plate, contact-plates, and insulating-washers of the same group, and its head bears against the adjacent washer o^2, which in turns bears against the supporting-plate of the outermost contact.

The emergency-contacts l l' are separated by a wide insulating-washer p. A metal binding-plate p' is interposed between the inner contact l and the base. These two contacts are connected with each other and with the base, but are insulated from each other by coupling-bolts p^2 and insulating sleeves and washers p^3 p^4. The emergency-contacts l^2 l^3 are separated from each other by a metallic washer q, and a metallic binding-plate q' is interposed between the inner contact l^2 and the base, whereby the emergency-contacts are both electrically connected with the binding-plate q'.

Upon turning the switch-lever so that its blades stand in line with either set of battery alternating contacts the innermost blade D engages between the jaws of the contacts K K^3, the outermost blade D^2 engages between the jaws of the contacts K^2 K^4, and the intermediate blade D' engages with one of its ends between the jaws of the contact K' and with its opposite end between the jaws of both contacts K^5 K^6, as represented in Figs.

1 and 2. In this position of the switch-lever the current from the dynamo is conducted to one of the batteries, the current from the other battery is conducted to the service-circuit, and the armature and field circuits are closed. Upon turning the switch-lever so that its blades connect the other set of battery alternating contacts the battery connections between the charging-battery and service-circuits are reversed in such manner that the battery formerly connected with the generating-circuit is now connected with the service-circuit, while the battery formerly connected with the latter is now connected with the generating-circuit, the generating and field circuits remaining closed, as before. Upon turning the switch-lever so that its blades stand in line with the emergency-contacts one end of the inner blade D engages between the jaws of the contact l and its opposite end between the jaws of the contact l^2, and one end of the outer blade D^2 engages between the jaws of the contact l' and its opposite end between the jaws of contact l^3, while the intermediate switch-blade is not engaged with any contact and is idle, as represented in Figs. 3 and 4. In this position of the lever both batteries are placed in parallel with the service-circuit and the generating and field circuits of the dynamo are broken.

In order to insure a close contact of each blade between the two members of a contact, the blade is made slightly thicker than the space between the two members of the contact, and the edges of the contacts and the blades are beveled or rounded to facilitate the entrance of the blade between the members.

In the position of the switch-lever shown in Fig. 8 its blades connect one set of alternating contacts, whereby one of the batteries is connected with the charging-circuit, the other battery is connected with the service-circuit, and the field-circuit of the generator is closed. When the switch is in this position and the dynamo-switch or contact-lever Y is in the position shown in Fig. 8, the current generated by the dynamo is distributed as follows: Commencing at the brush z on one side of the armature, the current passes successively through wire z', contact z^2, switch-lever contact y, contact z^3, and wire z^4 to binding-post s on one side of the resistance S, where the current divides. One part of the divided current passes from the binding-post s through wire r, upper contact K^3, switch-blade D, lower contact K, wire t', and enters battery T' from one side and charges the same. The current returns from the opposite side of battery T' through wire W, lower contact K', switch-blade D', upper contact K^6, wires X' v^2, contact z^5, switch-lever contact y', contact z^6, and wire z^7 to brush z^8 on opposite side of armature, thus completing the charging-circuit. The other part of the current from the dynamo passes from the binding-post s through the resistance S, binding-post s', wire v^3, contact v^4, switch-lever v^5, wire v, and enters the lamps from one side. The current returns from the opposite side of the lamps through wire W, lower contact K', switch-blade D', upper contact K^6, wires X' v^2, contacts z^5 y' z^6, wire z^7, and brush z^8, thereby completing one part of the service-circuit. The resistance is so proportioned that the pressure of the current from the dynamo after passing the resistance is somewhat less than the pressure of the previously-charged battery T, which causes this battery to discharge slightly, and the current so discharged passes from one side of the battery T through wire t, lower contact K^2, switch-blade D^2, upper contact K^4, and wire v' to binding-post s', where it joins the current from the dynamo on its way to the lamps, and returns by wire W to the opposite side of the battery T, thereby completing the other part of the service-circuit. The current for exciting the field-coils passes from the brush z through wire z', contact z^2, switch-lever contact y, contact z^3, wire x, field-contact x', field switch-blade x^3, field-contact x^3, wire X, including field-coils X^2, upper contact K^5, switch-blade D', upper contact K^6, wires X' v^2, contact z^5, switch-lever contact y', contact z^6, wire z^7, and brush z^8, thereby completing the field-circuit.

Upon turning the switch-blades D D' D^2 so that they engage with the other set of alternating contacts the current from the dynamo is distributed as follows: Commencing at brush z, the current passes successively through the wires z', contacts z^2 y z^3, and wire z^4 to binding-post s, where the current divides. One part of the current passes from binding-post s through wire r, lower contact K^3, switch-blade D, upper contact K, wire t, and enters the battery T from one side and charges the same. The current returns from the opposite side of the battery T through wire W, upper contact K', switch-blade D', lower contact K^6, wires X' v^2, contacts z^5 y' z^6, wire z^7, and brush z^8, thereby completing the charging-circuit. The other part of the current passes from binding-post s through the resistance S, binding-post s', wire v^3, contact v^4, switch-lever v^5, wire v, and enters the lamps from one side thereof. The current returns from the opposite side of the lamps through wire W, upper contact K', switch-blade D', lower contact K^6, wires X' v^2, contacts z^5 y' z^6, wires z^7, and brush z^8, thereby completing one part of the service-circuit. The current discharged from the battery T' passes through wire t', upper contact K^2, switch-blade D^2, lower contact K^4, and wire v' to post s', where it joins the dynamo-current on its way to the lamps, and returns by wire W to opposite side of the battery T'. The current for exciting the field-coils in this altered position of the switch passes from the brush z through wires z', contacts z^2 y z^3, wire x', contacts x' x^2 x^3, wire X, including field-coils X^2, lower contact K^5, switch-blade D', lower contact K^6, wires X' v^2, contacts z^5 y' z^6, and wire z^7 to brush z^8.

Upon turning the switch-lever into the position shown in Figs. 3 and 4 the connections between the dynamo and the batteries and the field-circuit are broken and the batteries are placed in parallel with the lamps. In this position of the switch-lever the current from one pole of battery T passes through wires $t\,l^4$, contact l, switch-blade D, contact l^2, and wires $l^6\,v$ to one side of the lamps and returns by wire W from the other side of the lamps to the opposite pole of the battery T. The current passes from one pole of battery T′ through wires $t'\,l^5$, contact l', switch-blade D^2, contact l^3, and wires $l^6\,v$ to one side of lamps and returns by wire W from opposite side of the lamps to the opposite pole of the battery T′.

I do not wish to claim in this application any invention or improvement which is claimed in another application filed by me November 20, 1899, Serial No. 737,570.

I claim as my invention—

1. The combination with the base provided with an insulating-pivot and with contacts arranged around the pivot, of a switch-lever mounted thereon and composed of a handle, switch-blades arranged side by side, connecting-bolts, insulating-washers separating the handle and the several blades, and insulating-sleeves surrounding the connecting-bolts, substantially as set forth.

2. The combination with the base and a switch-lever mounted on the base and provided with insulated switch-blades which are arranged different distances from the base, of a group of contacts arranged side by side at different distances from the base and composed of contacts each having projecting jaws, insulating-washers interposed between the contacts, a connecting-bolt, and an insulating-sleeve surrounding the bolt, substantially as set forth.

3. The combination with the base and the switch-lever rotatably mounted thereon and provided with a plurality of blades, of two sets of emergency-contacts, one set being composed of two contacts which are insulated from each other and the other set being composed of two contacts which are electrically connected, substantially as set forth.

4. The combination with the base and the switch-lever rotatably mounted thereon and provided with three blades which are insulated from one another, of groups of battery alternating contacts, each group being composed of three contacts which are insulated from each other and arranged in line with said switch-blades, and two groups of emergency-contacts, each composed of two contacts which are arranged in line with two of said switch-blades, substantially as set forth.

5. The combination with the base and the switch-lever rotatably mounted thereon and provided with a two-armed switch-blade, of a contact adapted to be engaged by one of said arms and two contacts arranged edge to edge in the same plane and adapted to be engaged by the other arm of the switch-blade, substantially as set forth.

6. The combination with the base and the switch-lever rotatably mounted thereon and provided with three blades arranged side by side, of a set of contacts composed of two groups, one group consisting of three contacts arranged side by side in line with the three switch-blades and the other group consisting of four corresponding contacts, two of which are arranged edge to edge in the same plane with one of the contacts of the opposing group, substantially as set forth.

Witness my hand this 13th day of November, 1899.

WILLARD F. RICHARDS.

Witnesses:

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