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1,476,013

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AUTOMATIC SWITCH

Filed March 8, 1920

2 Sheets-Sheet 1

Fig. 1.

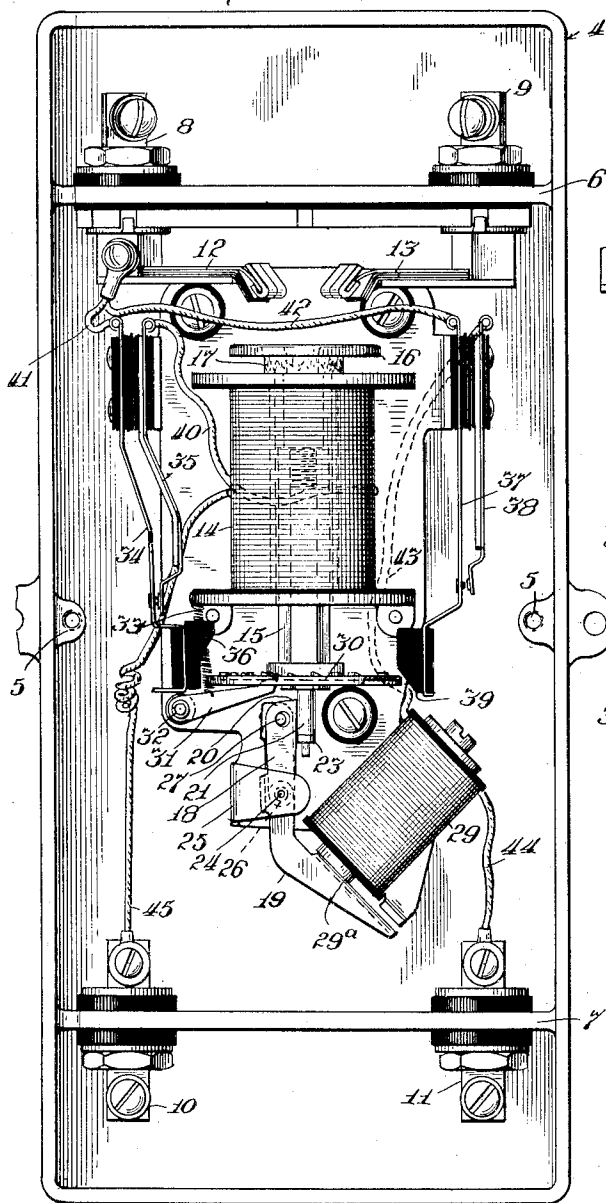
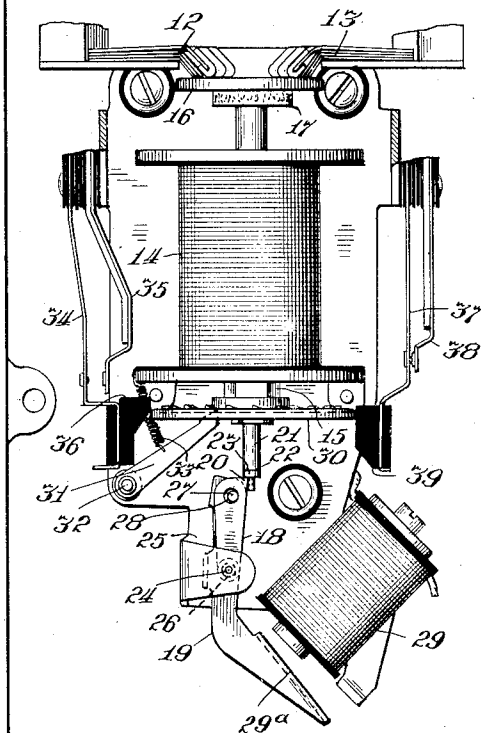


Fig. 2.



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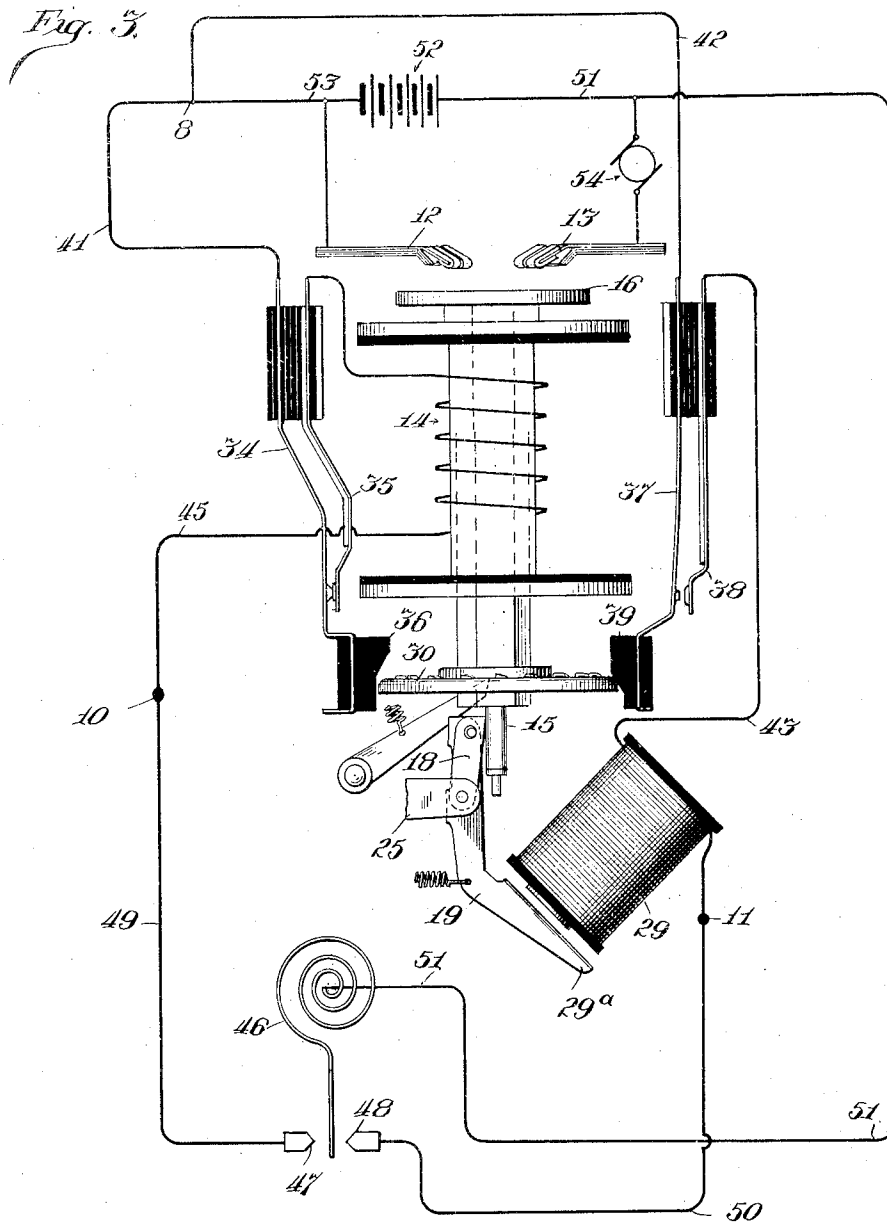
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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AUTOMATIC SWITCH.

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To all whom it may concern:

Be it known that I, FREDERICK C. HOLTZ, a citizen of the United States, and a resident of Springfield, in the county of Sangamon and State of Illinois, have invented certain new and useful Improvements in Automatic Switches, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to automatic electric switches used for controlling the turning on or off of lights, the starting or stopping of a motor; or in fact any cutting on or off of an electric circuit by control from one or more distant points, as by means of a thermostat, and has for its object to provide certain improvements in electric switches of the type employing a rotary solenoid operated plunger for closing the circuit between the lead wire terminals of the main circuit controlled by the switch. The nature of such improvements will appear from the description of my improved switch as illustrated in the drawings which form a part of this specification. What I regard as new will be pointed out in the claim.

In the accompanying drawings,—

Fig. 1 is a plan view of my improved switch in position in the case in which it is mounted, the parts being in the position they occupy when the main line circuit is broken;

Fig. 2 is a view of the switch showing the parts in the position which they occupy when the main line circuit is closed; and

Fig. 3 is a diagrammatic view illustrating the circuits in an arrangement employing thermostatic control.

Referring to the drawings,—4 indicates the main portion of the case without the cover, which is in the form of an oblong box of metal or other suitable material. The cover, which is not shown, is adapted to fit upon the side edges of the box and be secured in position and sealed in any suitable way, as by screws passing through lugs 5 at the sides of the box. In the construction illustrated the box is provided with two transverse ribs 6, 7 near its ends, to which are secured binding posts or terminals 8, 9 and 10, 11, respectively, as shown in Fig. 1. 12, 13 indicate spring contact brushes of any suitable type, which are secured to the terminals 8, 9, respectively. The main cir-

cuit is closed by connecting these brushes in the manner hereinafter described.

14 indicates a solenoid suitably mounted in the case 4 and provided with a core 15 which is movable upwardly by the energization of the solenoid coil 14 and drops by gravity to the position shown in Fig. 1 when the said coil is deenergized. At its upper end the core 15 carries a contact disc or head 16, which, when the solenoid core 14 is energized rises into engagement with the brushes 12, 13, as shown in Fig. 2, thereby connecting said brushes and establishing the main circuit. The core 15 is adapted to rotate in the coil 14 for the purpose of changing the points of contact between the brushes 12, 13 and the disc 16, this rotation being effected automatically by means which will be hereinafter described. 17 indicates a cushioning collar of any suitable material, which is fitted upon the core 15 above the coil 14 and below the disc 16, as shown in Figs. 1 and 2. Said collar serves to cushion the core when it drops upon the deenergization of the coil 14.

When the contact disc 16 is raised to its operative position shown in Fig. 2 it is held up in such position by means of a dog 18 carried by a rocking arm or lever 19, said dog being provided with a sharp corner 20 which is adapted to intercept the lower end of a depending rod or stem 21 which projects from the lower end of the core 15. As shown in Figs. 1 and 2, the lower end of said stem is reduced to form a shoulder 22, and preferably a hardened collar 23 is tightly fitted upon the reduced lower end of said stem to take the wear. It will be apparent that when the dog 18 underlies the collar 23 the core 15 will be locked against descent, but by rocking the arm 19 in a counterclockwise direction as viewed in the drawings, the dog 18 will be moved out of engagement with said collar, thereby permitting the core 15 to drop. The arm 19 is mounted upon a pivot 24 fitted in a suitable bracket 25, and a coiled spring 26, shown in dotted lines in Figs. 1 and 2, is mounted on the pivot 24 and connected with the arm 19 so that it tends to rotate said arm in a clockwise direction, or in other words to move the dog 18 into operative position. In order to secure a percussive action on the dog 18 when the arm 19 is actuated to release the core 15, the dog 18 is

pivoted at its lower end upon the pivot 24, and near its upper end is loosely connected with the outer portion of the arm 19 by a pin 27 carried by said arm and extending loosely into a perforation 28 in said dog, as clearly shown in Figs. 1 and 2. It is evident that when the parts are in the position shown in Fig. 2, if the arm 19 be rocked in a counterclockwise direction the pin 27 will be permitted to move slightly independently of the dog 18 so that the arm can get under way before it acts to move said dog out from under the collar 23. When, therefore, the pin 27 strikes the left hand side of the perforation 28 it will act percussively upon the dog, and, therefore, will be more effective in moving it out of operative position.

The trip arm or lever 19 is arranged to be rocked in opposition to the spring 26 by an electro-magnet 29, the armature 29^a of which is carried by the lower arm of said trip lever, as shown in the drawings. Therefore, when the magnet 29 is energized the trip lever 19 will be rocked to release the solenoid core 15 and permit it to drop. When the solenoid core is in its lowermost position the dog 18 will bear against the side of the stem 21 under the action of the spring 26, and as soon as the core 15 moves up to its operative position said spring will act to move the dog 18 under the collar 23, as illustrated in Fig. 2.

The contact disc 16 is rotated step by step whenever the core drops, this being accomplished by means of a ratchet disc 30 secured upon the core 15 near its lower end in position to be engaged by a pawl 31 which is mounted on a pivot 32 carried by the bracket 25 and extends under the disc 30 into position to engage the teeth of said disc. Preferably the teeth of said disc are formed by perforating it around its margin so that the operating end of the pawl 31 may engage successive perforations. Said pawl is provided with a spring 33 which is connected with the solenoid and with said pawl, so that it tends to swing its outer end upward, as shown in Fig. 2, and it will, therefore, be apparent that when the disc 30 is carried upward with the core 15 the dog 31 will follow it up and engage one of its teeth. When the core drops the pawl 31 will swing to a more nearly horizontal position, with the result that the disc 30 will be rotated to a slight extent owing to the change in the angular position of the pawl. When the core is again raised the pawl will move into engagement with the next tooth of the disc 30 so that when the core again drops the disc will be rotated another step. By this means, the points of contact between the contact disc 16 and the contact brushes 12, 13 are changed by each actuation of the switch.

It is desirable that current be supplied to the solenoid coil 14 or the electro-magnet 29

only during the instant when a change in the main circuit is effected. To this end two auxiliary switches are provided, one of which is normally closed when the contact disc 16 is out of operative position, and the other of which is normally open at that time, both these switches being arranged to be reversed when said contact disc is moved into operative position. The first of these switches comprises spring members 34, 35 which are normally in contact with each other, but which may be separated by moving the member 34 laterally, as illustrated in Fig. 2. The member 34 carries a tapered block 36 of insulating material which lies opposite the margin of the disc 30 and is so arranged that when said disc is in its lowermost position the member 34 will remain in contact with the member 35. When, however, the disc 30 is moved upward by the energization of the coil 14 said disc engages the thicker portion of the block 36 and moves the member 34 away from the member 35, thereby breaking the contact between them. The other switch, which is preferably at the opposite side of the disc 30, also comprises two spring contact members 37, 38, which as shown at the right in Fig. 2, are normally separated, but are arranged to be brought into contact with each other by a movement of the member 37 to the right, as illustrated in Fig. 2. The member 37 carries a tapered insulating block 39 which lies opposite the margin of the disc 30 in such position that when said disc is moved upwardly it will move the member 37 to the right and make contact between it and the member 38. The latter auxiliary switch controls the circuit to the trip magnet 29 while the former controls the circuit to the solenoid coil 14. To this end the member 35 is connected by wire 40 with one end of the solenoid coil 14, while the member 34 is connected by wire 41 with the terminal 8. The member 37 is connected by a wire 42 with the terminal 8, and the member 38 is connected by a wire 43 with one end of the coil of the magnet 29. The other end of the coil of said magnet is connected by a wire 44 with terminal 11, and the other end of the coil of the solenoid 14 is connected by a wire 45 with terminal 10.

For better illustrating the circuits, in Fig. 3 I have shown a diagram in which my improved switch is illustrated as installed for thermostatic control, 46 indicating the swinging contact member of the thermostat, and 47, 48 two stationary contacts between which the member 46 extends so that it may make contact with one or the other. 49 indicates a wire connecting the terminal 10 with the contact member 47, and 50 indicates a wire connecting terminal 11 with contact member 48. 51 indicates a wire connecting the member 46 with a source of

current 52, which, in the diagram, is indicated as in the form of a battery, but may be provided in any other suitable way.

The terminal 8 is also indicated as connected by wire 53 with the other side of the battery 52. A translating device such as lights or a motor 54 is connected between the battery or other source of current and one side of the main switch contacts; that is between the line, represented by battery 52, and contact 13. The motor 54 is thus energized when the circuit is closed between contacts 12 and 13 by plate 16, and is stopped when this circuit is opened.

It is clear that when the parts are in the position shown in the diagram, since the thermostat member 46 is out of contact with both contact points 47, 48 the solenoid coil 14 and the electro-magnet 29 will both be deenergized. When, however, the member 46 engages the contact 47 the circuit will be closed through the solenoid coil 14 since the switch members 34, 35 are in contact, but if the thermostat member 46 engages contact 48 electro-magnet 29 will not be energized as the circuit is broken at switch members 37, 38. Assuming therefore, that the circuit is closed through contact members 46, 47 the energization of solenoid coil 14 will cause the core 15 to rise, thereby closing the main circuit through brushes 12, 13, breaking the circuit through switch members 34, 35 and moving switch members 37, 38 into contact with each other. This will deenergized solenoid coil 14, but electro-magnet 29 will not be energized as the circuit through it remains broken at contacts 46, 48. When, however, the action of the thermostat brings contact 46 into engagement with con-

tact 48 the magnet 29 will be energized by reason of the fact that contacts 37, 38 are in engagement with each other, and consequently the latch mechanism which holds up the core 15 will be tripped, permitting said core to drop. As soon, however, as said core drops the contact between members 37, 38 will be broken. It will be seen, therefore, that solenoid coil 14 and magnet 29 are energized only momentarily whether the main circuit be open or closed.

By the construction described both the self-closing switch 34, 35 and the self-opening switch 37, 38 are opened or closed, as the case may be, by the comparatively powerful solenoid coil 14 so that the only work performed by the trip magnet 29 is that of tripping the latch mechanism to release the core 15, thus making it practicable to use a lighter construction and insuring the proper operation of the different parts of the mechanism.

What I claim as my invention and desire to secure by Letters Patent, is—

An electric switch comprising a solenoid, a rotatable core movable longitudinally therein, a ratchet disc secured to and moving with said core, a rocking pawl mounted on a stationary support adjacent to said disc and operatively engaging the same, said pawl being arranged to effect the rotation of said disc when said core is moved longitudinally in one direction, and a spring connected with the solenoid and with said pawl for holding said pawl in operative engagement with said disc notwithstanding longitudinal movement of said core.

FREDERICK C. HOLTZ.