No. 647,492. Patented Apr. 17, 1900.

P. HOFFMANN.

ELECTROMAGNETIC SWITCH ARRANGEMENT.

(Application filed Dec. 5, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

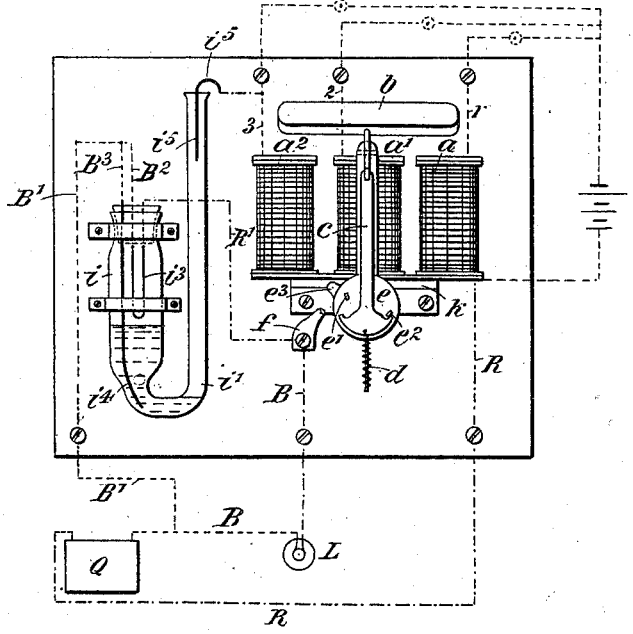

Fig. 2.

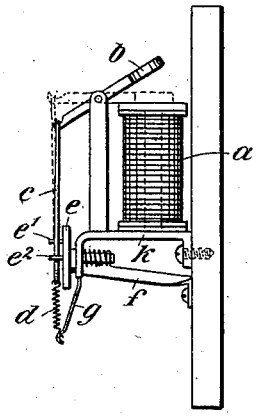

Fig. 3.

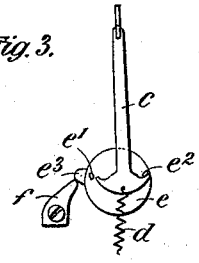

Fig. 4.

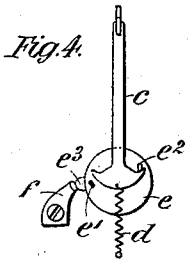

Fig. 6.

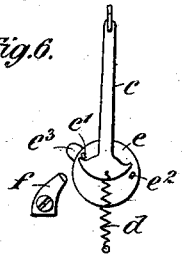

Fig. 5.

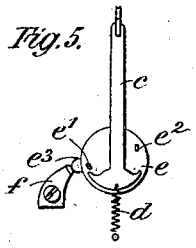

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Fig. 7.

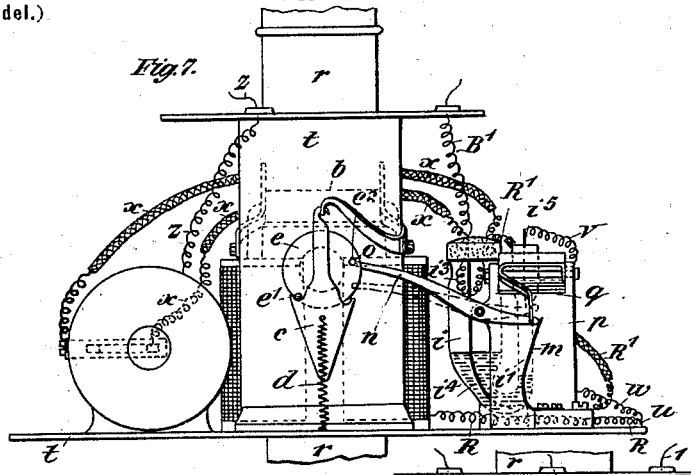

Fig. 8.

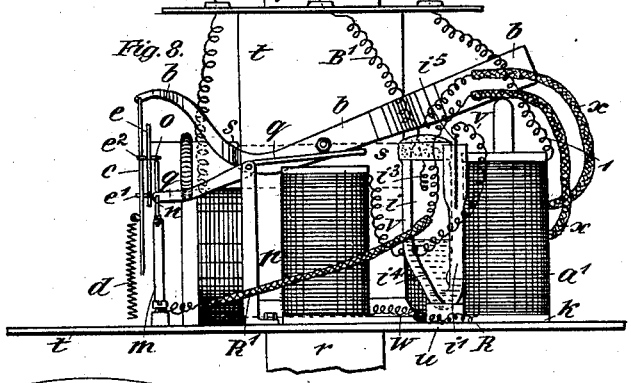

Fig. 9.

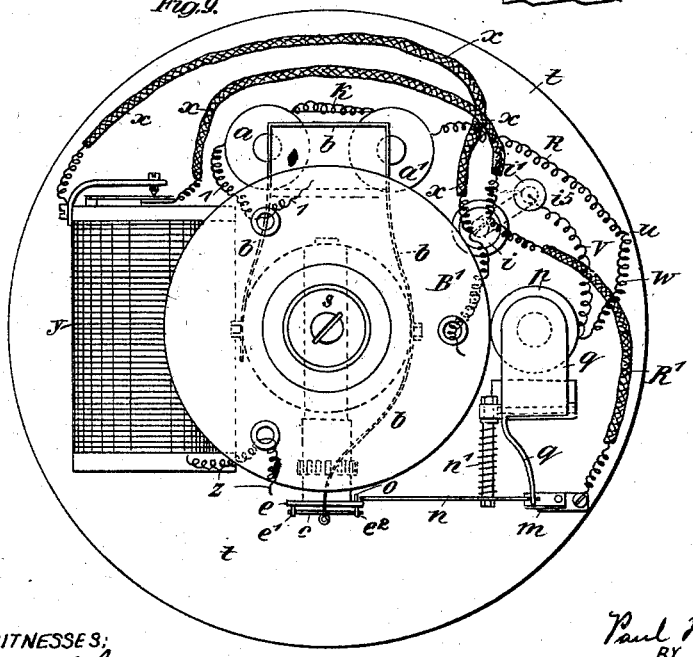

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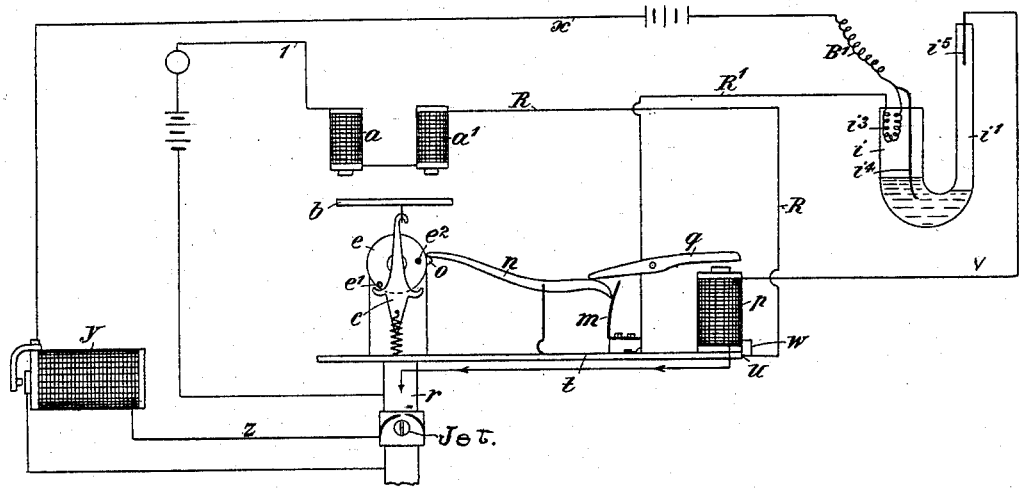
Fig. 10.



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UNITED STATES PATENT OFFICE.

PAUL HOFFMANN, OF CHARLOTTENBURG, GERMANY.

ELECTROMAGNETIC SWITCH ARRANGEMENT.

SPECIFICATION forming part of Letters Patent No. 647,492, dated April 17, 1900.

Application filed December 5, 1899. Serial No. 739,301. (No model.)

To all whom it may concern:

Be it known that I, PAUL HOFFMANN, a subject of the Emperor of Germany, residing at Charlottenburg, near Berlin, in the Empire of Germany, have invented certain new and useful Improvements in and Connected with Electromagnetic Switch Arrangements, of which the following is a specification.

My invention relates to an electromagnetic switch arrangement in which by the successive excitations of a single electromagnet an electric current to be used for any work or a mechanical reversing device—for instance, a gas-valve—is alternately closed or opened, whereby the opening may be effected either by hand or, if the opening by hand has not taken place within a certain time, automatically. The latter effect is obtained simultaneously with the opening of the working current or of the mechanical reversing device switching in an electric heating-current, by the heating action of which a contact liquid is expanded, which after a certain time closes a current running through the coil of the electromagnet, so that the latter is energized. From United States Patents No. 548,904, dated October 29, 1895, granted to F. B. Badt, and No. 276,286, dated April 24, 1883, it is already known how to close, by means of the expansion of a conducting liquid by heat, a current through a switch electromagnet which interrupts the working current. In the present application the novelty consists in the employment of this arrangement above referred to in combination with the electromagnet alternately effecting the switching in or out, so that by the most simple means a switch device is obtained which may be used not only for switching an electric working current, but also for switching mechanical reversing devices, and which therefore is particularly applicable to stair-lighting arrangements, kindling gas-flames from a distance, and like purposes, where a current is to be switched in only for a short time and then again to be switched out—or, for instance, a gas-cock is to be opened for a short while and then again to be closed.

In order to enable others skilled in the art to which my invention appertains to make and use the same, I will now proceed to describe its construction and operation.

Referring to the drawings which form a part of this specification, Figure 1 illustrates a front elevation of this electromagnetic switch arrangement. Fig. 2 shows a side elevation of the electromagnet and its appurtenances. Figs. 3 to 6 represent a part of the switch arrangement in different positions. Fig. 7 illustrates a side elevation of a modified arrangement of the switch for gas-lighting. Fig. 8 shows a side elevation of the same, taken at a right angle to Fig. 7. Fig. 9 is a top view, and Fig. 10 is a diagrammatic view.

k is the body or core of the electromagnet, which carries one or more coils a a' a^2, Fig. 1, and b is the armature or keeper of the same. The latter carries on its free end a double hook c, by means of which a revolving disk e, provided with two pins e' and e^2, is set in alternate rotary motion—that is to say, in opposite directions. The revolving disk e is provided with a contact-piece e^3, and beside the said disk a contact-spring f is fixed to the framework. The latter is connected with the one branch B of the working-current lines, and the contact-piece e^3 has connection, through the disk e and the body k, with the other returning branch R of this working-current line, the source of which is Q, and in which, for instance, an electric lamp L (or several such lamps) may be put in. 1 2 3 are the conveying-lines to the coils of the electromagnet-bobbins, which may be fed by the same source of current. The return-lines of these circuits are jointed with the body k, and thereby with the common return-line R.

From the working line B another line B′ is branched off, which is again branched into two lines B^2 and B^3. The one line, B^2, leads to a glow-thread i^3, being arranged within the wider i of two legs of a mercury-bulb, the return-line R′ of which being connected with the contact-spring f, so that it finds connection, through the disk e and the bracket k, with the return-line R. The second line, B^3, leads to a wire i^4, arranged within the leg i of the mercury-bulb, reaching almost closed to the bottom of the latter. On the top of the other leg i' of the mercury-bulb a wire i^5 is arranged, being connected with the conveying-line of one of the three coils of the electromagnet—say with the line 3.

In using the switch arrangement for the lighting of staircases I put, for instance in the circuit 1 of the first bobbin of the electromagnet, a contact (push-button, door-contact, or the like) placed below-stairs, in the circuit 2 of the second bobbin a contact placed farther upstairs—say in the first story—and in the circuit 3 of the third bobbin a contact placed still farther upstairs—say in the second story. If one intends to ascend the stairs, he actuates the lowest contact, (or it will be actuated automatically by the opening of the street-door.) Hereby the circuit 1 will be closed, the electromagnet-bobbin a excited, and the keeper b attracted. The double hook c moves upward, lifts the right pin e^2 of the disk e, and rotates the disk e to the left. At this rotary motion of the disk e the double hook c swings a little to the right, so that the other pin e', which is traveling downward, may pass by the hook. (See Fig. 3.) At the upper position of the double hook, Fig. 4, the contact-piece e^3 is in contact with the contact-spring f, so that the circuit B R of the lamp or lamps L will be closed and the latter be lighted. At the same time the circuit B' B^2 i^3 R' R is closed and the glow-thread i^3 is made incandescent, so that it radiates heat. As soon as the electromagnet loses its magnetic force by the release of the push-button or opening of the circuit-closer, whether it be a push-button or other device, a spring d pulls the double hook c back into the lower position, as will be seen from Fig. 5. In having arrived at one of the upper-contact push-buttons (either at that one arranged within the line 2 or at that one arranged within the line 3) it may be actuated, whereby the bobbin a' or a^2 becomes excited and the keeper b is again attracted. Now the double hook, again arising, lifts the left pin e' of the disk e and rotates the latter to the right, thus moving the contact-piece e^3 off the contact-spring f, as represented by Fig. 6, so that the circuits B R and B' B^2 i^3 R' R will be interrupted, the lamp or lamps L will extinguish, and the glow-thread i^3 ceases to glow.

If one has not extinguished the lamp by actuating the contacts, the lamp or lamps will be extinguished automatically after a certain time, as the incandescent thread i^3 heats the air or gases above the mercury within the leg i of the mercury-bulb, so that the heated air or gases expand and force the mercury into the other leg i'. As soon as the mercury has risen within the latter to such a height that it reaches the wire i^5 connection will be had between the wires i^4 and i^5, whereby the circuit B' B^3 i^4 i^5 3 and return-wire R are closed and the electromagnet-bobbin a^2 becomes excited, the keeper b is attracted, the contact f e^3 interrupted, and the lamp or lamps extinguished. Together with the extinguishing of the lamps the glow-thread i^3 ceases to glow. Therefore the gases above the mercury within the leg i contract, whereby the mercury falls again within the leg i' and interrupts the connection between i^4 and i^5. On the other hand, one is enabled in passing downstairs to first light the lamp or lamps by means of one of the upper switches and afterward to extinguish the lamp or lamps by one of the lower switches, or the lamp may be extinguished automatically by the safety-extinguisher.

Instead of employing the circuit B (working current) for lighting purposes it may also be advantageously employed for other purposes—for instance, for lighting gas-jets from a distance—and the rotation of the disk e may be used directly for actuating a mechanical reversing device, (gas-valve or the like,) in which case the working current B is dispensed with. In order to light, for example, the gas-lamps of a chandelier or the like by means of the described switch device from any distant point, this device is mounted on a bracket t, Figs. 7 to 9, secured to the gas-pipe r, preferably close to the ceiling. k is, again, the body or core of the electromagnet, which has two (or another number) of bobbins a a'; b, the armature or keeper of the electromagnet; c, the double hook; d, the spring of the latter; e, the revolving disk, fixed to the spindle of the gas-cock s and provided with pins e' e^2; i i', the mercury-bulb, consisting of two legs; l, the conveying-line to the bobbins a a' of the electromagnet, and R the return-line of the same. This return-line is connected at u to the conducting-bracket t and the current is led back through this bracket and the gas-pipe r. B' is the conveying-line to the heating-wire i^3 and conducting-wire i^4, both located within the leg i of the mercury-bulb. The return-line R' of the heating-wire i^3 leads to a contact-spring m, forming contact with a double-armed lever n. The latter is situated in the reach of a pin o, being secured to the back side of the disk e and which lies directly back of the position of the pin e^2. The return-line v of the contact-wire i^5, located on the top of the leg i' of the mercury-bulb, leads to the coil of a special electromagnet p, the keeper q of which being connected with the contact-lever n. w is the return-line of the coil of the electromagnet p, being also connected at u to the bracket t. From the line B' a line x is still branched off, which leads to an induction-bobbin y and from this bobbin back again to the return-line R'. The induced current produced in the coil of the induction-bobbin by exciting the line x runs through the line z to the gas-lamps, which will be kindled by the sparks of this induced current.

The position of the disk e shown in Fig. 7 corresponds with the open position of the gas-cock s. At this position of the disk the contact-lever n has been lifted by the pin of the disk e and its other end forms contact with the spring m. Therefore the heating-current is switched in through B' i^3 R' m n. The return-line of this heating-current is effected through the bracket of the lever n, the bracket

t, and the gas-pipe r. Simultaneously with the heating-current the induction-bobbin y has been switched in by the line x, and the induced current will effect the kindling of the gas-flames. By the action of the heating-current the current through the wires i^4 i^5 will then be closed, so that the electromagnet p put in this circuit attracts its keeper q, which latter lifts the contact-lever n on its outer end and brings the same out of contact with the spring m, as will be seen from the dotted position of the lever n, Fig. 7, whereby the switching out of the heating-current and of the induction-bobbin will be effected. At the next excitation of the electromagnet k a a' the rotation of the disk e will take place in opposite direction, as above mentioned, whereby the gas-valve s will be closed and the lamps be extinguished. During this movement the pin o of the disk e passes by the lever n, which has the position shown by dotted lines. The lever n is enabled by reason of its jointed connection with the keeper q to yield a little downward to let pass by the pin o, and then by the action of a weak spring n', Fig. 3, mounted upon its bracket, swings back in the dotted position. The pin o is now again below the lever n to lift it again by its next rising. In the upper position the lever n is held by its engagement with the contact-spring m.

It will be seen that although the heating-circuit in Fig. 1 effects the second operation of the main magnet and puts out the light, while in Figs. 7, 8, and 9 the heating-circuit does not act to put out the light, but simply cuts out the sparking-coil, both forms have features in common in that the heating-current reacts upon or affects the condition of the lighting medium, and this term "lighting medium" is chosen to include the light in Fig. 1 or the gas-cock and sparking-coil in Figs. 7, 8, and 9.

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

1. In combination, an electromagnet with its armature, a device controlled by said armature, a circuit having means adapted to be heated by the passage of a current, said circuit being closed when said device is operated a contact adapted to be closed upon the generation of heat, said contact controlling a connection to the electromagnet to energize the same a second time and thus reverse the action of the device controlled by the movement of the armature, substantially as described.

2. In combination, a lighting medium, an electromagnet with its armature, means controlled by the movement of the armature for controlling the lighting medium, circuit connections, means therein to be heated by the passage of the current automatically when the light is lighted, a contact to be closed upon the generation of heat and circuit connections leading from said contact, the passage of the current through said connections effecting a change in the condition of the lighting medium, substantially as described.

3. In combination, a lighting medium, comprising a gas-cock and a sparking-coil, an electromagnet and armature, devices controlled by said armature for the turning on the gas and lighting the same, circuit connections, a heating device therein adapted to be heated by the passage of the current through said connections when the armature is operated, a contact arranged to be closed by the generation of heat, a circuit connection leading therefrom, a special electromagnet in said circuit connection, an armature for said special electromagnet, said armature effecting the cutting out of the sparking-coil and the heating-current, substantially as described.

4. In combination, an electromagnet, its armature, a disk, a double hook adapted to engage pins on the disk, a spring for retaining the hook and armature, a contact and lighting medium controlled by the disk, a heating-circuit, and means controlled thereby for effecting a change in the condition of the lighting medium automatically, substantially as described.

5. In combination, an electromagnet, its armature, a lighting medium and contact controlled by said armature, a heating-circuit controlled by said contact and means controlled by the heating-circuit for effecting a change in the condition of the lighting medium, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

PAUL HOFFMANN.

Witnesses:
WOLDEMAR HAUPT,
WILHELM BEER.