(No Model.)

E. T. GREENFIELD & C. S. BRADLEY.

SWITCH AND INDICATOR FOR ELECTRIC LAMPS.

No. 260,562. Patented July 4, 1882.

Fig. 1.

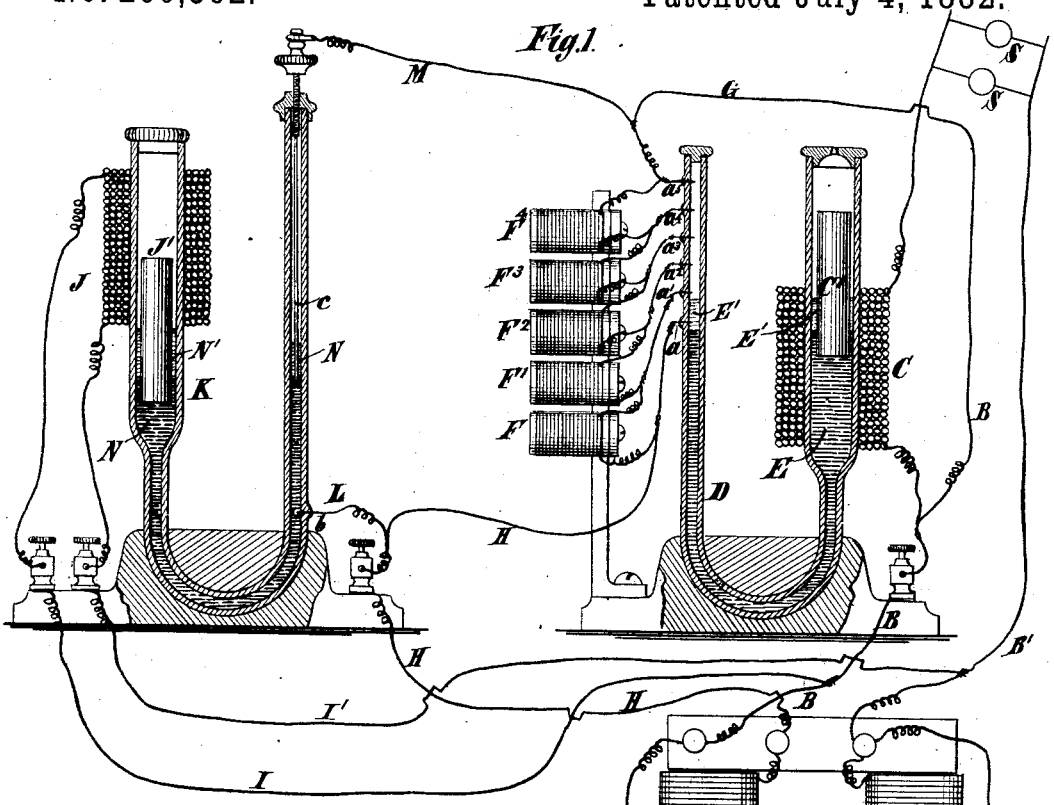
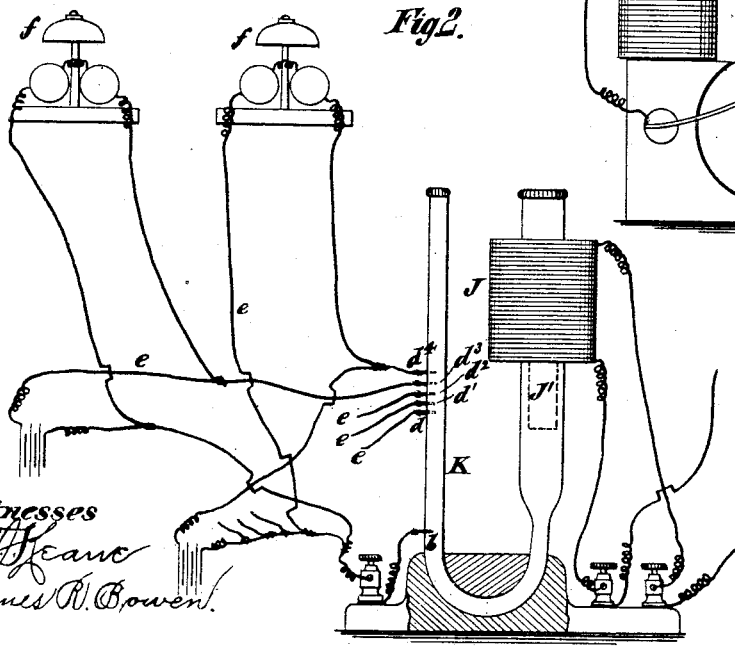


Fig. 2.



Witnesses
H. Keane
James R. Bowen.

Inventors
E. T. Greenfield
C. S. Bradley
By their Atty
Edwin H. Brown.

UNITED STATES PATENT OFFICE.

EDWIN T. GREENFIELD, OF BROOKLYN, AND CHARLES S. BRADLEY, OF NEW YORK, ASSIGNORS OF ONE-THIRD TO SIGMUND BERGMANN, OF NEW YORK, N. Y.

SWITCH AND INDICATOR FOR ELECTRIC LAMPS.

SPECIFICATION forming part of Letters Patent No. 260,562, dated July 4, 1882.

Application filed March 22, 1882. (No model.)

To all whom it may concern:

Be it known that we, EDWIN T. GREENFIELD, of Brooklyn, in Kings county, and the State of New York, and CHARLES S. BRADLEY, of New York, in the county and State of New York, have invented a certain new and useful Improvement in Switches and Indicators for Electric Lamps, of which the following is a specification.

The object of our improvement is to produce a device which will automatically indicate that one of a number of electric lamps which are arranged in a circuit has gone out; also, to produce a switch which will automatically introduce into a circuit a resistance which, when a lamp goes out, will obviate any detrimental effect on the other lamps.

Our improvement consists in an electro-magnetic switch composed of a tube having two legs and containing mercury or analogous liquid, a helix or solenoid surrounding one leg of the tube, a core for the helix or solenoid contained in this leg of the tube, and contact-points accessible to the mercury or other liquid, the helix or solenoid serving to control the position of the mercury or other liquid with reference to the contact-points, so that the switch will be operated by the electric current passing through the helix or solenoid.

It also consists in the combination, with a dynamo-electric machine employed to supply a current of electricity to electric lamps, of an electro-magnetic indicator consisting of a tube having two legs and containing mercury or analogous liquid, a helix or solenoid surrounding one leg of the tube, a core for the solenoid contained in this leg of the tube, and contact-points accessible to the mercury or other liquid; also, in the combination, with the above, of a series of resistance coils or devices and an electro-magnetic switch for throwing them into the circuit as they are needed.

In the accompanying drawings, Figure 1 is a diagram illustrating an apparatus embodying our invention, and Fig. 2 is a view of a modification of a portion of the apparatus.

Similar letters of reference designate corresponding parts in both figures.

A designates a dynamo-electric machine of any approved kind. It is employed here as a generator of an electric current for a number of electric lamps.

B B′ designate the line-wires from the dynamo-electric machine to the electric lamps. They are connected with the brushes of the machine. The electric lamps are designed to be arranged according to the multiple-arc system in this example of our invention. Two arbitrary representations of lamp thus arranged are given in Fig. 1, and are marked S.

The line-wire B is connected with the coils of a helix or solenoid, C, which forms part of our automatic switch. This helix or solenoid surrounds one leg or upright portion of a tube, D, of glass or other suitable material. The core C′ of the helix or solenoid is arranged in this leg of the tube and floats in mercury E, which is contained in said tube. The right leg of the tube, with which the helix or solenoid and its core are combined, is diametrically larger than the remainder of the tube. The other leg of the tube has applied to it a number of resistance coils or devices, F F′ F^2 F^3 F^4, which are connected together and are severally connected with contact-points a a' a^2 a^3 a^4 a^5, which extend through the leg into the interior thereof. Each one of these resistance-coils is to act in conjunction with any desired number of electric lamps—say, for example, five. A wire, G, extends from the wire B to the upper contact-point, a^5, and a wire, H, extends to the lower contact-point, a, from one end of one of the coils of the field-magnets of the dynamo-electric machine. The corresponding end of the other coil of the field-magnets is connected to the line-wire B′. When the helix or solenoid C attracts its core C′ and draws it downward it displaces from the right leg of the tube a certain amount of mercury and forces the same into the left leg. When the mercury rises to or above the contact-point a it cuts out one or more of the resistance-coils F F′,

&c., because then the contact-point is continued through the mercury from the contact-point *a* to the one above it, which the mercury reaches. When the mercury reaches the top contact-piece, a^5, all the resistance-coils are cut out. When the helix or solenoid becomes weakened its core rises and the mercury in the left leg descends and one or more of the resistance-coils are introduced again. Thus a resistance is introduced into the field of the dynamo-electric machine and the current generated by said machine is correspondingly reduced. The tube, its mercury, the helix or solenoid, its core, and the contact-points therefore constitute an automatic electro-magnet switch.

From the line-wires B B′ wires I I′ extend to a helix or solenoid, J, surrounding one leg of a tube, K, similar to the tube D, before described. The core J′ of the helix or solenoid of the tube K floats in the mercury N in the larger left leg of the tube. A wire, L, leads from the wire H to a contact-point, *b*, which extends into the right leg of the tube K and into the mercury therein.

The right leg of the tube is provided with an adjustable contact-piece, *c*, which is screwed into a cap fitted to the upper end of the said leg, so that it may be adjusted up and down in the said leg at pleasure. A wire, M, connects the wire G with the adjustable contact-piece *c*, and preferably has a swiveling connection with the latter, so as not to interfere with its adjustment; but contact may be made in any other suitable manner.

The helix or solenoid J, when sufficiently energized, draws up its core J′ and allows the mercury in the left leg to leave the contact-piece *c*. As it becomes weakened it allows the core to descend and force the mercury up into the right leg. When the dynamo-electric machine is started an electric current passes along the wire H to the wire L, thence to the contact-point *b*, thence through the mercury N in the tube K, thence to the contact-point *c*, thence along the wire M to the wire G, and from the latter to the line-wire B. As soon as the current passing along the line-wires B B′ becomes sufficiently powerful the helix or solenoid J draws up its core J′, and the mercury falls in the right leg of the tube K, and breaks contact with the contact-point *c*. The circuit then proceeds along the wire H to the contact-piece *a* of the first resistance-coil F, thence through all the resistance-coils or through the mercury E in the tube D and more or less of the resistance-coils, and thence along the wire G to the line-wire B.

The tube K, with its mercury N, the helix or solenoid J, its core J′, and the contact-points *b c*, forms an automatic switch, and one which cuts out the resistance-coils when the dynamo-electric machine is starting. It also is an indicator, for when the mercury N is not in contact with the contact-piece *c* it shows that the resistance-coils are in circuit, and that the electric lamps are being cared for by the other switch. This indicator may be made to operate an electro-magnetic bell, if desirable.

In Fig. 2 we have shown the switch K J J′ modified for use without the switch D E C C′. It has the contact-piece *b*, as before, but in lieu of the adjustable contact-point *c* it has a series of contact-points, *d d′* d^2 d^3 d^4. Each of the latter forms, with the contact-piece *b*, a local circuit, provided with a battery, *e*, and an electro-magnet bell *f*.

Each local circuit consists of wires extending directly from the battery to the coils of the electro-magnets of the bell and wires leading from the former, one to contact-point *b* and the other to one of the contact-points *d d′*, &c. When the mercury closes the circuit between the contact-points the bells will not be operated; but when the mercury recedes from any of the contact-points *d d′*, &c., the bell of the circuit from whose contact-point the mercury receded will be rung, because the electric current from the battery of that circuit will then pass solely through the wires that connect the battery directly with the coils of the electro-magnet of the bell. When the bell is thus rung by the indicator it is the duty of the attendant to switch in a resistance coil or device. He should introduce resistance devices until the bells have stopped ringing. In this example of our invention the tube K, mercury N, helix or solenoid J, core J′, and contact-points also act as a switch.

It will be seen that by our invention we produce a very simple switch and indicator. Preferably we employ in the tubes D K alcohol E′ N′ or other suitable liquid which will prevent the oxidation of the mercury. The switches and indicators which we have described may be arranged in a house or public building, as well as in a central office, from which a number of electric lamps are controlled.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The electro-magnet switch consisting of the tube containing mercury or analogous liquid, the helix or solenoid, the core therefor, and contact-points accessible to the mercury or other liquid, substantially as specified.

2. The combination, with a dynamo-electric machine employed to supply a current of electricity to electric lamps, of an electro-magnetic indicator consisting of the tube containing mercury or analogous liquid, the helix or solenoid, the core therefor, and contact-points accessible to the mercury or other liquid, substantially as specified.

3. The combination, with a dynamo-electric machine employed to supply a current of electricity to electric lamps, of a series of resistance coils or devices, an electro-magnetic switch, and an electro-magnetic indicator consisting of the tube containing mercury or analogous liquid, the helix or solenoid, the core

therefor, and contact-points accessible to the mercury or other liquid, substantially as specified.

4. The electro-switch consisting of the tube containing mercury or analogous liquid and alcohol or other suitable insulating and non-oxidizing liquid above the same, the helix or solenoid, the core therefor, and the contact-points accessible to the mercury or analogous liquid, substantially as specified.

E. T. GREENFIELD.
C. S. BRADLEY.

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T. J. KEANE,
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