No. 652,634. Patented June 26, 1900.

H. N. POTTER.

AUTOMATIC HEATER OPERATING DEVICE FOR LAMP CIRCUITS.

(Application filed Aug. 9, 1899.)

(No Model.)

Fig. 1

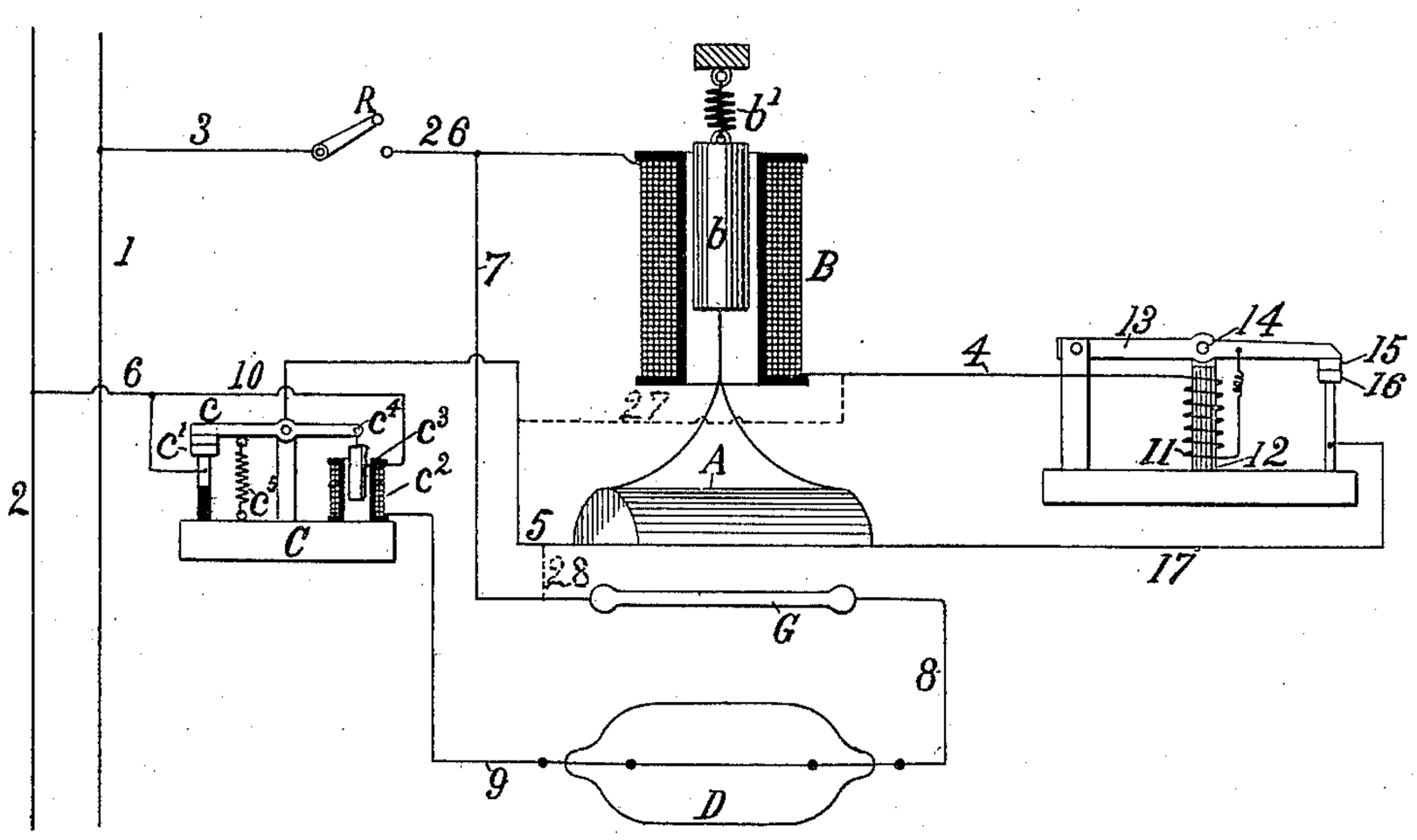


Fig. 2

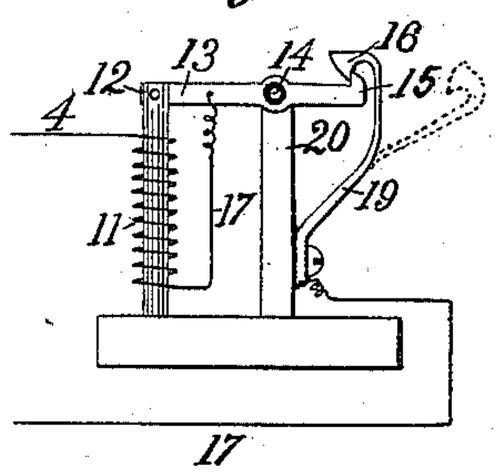
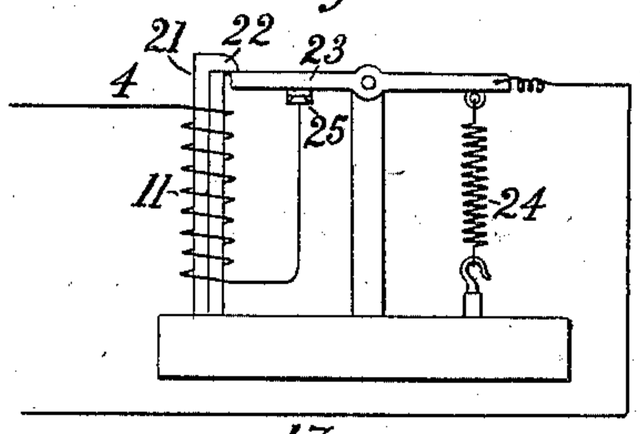


Fig. 3



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UNITED STATES PATENT OFFICE.

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AUTOMATIC HEATER-OPERATING DEVICE FOR LAMP-CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 652,634, dated June 26, 1900.

Application filed August 9, 1899. Serial No. 726,619. (No model.)

To all whom it may concern:

Be it known that I, HENRY NOEL POTTER, a citizen of the United States of America, and a resident of Göttingen, Germany, have invented certain new and useful Improvements in Automatic Heater-Operating Devices for Lamp-Circuits, of which the following is a specification.

My invention relates to the class of apparatus employed for imparting the necessary initial temperature to glowers of that class of electric lamps in which the glower is a non-conductor of electricity when cold and becomes conductive when heated to a proper temperature. Heretofore it has been customary to locate an electric heater in proximity to the glower and to either allow it to remain in a fixed position with reference to the glower after the latter has become conductive or else to withdraw it by the action of the electric current traversing an electromagnet or a solenoid adapted to automatically remove the heater. In some instances it is entirely practical to allow the heater to remain in proximity, but frequently it is desirable that it shall be removed; but the devices heretofore employed required a continued consumption of energy in order to hold the heater away from the glower.

My invention is designed to obviate the necessity of the expenditure of energy, or at least any material amount of energy, for the purpose of retaining the heater in its remote position after the glower has become incandescent.

My invention consists generally in providing apparatus in which the heater is held away from the glower so long as no current is traversing the lamp. When, however, current is first sent through the lamp, the current traversing the heater operates to move the heater into proximity to the glower and it remains in this position until the current commences to flow through the glower itself. Thereupon the heater-circuit is interrupted, and the heater is at the same time automatically moved away from the glower.

In the accompanying drawings, Figure 1 is a diagram of circuits and an apparatus for carrying out my invention. Figs. 2 and 3 illustrate details.

Referring to the drawings, G represents a glower composed of rare earths suitably prepared and formed in the manner employed in the so-called "Nernst" lamps. These glowers must be raised to a fairly high temperature before they become conductors of electricity under normal pressures. For the purpose of raising the glowers to such a temperature the heater A is employed. This may be of any suitable character—such, for instance, as a coil of wire suitably arranged and disposed with reference to the glower, so that when it is in proximity thereto and traversed by an electric current it will develop sufficient heat to raise the glower to its required temperature. The heater is supported by a movable core *b* of a solenoid B. This core is normally drawn away from the glower G by the spring *b'* or other suitable device, and at the same time partially drawn out of the coil B.

1 and 2 represent the mains of any suitable circuit, and a conductor 3 leads from the main 1 to one terminal of the switch R, from the other terminal of which a conductor 26 leads to one terminal of the solenoid B, the other terminal of which is connected by the conductor 4 with one terminal of the heater-wire A, and the remaining terminal of the heater is connected by a conductor 5 with a contact-point *c* of a circuit-controlling device C. The corresponding contact-point *c'* of this device is connected by a conductor 6 with the main 2. When current is turned onto the lamp—as, for instance, by closing the switch R—the current traversing heater A and the solenoid B draws down the core *b* and places the heater in proximity to the glower G, and it continues to occupy this position so long as the glower remains non-conductive.

The circuit connections of the glower are from the conductor 26 by conductor 7 to the glower and from the glower by conductor 8 to a balancing or current-restraining device D, thence by conductor 9 to the solenoid c^2 of the circuit-controller C. From the remaining terminal of this solenoid a conductor 10 leads to the conductor 6, and thus to the main conductor 2. The core c^3 of the circuit-controller C is carried by a pivoted lever c^4, which carries the contact-point *c*. Normally the

core c^3 is held partially withdrawn from the solenoid by a spring or equivalent device c^5; but when current traverses the glower and the solenoid c^2 the core c^3 is drawn downward, and thus the heater-circuit is broken at the points c c'. Thereupon the current through the coil B ceases, and the heater A is thus withdrawn automatically from proximity to the glower, and it will remain away from the glower until it is returned by the passage of current through the solenoid B. In this manner I am enabled to avoid the waste of energy which takes place when the solenoid is employed in the glower-circuit for positively withholding from proximity to the glowers a heater which is normally held near them by gravity or some other force, the only waste energy being that consumed in the solenoid c^2 and the current which is necessarily consumed in the balancing device or steadying-resistance D, which it is customary to employ in connection with glowers of this character to prevent an undue flow of current therethrough.

In some instances it is desirable to combine the circuit-breaking device for the heater with the balancing device, and in such cases the solenoid c^2 may be dispensed with. In another application I have described a circuit-breaking device operated by a steadying-resistance, and I desire to have it understood that I do not limit myself to the use of any particular form of circuit-breaker, for it may be employed in connection with a thermostatic or other form of interrupter.

It might happen that a glower provided with a heating device of the kind described in the foregoing specification would become inoperative by being broken or for some other cause, in which case, unless special provision were made to prevent it, the heating-circuit might remain closed, and in this way energy might be consumed to no purpose. In order to provide for a positive rupture of the heating-circuit even though the glower should be thus inoperative, I insert in the wire 4 of the said heating-circuit a coil 11, of nickel, copper, or iron, or any other suitable metal, closely surrounding but insulated from a bar 12, of zinc or other metal, having considerable expansibility under the influence of heat, and I connect the said bar to a lever 13, pivoted at 14 and provided with a contact-point 15, which is normally in contact with terminal 16, which is connected by a wire 17 to the heater A and through the wire 5, running from the other side of the heater, to the main conductor 2, as already described. The arrangement is such that, owing to the slow expansion of the rod or bar 12, contact will not be broken between the parts 15 and 16 until after the heater A has had time to do its work of bringing the glower G to a conductive temperature. Should it happen that the said glower is for any reason in an inoperative condition, so that the glower-circuit would be interrupted and the solenoid c^2 fail to do its work of breaking the heater-circuit, the expansion of the rod or bar 12 will ultimately be sufficient to separate terminal 15 from the terminal 16 and so break the heater-circuit.

I prefer to let the expansion of the bar 12 operate the pivoted lever for the purpose of releasing a catch, both in order to provide a sudden wide separation between the terminals and the heater-circuit and also to insure permanent rupture of the circuit. Different arrangements for accomplishing this result are illustrated in different figures in the drawings. In Fig. 2 the lever 13, which is acted upon by the bar 12, is both pivoted and insulated at the point 14, and the current after passing through the coil 11 reaches the said lever by way of the wire 17 and passes through the said lever to contacts 15 and 16 and the spring 19. This spring is supported upon the pivot-post 20 and normally has a tendency to move to the right far enough to make a wide break between the terminals 15 and 16 when these terminals are released from engagement with each other. From the spring 19 the current passes by wire 17, as before, to the heater A. When the rod or bar 12 expands under the heat of the coil 11 sufficiently to cause the terminal 15 to move downward and away from the terminal 16, the latter is carried by the force of the spring 19 to a considerable distance from the terminal 15, thus breaking the heater-circuit and making it necessary to restore the parts by hand before the heater-circuit is again complete. The position of the parts after the rod has expanded sufficiently to break the heater-circuit is illustrated in dotted lines in Fig. 2.

In Fig. 3 I show the coil 11 surrounding a compound bar 21, composed of two metals having different degrees of expansibility under the influence of heat. In the instance illustrated the expansion of the rods is supposed to be such as to move the top of the bar 21 to the left. This top, as shown, is provided with a catch 22, which engages with the inner end of a pivoted lever 23. A spring 24, which may be replaced by a weight, tends to move the inner end of this lever upward when the catch 22 is removed from it. The action is the same as already described with relation to the apparatus shown in Fig. 2—that is to say, when the catch 22 of the bar 21 is disengaged from the lever 23 the spring 24 draws the lever 23 out of contact with the fixed terminal 25, and the heater-circuit is thereby broken.

It is obvious that the range of movement of the expanding rod in the circuit-breakers (illustrated in Figs. 2 and 3) may be increased by any well-known means, such as a combination of levers adapted for the purpose.

In place of the solenoid B for positively withdrawing the heater from the glower after the initial operation of the heater-circuit I may employ a thermostatic device which is adapted to be operated by the heat developed by the current, and in this case also I may

magnify the range of movement of the said thermostatic device by a suitable system of levers. This employment of a thermostatic device for operating the heater could be applied to lamps in which the heater is normally in proximity to the glower or glowers, but is removed from proximity thereto after having done its work.

In some instances it may be desirable to connect the solenoid B in shunt upon the heater-circuit, as indicated in dotted lines 27 and 28 in Fig. 1, the conductor 5 being opened at a point between the two conductors 27 and 28 when this arrangement is used.

I claim as my invention—

1. The combination with a glower of an electric lamp composed of a material which is non-conductive when cold and a conductor when heated, of an electric heater therefor, means for normally retaining the heater out of proximity to the glower and means for placing the heater in proximity to the glower when current is traversing the heater.

2. The combination of an electric lamp having a glower composed of material which is a non-conductor when cold and a conductor when heated, a heater for giving an initial temperature to the glower, and means for temporarily placing the heater in proximity to the glower, operated by the current traversing the heater.

3. The combination of an electric lamp having a glower composed of material which is a non-conductor when cold and a conductor when heated, a heater, a retracting device for the said heater, a device in the heater-circuit adapted to overcome the said retracting device and a circuit-breaker for the heating-circuit.

4. In an electric lamp of the class described a glower formed from rare earths or a mixture thereof, a heating device normally remote from the said glower, an electro magnetic device included in the heater-circuit and adapted to move the heater into proximity to the said glower and means operated by the current in the glower-circuit for breaking the heater-circuit.

5. An electric lamp containing one or more glowers, a glower-circuit containing a glower formed from rare earths or an intimate mixture thereof, a heater-circuit containing an electrical heating device normally held retracted from the said glower by a spring or its equivalent, an electro magnetic device in the heater-circuit acting in opposition to the said spring, and a circuit-breaker in the heater-circuit operated from the glower-circuit.

6. An electric lamp of the class described having its glower and heater in parallel circuits and provided with an automatic circuit-breaker for cutting out the heater when the glower becomes conductive, and a thermostatic cut-out for the heater which operates independently of the glower-circuit.

7. An electric lamp of the class described having its glower and heater in parallel circuits and provided with an automatic breaker for the heater-circuit operated by the glower-circuit current and an auxiliary breaker for the heater-circuit operated independently of the glower-circuit.

8. An electric lamp of the class described having its glower and heater in parallel circuits and provided with a heater cut-out operated by current in the glower-circuit when the glower becomes conductive, an auxiliary cut-out for the heater-circuit and a thermostatic actuating means therefor that becomes effective after a predetermined interval of inactivity of the first-named cut-out.

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