No. 652,626. Patented June 26, 1900.

W. NERNST & H. N. POTTER.

HEATER CUT-OUT DEVICE FOR ELECTRIC LAMPS.

(Application filed Sept. 12, 1899.)

(No Model.)

Fig. 1.

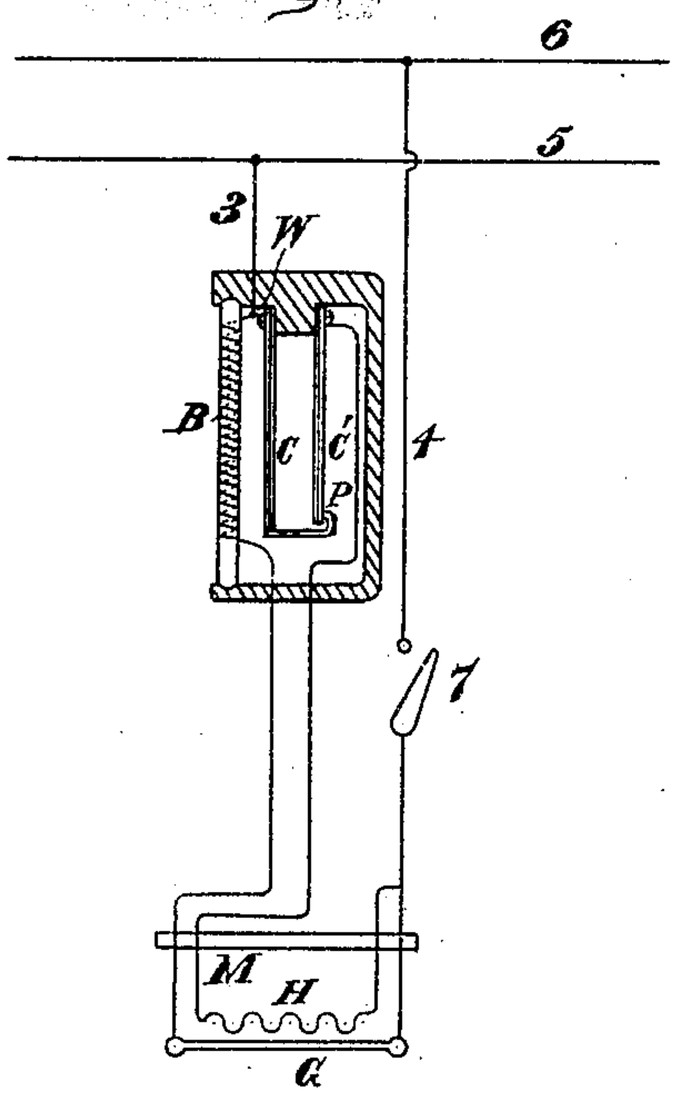
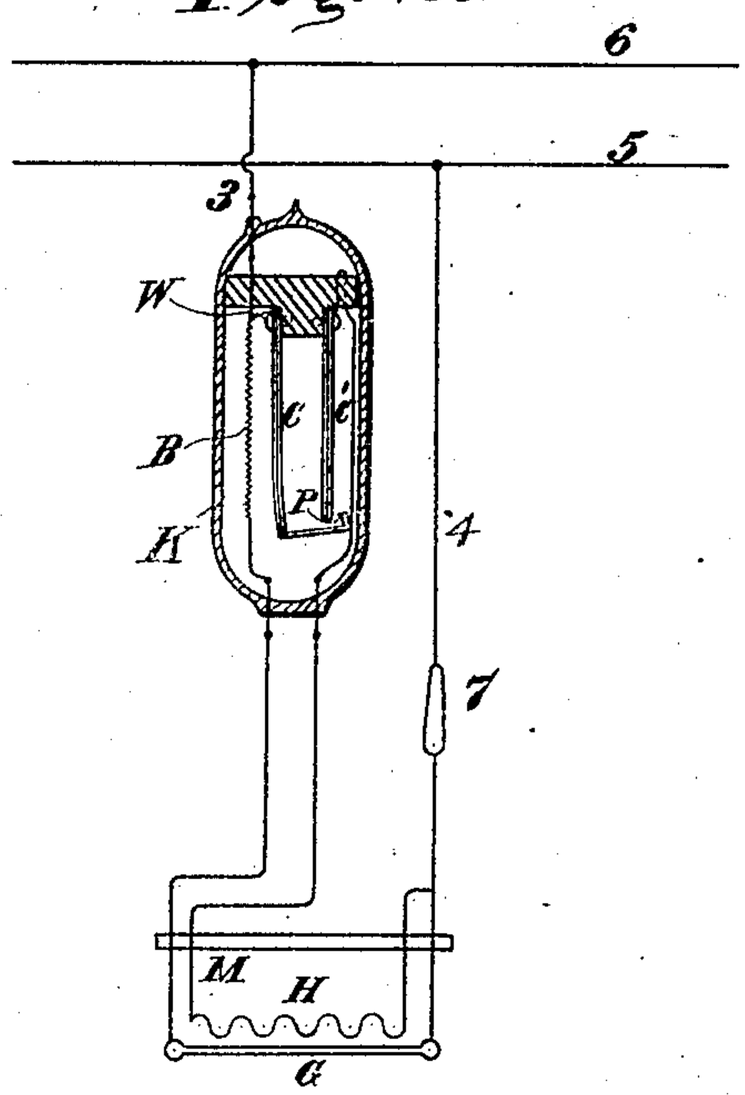


Fig. 2.



WITNESSES:
Ethan G. Dodds
H. C. Tener

INVENTORS
Walther Nernst
Henry Nott Potter
BY
Charles A. Terry
ATTORNEY.

UNITED STATES PATENT OFFICE.

WALTHER NERNST AND HENRY NOEL POTTER, OF GÖTTINGEN, GERMANY, ASSIGNORS TO GEORGE WESTINGHOUSE, OF PITTSBURG, PENNSYLVANIA.

HEATER CUT-OUT DEVICE FOR ELECTRIC LAMPS.

SPECIFICATION forming part of Letters Patent No. 652,626, dated June 26, 1900.

Application filed September 12, 1899. Serial No. 730,213. (No model.)

To all whom it may concern:

Be it known that we, WALTHER NERNST, a subject of the Emperor of Germany, and HENRY NOEL POTTER, a citizen of the United States of America, residing at Göttingen, in the Kingdom of Prussia, Germany, have invented certain new and useful Improvements in Heater Cut-Out Devices for Electric Lamps, of which the following is a specification.

Our invention relates to that type of electric lamps in which the light-giving element or "glower" is a non-conductor when cold, but becomes a conductor when heated.

Our invention relates particularly to current interrupting or controlling devices used in connection with the electric heating devices of automatic lamps of the above-mentioned type. In such automatic lamps it is usual to arrange a heating device in operative relation to the glower and in starting the glower to pass current through the heater by means of a circuit in parallel to that in which the glower is located. It is desirable to interrupt the current in the said heater-circuit after the glower has become conducting and is in operation, and various means have been proposed for effecting this result. In our experience we have found it desirable to make use of a heater cut-out located in a chamber containing an inert gas and to operate the same thermostatically by means of heat generated in a steadying resistance or ballast-conductor, also located in said chamber. We find, however, that the thermostatic devices hitherto employed are very slow in returning to their circuit-closing position by reason of the fact that the inclosed devices and the chamber in which they are inclosed require considerable time to cool down to such a temperature as will permit the thermostat to reëstablish the heater-circuit. To avoid the effects of the slow cooling and to render it possible to relight our lamp almost immediately after having extinguished it, we make use of the means shown diagrammatically in the accompanying drawings, in which—

Figures 1 and 2 are views, partially sectional and partly diagrammatic, of two embodiments of our invention.

Referring to Fig. 1, G is the glower, and H the heater, both of which are supported upon an insulating-base M.

B is the steadying resistance or current-restraining device and may be of any suitable material—such, for example, as platinum or nickel.

W is the return-circuit terminal of current-restraining device B.

Near current-restraining device B and warmed by it are located two strips of compound section C and C′. The free end of strip C extends around the free end of strip C′, so as to make contact at P with the remote side of the said end of strip C′. Each of strips C and C′ is composed of two metals having different coefficients of expansion under the action of heat. They are arranged with the side of greatest expansion coefficient toward device B, and when warmed by the heat from said ballast they bend away from it, strip C bending sooner and to a greater extent than strip C′, thereby breaking contact between the end of the strips at P.

The two strips C and C′ when in contact are connected in series with each other and with the heater H. Strip C is further connected at W to a conductor 3, leading from a main 5 to one terminal of ballast B. The end of the heater H remote from that to which strip C′ is connected and the end of the glower G remote from that to which device B is connected are provided with terminals which are connected together and to a conductor 4, which in turn is connected to the current-main 6.

In action our device operates as follows: Current flows at first through conductor 3, strips C and C′, heater H, and conductor 4, thus raising the temperature of the heater, which imparts its heat to the adjacent glower G. When the glower has become sufficiently heated, it becomes conducting and current flows through conductor 3, device B, the glower, and conductor 4. The current traversing the last-named path heats up the restraining device B, which in turn heats strips C and C′, causing them to bend and thus break the contact at P, whereby the further passage of current to the heater H is prevented. When now the operation of the

lamp is interrupted—as, for instance, by means of a switch 7 in conductor 4—current ceases to maintain the restraining device B at an elevated temperature and strips C and C′ cool off. Strip C, being located nearer to device B, is hotter and therefore cools more rapidly than strip C′. It follows that contact between strips C and C′ is established at P before the strips become entirely cold. The lamp may be again set in operation at any time after contact is reëstablished at P, and, as this takes place before strips C and C′ entirely cool off, it occurs earlier than it would with any arrangement heretofore employed.

In Fig. 2 we show our device placed within a closed chamber K, which contains a body of inert gas—such, for example, as hydrogen or nitrogen. In this case we make use of iron for the steadying resistance B, as oxidation is prevented by the inert gas. We further find that the spark which occurs when the heater-circuit is broken is not of the same size in hydrogen as in air, it being markedly smaller in the hydrogen atmosphere, which may be in part accounted for by the superior heat conductivity of hydrogen. We do not, however, in general use an atmosphere of hydrogen under full atmospheric pressure in the chamber K, as an accidental rupture of the walls of the chamber might admit air to form an explosive gas mixture within. We have found as the result of experiments that if the pressure of hydrogen within chamber K be only about one-fifteenth of atmospheric pressure the admission of air will not cause an explosion, the hydrogen then being too dilute to burn explosively. There is, however, no sharply-defined pressure at which explosion begins, nor do we always consider it necessary to avoid the possibility of explosion, as frequently the chamber K may be so located that an explosion can do no considerable damage.

We have made a great variety of arrangements of the parts constituting this device in order to adapt it to various conditions of practical service, and we do not, therefore, confine ourselves to any special arrangement. It is sufficient for our purpose if the structure and arrangement of apparatus be such as to insure a quickly-reëstablished contact by means which depend in general upon the use of a temperature gradient instead of merely an elevation of temperature.

The interruption of an electric current in an atmosphere of hydrogen as distinguished from other inert gases, such as nitrogen, also has a wider application than we have specifically illustrated.

We claim as our invention—

1. In an electric lamp having a glower which requires the application of heat to render it conductive, the combination with such glower, of a heater in proximity thereto, a current-restraining device in series with the glower, and an interrupter for the heater-circuit comprising two thermostatic arms movable in the same direction under the influence of the heat developed in the current-restraining device, one of said arms being in closer proximity to said current-restraining device than the other.

2. In an electric lamp having a glower which requires the application of heat to render it conductive, the combination with such glower, of a heater in proximity thereto, a current-restraining device in series with the glower, and a making and breaking device for the heater-circuit comprising two thermostatic arms located in proximity to the current-restraining device but at different distances therefrom, whereby they move in the same direction but in unlike degree under the influence of heat.

3. In an electric lamp having a glower which requires the application of heat to render it conductive, the combination with such glower, of a heater in proximity thereto, a current-restraining device in series with the glower, a making and breaking device for the heater-circuit comprising two thermostatic arms, and a chamber for the restraining device and the thermostatic arms containing hydrogen.

4. A circuit-breaking device comprising two thermostatic arms, means for applying heat thereto and an inclosing chamber therefor containing hydrogen.

5. A circuit-breaking device comprising two thermostatic arms, heating means for said arms located nearer to one than the other, and an inclosing chamber therefor containing hydrogen.

6. In an electric lamp of the type described, the combination with the glower and a current-restraining device therefor, of a heater in proximity to the glower, and making and breaking means for the heater-circuit comprising two thermostatic arms one of which has its body portion and its contact end on opposite sides of the other arm, said current-restraining device being located adjacent to said body portion.

7. In an electric lamp of the type described, the combination with a glower and a current-restraining device therefor, of a heater in proximity to the glower and making and breaking means for the heater-circuit comprising a short and a long thermostatic arm, the latter of which extends around the former to make contact with its remote side, the current-restraining device being located in proximity to said long arm.

In witness whereof we have hereunto signed our names, this 10th day of August, 1899, in the presence of two subscribing witnesses.

WALTHER NERNST.
HENRY NOEL POTTER.

Witnesses:
FREDERICK VON VERSEN.
WOLDEMAR HAUPT.