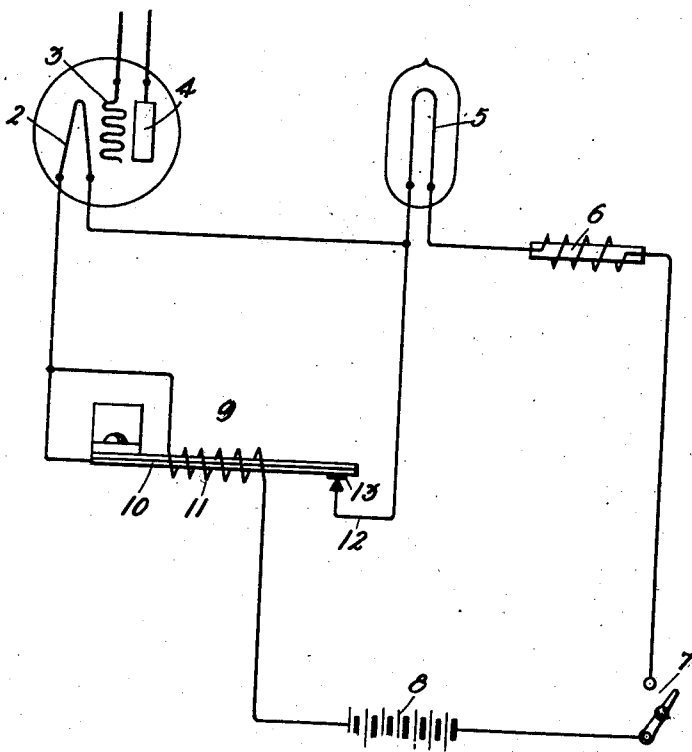


H. E. SHREEVE.
 PROTECTIVE CIRCUIT.
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1,252,502.

Patented Jan. 8, 1918.



Witnesses:
O. M. Cutler
O. C. [unclear]

Inventor:
 Herbert E. Shreeve
 by *A. C. [unclear]* Att'y.

UNITED STATES PATENT OFFICE.

HERBERT EDWARD SHREEVE, OF MILBURN, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO WESTERN ELECTRIC COMPANY, INCORPORATED, A CORPORATION OF NEW YORK.

PROTECTIVE CIRCUIT.

1,252,502.

Specification of Letters Patent.

Patented Jan. 8, 1918.

Application filed February 9, 1915. Serial No. 7,123.

To all whom it may concern:

Be it known that I, HERBERT E. SHREEVE, a subject of the King of Great Britain, residing at Milburn, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Protective Circuits, of which the following is a full, clear, concise, and exact description.

This invention relates to protective circuits and more particularly to a circuit arrangement in which a ballasting resistance or similar current limiting device is used in connection with a sensitive current consuming apparatus for the purpose of limiting the flow of current therethrough. This invention has for its object to provide an auxiliary protection against excess current which shall be effective during such period as the main current limiting device is ineffective.

In the circuit of my invention the current actuated apparatus, which is to be protected, is supplied with current from a battery or other source in series with a current limiting or regulating device such, for example, as a ballast resistance element. Elements of this type are customarily made from iron wire inclosed in an evacuated vessel or one containing a gas, such as hydrogen, which does not attack iron but which is a good conductor of heat. As is well known, an element of this sort, if properly selected, is effective automatically to compensate for fluctuations in impressed voltage or external circuit resistance and to insure, within a given range, a current flow of steady value in the circuit of which it forms a part. When, however, the current flow through such an element is initiated, it being cold it will not immediately present the requisite degree of resistivity, but a period of time will elapse before its resistance builds up to what we may call the regulative value. While this time interval is generally of short duration, it is nevertheless sufficient to permit a temporary excessive surge of current through the circuit which may, in the course of time at least, be detrimental to any sensitive apparatus included therein.

My invention therefore, provides a path for deflecting current away from the sensitive device in question and a slow acting mechanism which opens the said path at a predetermined time after the circuit through the resistance element has been established,

this period being sufficient to allow the element in question to build up to its regulative resistance.

In the particular embodiment herein set forth, my invention is shown as applied to the heater or filament circuit of an audion such as is used, for example, in the telephone art in a system such as that described in Arnold Patent No. 1,114,845 of October 27, 1914. It is evident, however, that the scope of this invention includes a variety of other adaptations and uses.

The invention will be more clearly understood by reference to the accompanying drawing in which 2, 3 and 4 represent respectively the filament grid and plate elements of an audion; 5 is an iron ballast resistance of the well known type, 6 is a retardation coil or other suitable resistance, 7 is a circuit closing device which may be either manually or automatically operated, depending upon the requirements of the problem in hand, 8 is a battery and 9 is a thermostat comprising the well known bimetallic strip 10 and the heating coil 11 and adapted when suitably heated to open the contact between points 12 and 13.

Upon the closure of the circuit at 7, current flows from battery 8 by way of coil 6, ballast resistance 5, contact 12—13, bimetallic strip 10 and winding 11 back to battery. Current in winding 11 will heat strip 10 and cause it to warp away from contact point 12, thereby opening the low resistance path in parallel with the filament 2, which path existed by virtue of the contact between points 12 and 13. The time taken for the thermostat 9 to open contact 12—13 can be regulated by properly designing the winding 11, or by making the contact point 12 adjustable, or both, so as to allow the ballast resistance 5 to build up to the required value before current is permitted to flow through the filament 2 by the removal of the short circuit thereon. Thus the filament will be protected from any momentary rush of current occurring at the time of closure of the switch 7 due to the low resistance caused by the cold condition of ballast 5.

While in the adaptation of this invention herein described a thermostat is employed as the slow acting means for removing a shunt circuit from the device to be protected, in another adaptation it might easily develop

that an electromagnetic device, rendered slow acting by any of the means well known in the art, might better serve the purpose.

What is claimed is:

- 5 1. A protective circuit comprising a source of current, a current actuated device to be protected, automatic means for regulating the amount of current flowing through said device under normal conditions of operation, a low resistance path in parallel with
10 said device and a slow acting means operating upon the closure of said circuit to open said low resistance path.
- 15 2. A protective circuit comprising a source of current, a current actuated device in

series therewith, a ballast resistance adapted when heated to limit the current flowing through said device, a shunt circuit for said device, and a slow-acting current-actuated means for opening said shunt circuit when
20 said ballast resistance shall have become heated.

In witness whereof, I hereunto subscribe my name this 8th day of February, A. D. 1915.

HERBERT EDWARD SHREEVE.

Witnesses:

E. EDLER,

K. L. STAHL.