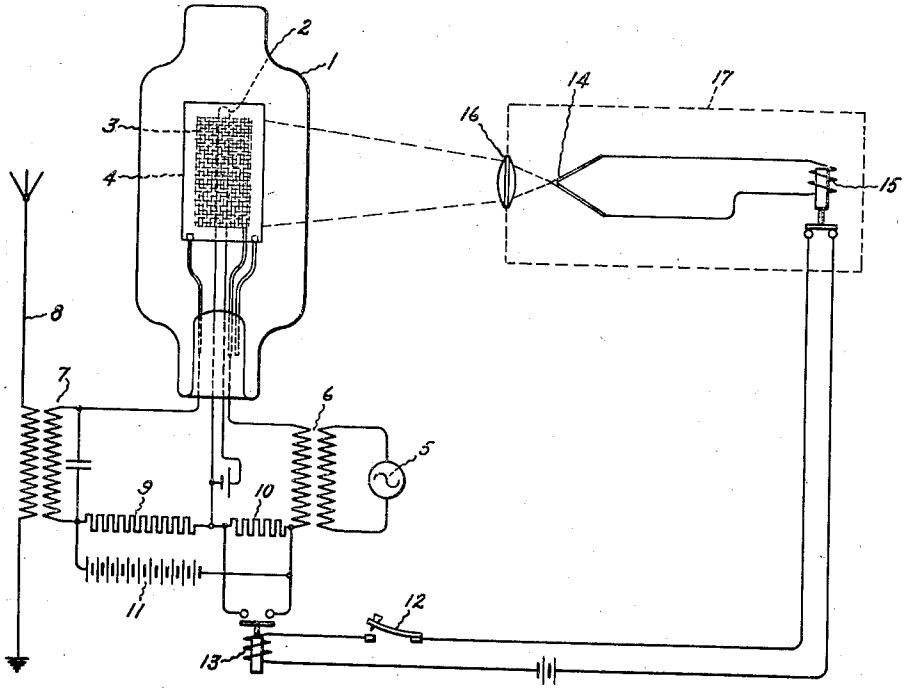
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PROTECTIVE SYSTEM

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PROTECTIVE SYSTEM

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My invention relates to protective systems for electron discharge devices and it has for one of its objects to provide an improved method and means for protecting electron discharge devices against excessive heating.

In the operation of high frequency signaling systems, particularly on board ship, circuit faults frequently occur, occasioning excessive heating of the electron discharge devices which are employed in the system. Thus, for example, it frequently happens that the antenna of a radio transmitting system becomes grounded, or short circuited, or is otherwise destroyed by waves, or in battle. In case of a fault of this nature, the anodes of the discharge devices employed in the latter stage, or stages, of the power amplifying equipment of the transmitter may be subjected to very rapid heating and are likely to be injured or destroyed within a very short period unless protective means are provided to care for the emergency.

One of the objects of my invention is to provide a method and means whereby somewhat more complete and satisfactory protection may be applied to the discharge device than has heretofore been possible.

A further object of the invention is to provide means responsive to the heating of the discharge device itself, and which operates practically simultaneously with the rise of temperature to a predetermined dangercus degree to control the circuits of the discharge device and thereby protect it from injury.

A further object of the invention is to provide means having the above characteristics and which operates in response to heat radiated from the heated electrode, or electrodes, of the discharge device.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing, in which the single figure represents an embodiment of my invention.

Referring to the drawing, I have shown at 1 an electron discharge device which may be assumed to be employed as an amplifier of the last stage of a radio transmitter. This discharge device has a heated cathode 2, a grid 3, and an anode 4. High frequency oscillations from the earlier stages of the transmitter, or from any other suitable source, conventionally indicated in the drawing at 5, are supplied through input transformer 6 to the grid of the discharge device.

The output circuit of the discharge device includes a tuned circuit 7 which is connected between the anode and cathode of the discharge device and is coupled to an antenna circuit 8. Anode potential for the discharge device is supplied from a resistance 9 and bias potential for the grid thereof is supplied from a resistance 10, these resistances being connected in series and constituting a potentiometer connected across a source of potential 11, the cathode of the discharge device being connected at a point between the two resistances. The potential upon the resistance 10 is normally of sufficient magnitude to cause the grid to be sufficiently negative with respect to the cathode substantially to preclude the flow of electrons from the cathode to the anode. This potential, therefore, normally interrupts operation of the discharge device.

In order to transmit the high frequency oscillations in accordance with desired signals, a key 12 is employed to control a suitable keying relay 13, the contacts of which are connected in shunt with the resistance 10. Thus upon operation of the key, the relay 13 short circuits the resistance 10 and thereby removes the bias potential from the grid of the discharge device and renders it operative to amplify high frequency oscillations from the source 5.

It will be readily understood by one skilled in the art that if the antenna circuit 8 becomes short circuited, and, likewise, if certain other faults occur in the circuit, the discharge device is subject to excessive heating. In accordance with my invention this excessive heating is prevented by providing a suitable radiation pyrometer indicated in the drawing at 14 to control the energizing circuits of the discharge device. This pyrometer may comprise any suitable thermocouple or junction of dissimilar metals such as tellurium and constantan, for example, whereby an electromotive force is generated having a magnitude dependent upon the temperature of the junction. This thermo-electric generator, or thermocouple, is connected in circuit with the winding of a sensitive relay 15.

The relay 15 and thermocouple 14 are shown as arranged within a suitable housing indicated by the rectangle 17 located in proximity to the discharge device. The housing has a lens 16 arranged therein for the purpose of focusing heat from the anode of the discharge device

upon the thermo-electric generator. Of course the most preferred location of the housing 17 is dependent upon the sensitivity of the thermo-electric generator and relay employed and upon the nature of the lens 16.

The relay 15 may be of any suitable sensitive construction, preferably one of the galvanometer type, and is employed to control the energizing circuits of the discharge device. Preferably its contacts are included in circuit with the key 12 and winding of relay 13.

Thus in the normal transmission of signal impulses by means of the system the operator operates the key 12 in accordance with a telegraphic code, thereby causing oscillations to be transmitted from the antenna when the key is closed. Under these conditions the electromotive force generated by the thermo-electric generator 14 is insufficient to cause operation of the relay 15. If, however, during the transmission of signal impulses, due to a fault occurring in the circuit or due to any other cause, such as holding the key 12 closed for an abnormally long period, excessive heating of the discharge device is caused, the electromotive force generated by the thermo-electric generator 14 will be sufficient to cause operation of the relay 15. This relay will then open its contacts and thereby de-energize relay 13 and cause the negative bias to again be applied to the grid of the discharge device, thereby reducing the anode current and protecting the device against injury due to the fault.

It will thus be seen that the supply of energy to the discharge device, in accordance with my invention, is reduced substantially simultaneously with the excessive heating thereof. This characteristic of the device is of great importance since after a certain predetermined dangerously high temperature is reached, which is likely to occur due to faults of the type indicated, either the electrodes, or the seal of the discharge device, or both, are likely to be destroyed within a very short period. The relay 15 in accordance with my invention may be adjusted to operate practically instantaneoulsy upon such a predetermined temperature being attained.

While I have described my invention as applied particularly to an electron discharge device employed in a radio signaling system, it will of course be understood that it is not limited thereto but that it may be applied to the protection of electron discharge devices as generally applied. Further, while I have shown a particular means whereby the energizing circuits of the transmitter are controlled in response to the thermo-electric generator 14, it will of course be understood that this is by way of illustration of a preferred embodiment of my invention and that any suitable means whereby the energy supplied to the discharge device is materially reduced in response to the electromotive force of the thermo-electric generator may be employed. It will thus be understood that while I have disclosed but a single embodiment of my invention, I do not wish to be limited thereto since many modifications may be made, and that I contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, an electron discharge device subject to excessive heating during operation thereof, a thermo-electric generator subject to heat radiated from an electrode of said discharge device, and means operable responsively to electromotive force generated by said thermo-electric generator to control a circuit of said electron discharge device.

2. In combination, an electron discharge device having an electrode subject to excessive heating, a thermo-electric generator, means for focusing heat radiated from said electrode upon said generator whereby an electromotive force is produced in accordance with the heating of said electrode, an energizing circuit for said discharge device, and means responsive to electromotive force generated by said thermo-electric generator for controlling said energizing circuit.

3. The combination, in a signal system, of an electron discharge device having an element which is subject to excessive heating during operation of said system, means for generating an electromotive force in accordance with the heating of said element, means including a keying circuit for controlling the operation of said discharge device in accordance with desired impulses, and means responsive to said electromotive force for controlling said keying circuit thereby to render said discharge device inoperative.

4. In combination, an electron discharge device subject to excessive heating when energized, a thermo-electric generator comprising dissimilar metals in contact with each other, said thermo-electric generator being arranged for substantially instantaneous response to heating of an electrode of said discharge device, and means responsive to electromotive force produced between the dissimilar metals of said generator to control the energization of said electron discharge device.

5. In combination, an electron discharge device comprising an output circuit therefor including an impedance, means including connections for said discharge device whereby said discharge device is energized and an electrode of said discharge device is subjected to excessive heating upon substantial variation of said impedance, and means comprising dissimilar metals in contact with each other and arranged for substantially instantaneous response to heating of said electrode, and means responsive to electromotive force generated between said metals to control said connections thereby to protect said discharge device against variations in said impedance.

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