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F. H. KROGER

1,920,646

PROTECTIVE RELAY FOR TUBE TRANSMITTERS

Filed July 18, 1929

Fig. 1

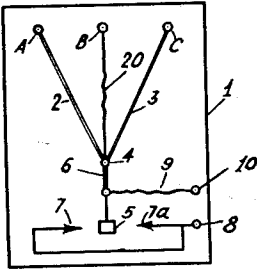


Fig. 2

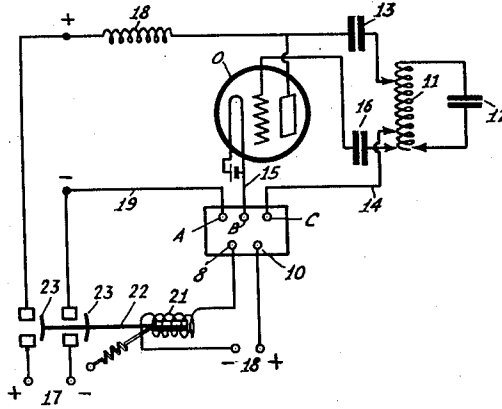


Fig. 3

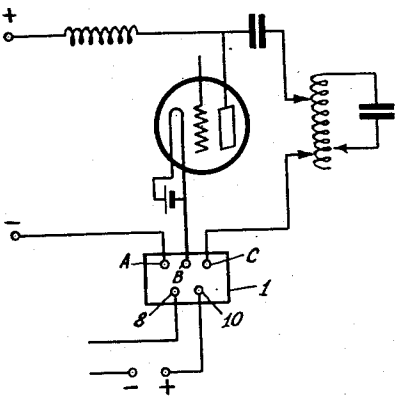
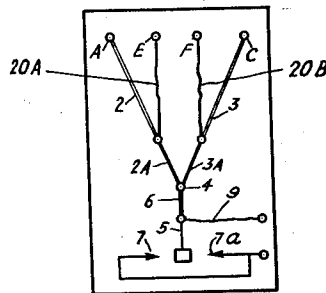


Fig. 4



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PROTECTIVE RELAY FOR TUBE
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3 Claims. (Cl. 250—17)

This invention relates to protective means to be used in radio apparatus and in particular with apparatus in which it is desired to protect one or more circuits from being overloaded or to maintain a constant ratio between the current in one circuit with respect to the current in another circuit.

Another object of this invention is to provide a device of the above nature in which the ratio between currents in various circuits may be kept constant although one of said circuits carries alternating current while the other of said circuits carries direct current.

Briefly and broadly the above objects are obtained by the use of a novel control unit in which two or more wires are arranged in a novel manner such that when current of normal intensity flows in the wires the wires will remain in original position, but should a larger amount of current flow in one of the wires the wires will, due to the heating effect in the overloaded wire, warp out of position and close an appropriately located contact in a circuit arranged when so closed to actuate control apparatus for energizing circuits of the radio apparatus, thereby suspending operation of the radio apparatus until flow of current in the circuits returns to normal. If desired the control apparatus may be arranged to permanently interrupt the energizing circuits, or to interrupt said circuits momentarily until the current in the circuits returns to normal, when the energizing circuits may be automatically closed.

This invention as will be obvious can be used for controlling any radio apparatus in general use today as, for instance, oscillators in which it is desired to protect a thermionic tube, that is, insure that the anode to cathode alternating current, for instance, bears a definite relation to the current in the anode cathode direct current circuit, and while I do not wish to limit the use of my novel invention to any specific apparatus it will be understood that it can be used in any circuits of oscillators, amplifiers repeaters and detectors of any known type today in which a thermionic tube is used.

A better understanding of the invention and the operation of the invention will be had from the following specification and therefrom when read in connection with the annexed drawing in which for purposes of illustration two uses of my novel invention have been shown.

In the drawing,

Figure 1 shows a control unit arranged in accordance with my invention;

Figure 2 shows the control unit of Figure 1 applied to a thermionic oscillator;

Figure 3 shows the control device associated with a thermionic amplifier; while,

Figure 4 shows a modification of Figure 1.

Referring to the drawing in Figure 1, 1 is a support of insulating material on which is mounted two or more resistance wires 2, 3 of such resistive value that when a predetermined current flows through the wires there is no change in the length thereof due to heating, but should the current increase to a value above the predetermined value in one of the wires, that wire will increase in length due to the heating effect. The wires are conductively connected at 4 and a contact member 5 is connected by means of an insulating bar or rod 6 to the joint between the wires 2 and 3 and adapted when either of the wires 2 or 3 increases in length to warp or swing toward one of the other of a pair of contact points 7 and 7a.

Binding posts A, B and C are connected as shown to the free end of 2 the juncture of 2 and 3 and the free end of 3 respectively. The purpose of these posts is to facilitate connection of the unit to the apparatus to be controlled, as will be pointed out hereinafter.

The contact 5 is conductively connected through its support or if 5 is supported on an insulator through a wire to connector 9 and thence to a binding post 10. The contacts 7 and 7a are conductively connected to post 8 in such a manner that when 5 rests on 7 or 7a a circuit is formed which includes post 8, contact 7a or 7, contact member 5, flexible lead 9, post 10, a source of energy and a relay winding arranged to control the circuits or a circuit of the thermionic device in any desired manner as, for instance, rendering the circuit or circuits inoperative.

The operation of the unit thus far disclosed is as follows, assuming current to be flowing through 2 and 3. If the current is normal, that is, if it is a predetermined value which may be above or below normal current for that circuit under its operating conditions 5 remains at rest position, however, if current in 2 or 3 increases the length of that wire increases and swings 5 into one of its closed positions, thereby completing the control circuit.

In Figure 2 the novel unit is shown as applied to an oscillator and in particular to the anode cathode direct current circuit and the anode cathode alternating current circuit thereof in such a manner as to insure that the ratio of the

currents in the respective circuits remain constant. The oscillation generator comprises a thermionic generator O having an oscillation circuit 11, 12 a portion of inductance 11 being connected through condenser 13 to the anode of 10 and through conductor 14 to the cathode of the tube after passing via binding post C, wire 3 of the control unit, and post B to the cathode of O.

To maintain oscillations in 11, 12 the remaining portion of inductance 11 is connected through grid condenser 16 to the grid electrode of 10 and through conductor 14, C, resistance wire 3 and post B to the cathode of 10. Current in the last named circuit is so little that it may be disregarded in determining the value of resistance wire 3. The anode potential circuit includes a source of power 17 having one pole connected (when operating) through a choke coil 18 to the anode of O and the other pole connected via conductor 19 and post A through resistance wire 2 to post B and the cathode of O.

Thus the alternating current anode cathode circuit is so arranged as to include the anode of the thermionic oscillator O, condenser 13, a portion of inductance 11, conductor 14, contact C, resistance wire 3, connector 20, contact B and the cathode 15 of the oscillation generator O.

The anode circuit for the space current includes source 17 one side of the line from 17 arranged to be opened by a switch 23 described later, choke coil 18 cathode 15 contact B, connector 20, resistance wire 2, contact A, and conductor 19 to the other side of source 17.

The contact points 7, 7a arranged to be closed by 5 in one of its extreme positions are connected through contact 10 to a source of power 18 in series, when one of the contacts 7 or 7a closes, with a winding 21 arranged as indicated to actuate an armature 22. The armature 22 carries two connectors 23, which are adapted to open the line between the power source 17 and the anode and cathode of the oscillator O, when the winding 21 is energized by closing of contact 7 or 7a.

In operation if the anode cathode current through 2 should increase beyond a predetermined value 2 will increase in length. This will swing 5 to the right on the drawing closing contact 7a thereby putting source 18 in series with 21. This will energize 21, withdraw the armature 22 thereby breaking the contacts in the anode, cathode circuit of the oscillation generator.

The anode space circuit can then be left open until manually closed, or means as for instance a biasing spring 25 on 22 may be provided to close the contacts 23 when the current in the wires of the control unit returns to normal.

In like manner if the alternating current in the anode cathode circuit of O increases beyond a predetermined value 3 will increase in length. This will swing 5 to the left closing contact 6 and putting source 18 in series with 21 to move the contacts 22 in the open position.

In Figure 3 my novel unit has been shown as applied to an amplifier. In this case the arrangement and the operation are similar to the previous case and a detailed description thereof is not necessary.

In each of the arrangements described above the two circuits which it was desired to control had a common lead so that three contacts A, B and C on the control unit were sufficient. That is to say, in the previous modification the conductor 20 between the juncture 4 of resistance

wires 2 and 3 and binding post B is common to both the anode cathode alternating current circuit and the anode cathode direct current circuit. In some cases where it is desirable to maintain a constant ratio between the currents in a pair of circuits which do not have a connection or a portion in common, an arrangement as illustrated in Figure 4 is necessary.

The control unit shown in Figure 4 is similar to the control unit shown in Figure 2 except that the resistance wires 2 and 3 are not conductively coupled together but each terminate in insulating members 2a and 3a respectively which are joined at 4 as in the previous case. In this manner by providing four binding posts A, E, F and C the two circuits to be controlled may be completed, 1, to conductor 28 to binding post E, the other C, 3, conductor 20b to binding post F. In this modification the insulating member 6 may be used as shown or may be dispensed with since the armature 5 may be connected directly to the point 4 which in this case is already insulated with respect to resistance wires 2 and 3. The control circuit connected to the binding post 8 and 10 is the same as the control circuit used in the previous modifications and operates in the same manner, that is, when either 2 or 3 is elongated due to an increase in current therein, 5 is warped or swung toward either contact 7 or 7a closing the control circuit. Application of this control unit to a circuit and a description of the operation thereof is thought unnecessary since the operation of said unit and arrangement thereof will be obvious from the brief description given since it is, except for the differences pointed out above, similar to the operation and arrangement of the unit described in Figure 1.

Although for purposes of illustration I have shown the at present preferred modification of the control unit and the operation thereof I do not wish to limit myself thereby except as marked out in the claims attached hereto.

I claim:

1. Protective means to be used with radio apparatus including a thermionic tube having a circuit including a source of potential connected with the output electrodes thereof and a circuit connected with the input electrodes thereof comprising, means for maintaining the ratio of current in said circuits at a predetermined constant value including a thermal element in each of said circuits, said thermal elements each having one end fixed and the free ends united physically by a pivoted element, the position of which depends on the relative length of the element, a pair of circuit closing contacts adjacent said pivoted element, a switch in said circuit including said source of potential, and a relay having an armature connected with said switch and an actuating winding connected with said contacts and said pivoted element.

2. Protective means to be used with radio apparatus including a thermionic tube having input and output electrodes and input and output circuits, one of which includes a source of potential connected with said electrodes comprising, means for maintaining the ratio of current in said circuits at a predetermined constant value, said means including a thermal element in each of said circuits, said thermal elements each having one end fixed and the other end united physically by a pivoted contact closing element, the position of which depends on the relative length of the thermal elements, a pair of circuit closing

contacts adjacent said pivoted element, a switch in said circuit including said source of potential, a magnetic relay having an armature connected with said switch, and a field winding having one terminal connected through a source of potential with said contacts and the other terminal connected to said pivoted element.

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cuits, each of said thermal elements having one end fixed and the other ends connected together and to a pivoted contact closing element, the whole being arranged so that a change in the ratio of current flowing in said circuits changes the relative length of said thermal elements and causes said pivoted element to move, a magnetic relay having an armature connected to said switch, means for normally biasing said armature to a position at which said switch is closed, a magnetic winding associated with said armature, a connection between one terminal of said winding and said pivoted contact closing element, and a source of potential connected between the other terminal of said winding and contacts adjacent said pivoted contact closing element.

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