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TIME DELAY CIRCUIT

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This invention relates generally to time delay circuits, and more particularly pertains to time delay control circuits associated with electron discharge devices whereby the said time delay control circuits exercise supervisory control functions, such as delaying the connection of external load circuits to the controlling electron discharge devices, until the latter are conditioned satisfactorily for controlling purposes.

It is recognized that many advantages flow from such arrangements wherein the connections of external load conditions are prevented until the electron discharge supply sources are properly conditioned for controlling purposes. For example, it is essential to the satisfactory operation of discharge devices of the thermionic cathode type, that the cathode elements shall have reached their normal operating temperatures before the said devices are energized to carry the load currents of the associated circuits in which they are used, and that the current flow in the devices should be interrupted in case their cathodes drop substantially below their normal operating temperatures.

It is an object of the present invention to provide an improved time delay circuit arrangement whereby an electron discharge device of the thermionic cathode type is prevented from operating in a translating circuit whenever the cathode of the device is below its normal operating temperatures or until the said cathode reaches its proper operating temperature.

To this end, provision is made whereby the cathodes of the electron discharge devices, which comprise the power supply source consisting of a full wave rectifier unit, are preheated at an abnormal rate until the proper operating temperatures thereof are attained. During the preheating operation, the devices are effective to charge a capacitor until the voltage drop across the latter is equivalent to the full load voltage rating of the discharge devices. A potentiometer control is provided for a cold cathode device which prevents any operation of the latter until the said capacitor is fully charged and a maximum voltage is applied to the said potentiometer control. Upon operation of the cold cathode device a control relay is energized to automatically connect the external load circuit to the electron discharge devices constituting the power supply source.

Therefore, another object of the present invention resides in the provision of control means responsive to the conductivity of the electron discharge devices for preventing the operation of

a cold cathode device and associated apparatus for connecting an external load to the said discharge devices until the latter are conditioned for satisfactory operation thereof.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawing, which discloses, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawing:

Fig. 1 is a wiring diagram of a preferred embodiment of the invention.

Fig. 2 is a wiring diagram of a modification of the invention shown in Fig. 1.

Referring now to Fig. 1 a time delay circuit arrangement is shown which has been found by experimentation to provide satisfactory operation. The power supply unit comprises the full wave rectifier consisting of two half wave rectifier tubes 10 of the mercury vapor type, the anodes 11 of which are connected to opposite terminals of the winding of transformer 12. A suitable source of alternating current which is impressed upon the winding of transformer 11 is indicated at S. The cathode elements 13 are connected to opposite terminals of the secondary winding of transformer 14, the primary winding of which is shown connected to the alternating current source. A resistor 15, and normally closed contacts 16, shunting the resistor, are included in the cathode circuit.

Now upon impression of the alternating current source upon the transformers 12 and 14, the rectifying tubes are rendered conductive as the cathode elements are heated to operating temperatures. Initially, the resistor 15 is shunted out of the cathode or filament circuit so that the cathodes are heated at a faster than normal rate. Upon opening of the contacts 16 the resistor 15 is effective to reduce the heating current in this circuit to normal.

As the rectifier tubes become conductive, the condenser 17, which is connected across the output circuit of the rectifier unit, represented by the conductors 18 and 19, is charged accordingly. Also connected to the said output circuit is a cold cathode gaseous discharge device 20, known in the art as a cold cathode starter anode type. The cathode 21 of which is connected to conductor 18, the anode 22 is connected to one terminal of relay 23, the other terminal of which is connected to conductor 19. The starter anode 24 is connected to one terminal of resistor 27, the other terminal of which is connected to the

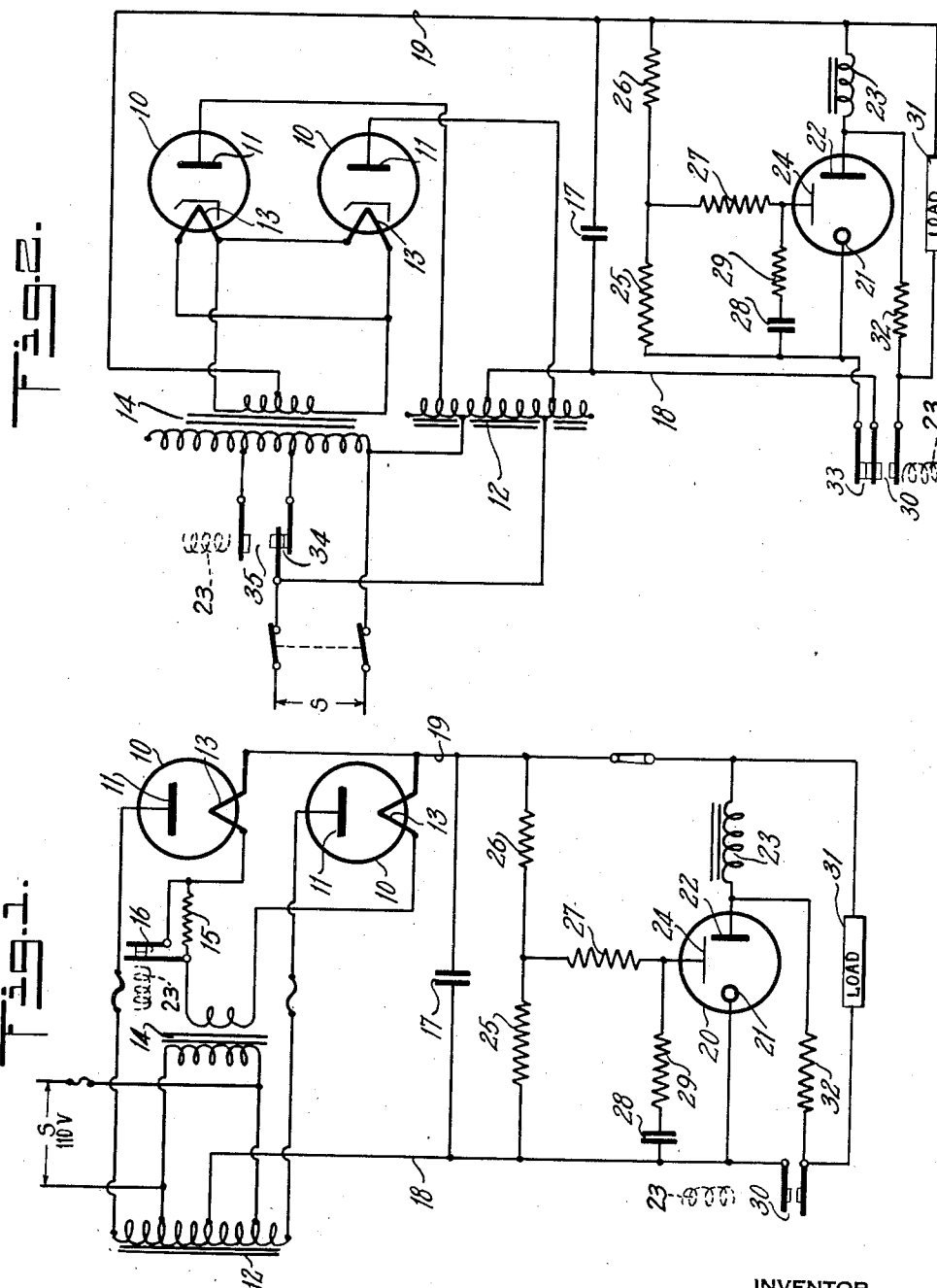
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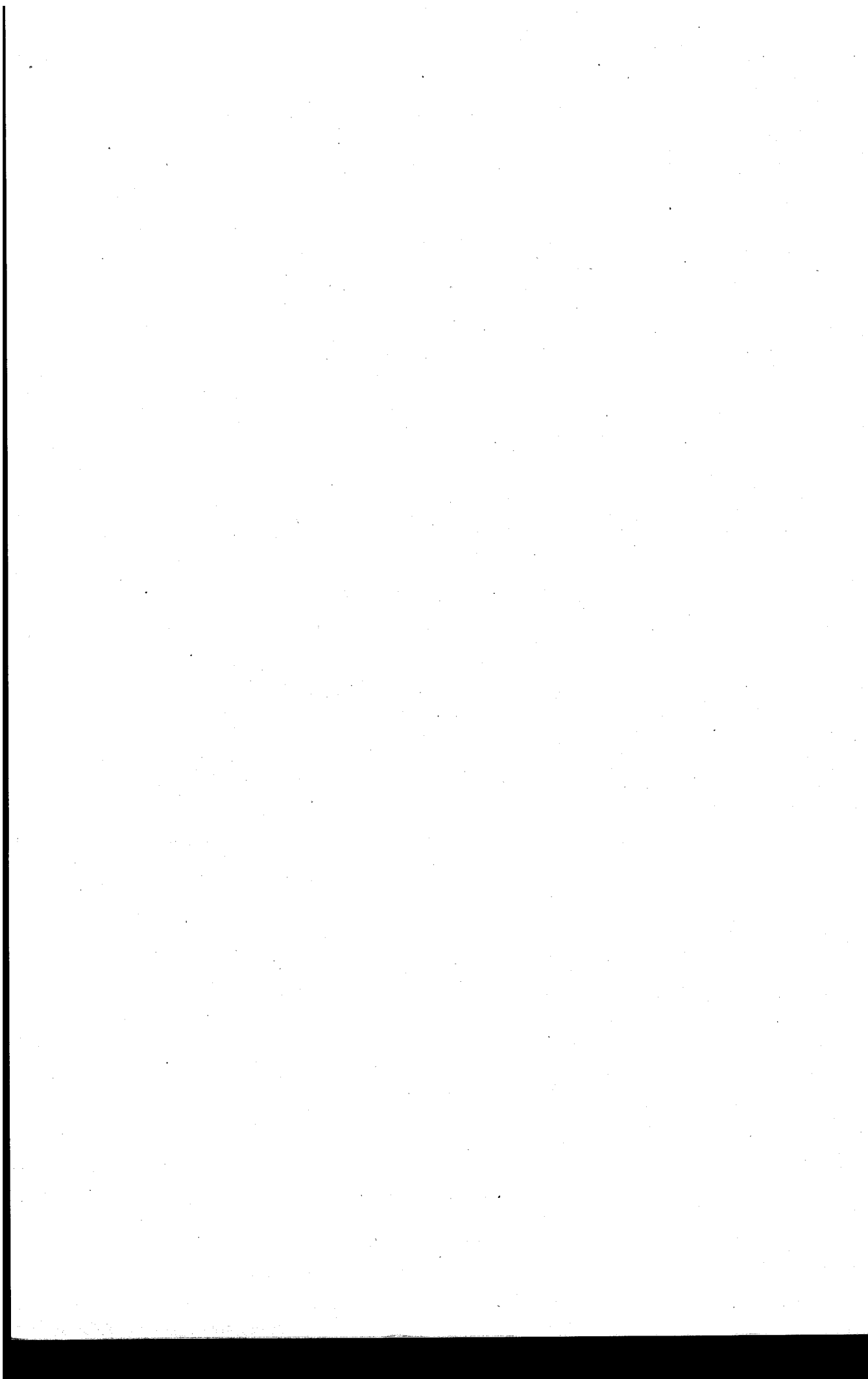
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ode-cathode circuit of said device in said translating circuit, cold cathode discharge means connected to said anode-cathode circuit for controlling the operation of said connecting means, means responsive to the conductivity of said electron discharge for controlling the conductivity of said cold cathode discharge means, and means for disconnecting the cold cathode discharge means from said anode-cathode circuit upon operation of the connecting means to connect the anode-cathode circuit in said translating circuit.

2. In combination, an electric translating circuit, an electron discharge device provided with an anode and a thermionic cathode, means including a source of potential for rendering the device conductive, relay means for connecting the anode-cathode circuit of said device in said translating circuit, cold cathode discharge means for controlling the operation of said relay means, means responsive to the conductivity of said electron discharge device for controlling the conductivity of said cold cathode discharge means, and resistor means connected in series with said relay means and connected to the anode-cathode circuit when the latter is effective to connect the anode-cathode circuit in the said translating circuit thereby rendering the relay means effective as an under-voltage relay.

3. In combination, an electric translating circuit, an electron discharge device provided with an anode and a thermionic cathode, means including a source of potential for rendering the

device conductive, means for connecting the anode-cathode circuit of said device in said translating circuit, cold cathode discharge means having a starter anode for controlling the operation of said connecting means, means responsive to the conductivity of the electron discharge device for exercising a partial control over the operation of the cold cathode discharge means, a resistor connected to the said responsive means and starter anode having a resistance value high enough to prevent the operation of the said discharge means, and means including said resistor under control of the said responsive means for rendering the cold cathode discharge means conductive a predetermined time after the said electron discharge device is rendered conductive.

4. In combination, an electric translating circuit, an electron discharge device provided with an anode and a thermionic cathode, means including a source of potential for rendering the device conductive, means for connecting the anode-cathode circuit of said device in said translating circuit, a first time delay circuit means responsive to the conductivity of the electron discharge device, electric discharge means for controlling the operation of said connecting means, and a second time delay circuit means controlled by the said first time delay circuit means for rendering the electric discharge means operative a predetermined time after the electron discharge device is rendered conductive.

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