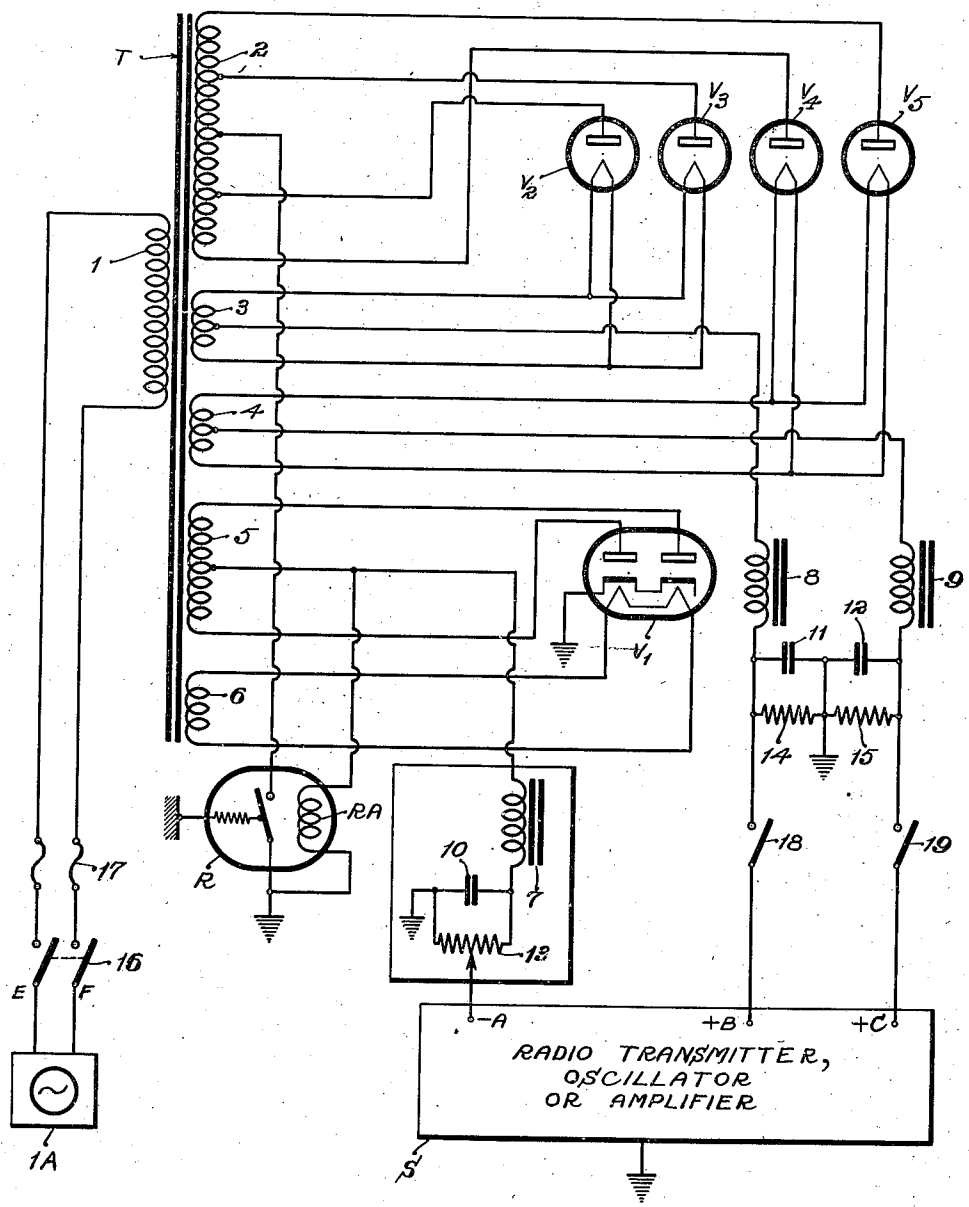
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ELECTRON DISCHARGE TIME DELAY SYSTEM

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ELECTRON DISCHARGE TIME DELAY SYSTEM

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This invention relates to a time delay system for electron discharge devices and is particularly directed to a time delay circuit for use in rectifiers of the mercury vapor type.

An object of the invention is to provide an improved system of time delay for the circuits of a radio transmitter.

Another object of this invention is to reduce the cost of the time delay system by elimination of many electrical contacts.

Still another object of this invention is to improve the operation of a radio transmitter by the application of the negative grid bias potential prior to the application of the positive anode voltage of the oscillator or amplifier tubes which may form the utilization circuit of the rectifier output.

A feature of this invention is the novel circuit arrangement including the operation of a high vacuum type of rectifier tube which has a slow heating cathode. Specifically, the invention makes use of the time delay occurring in the bias rectifier circuit to delay the application of plate power in an anode power rectifier until the cathodes have had time to heat up. This is accomplished by the use of an interlock electromagnetic relay.

Time delay systems for the prevention of the application of anode voltages as applied to amplifiers and oscillators of a radio transmitter until the bias voltages have built up sufficiently are well known in the prior art. However, I believe that the use of the time delay required for building up a bias voltage to prevent the application of rectifier plate power until the cathodes have had time to heat up sufficiently in the rectifier is new and according to my invention, improved circuit results are obtained.

This invention will best be understood by referring to the accompanying drawing in which the primary winding 1 of a power transformer T is connected to a source of A. C. input voltage 1A through switch 16 and fuses 17. The secondary of transformer T is divided into sections and includes the main rectifier high voltage winding 2, filament windings 3 and 4, an auxiliary or bias rectifier high voltage winding 5 and its associated filament, or heater, winding 6. The high voltage ends of the winding 2 connect to the anodes of mercury vapor rectifier tubes V2, V3, V4 and V5, which are the type of rectifiers that must be protected. The cathodes of V2 and V3 are connected in parallel to the outer ends of filament winding 3. The cathodes of V4 and V5 are also connected in parallel to the outside

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windings of the filament winding 4. The auxiliary rectifier high voltage winding 5 has its outer ends connected to a full wave high vacuum rectifier tube V1 which is of the type having a separate cathode and slow heating heater elements. A tube of this description is that of the RCA 84 type. This type of tube is not harmed by the direct application of anode voltage at the same time that the cathode heating voltage is applied.

The auxiliary rectifier tube V1 is employed for supplying the negative D. C. grid bias potential of a utilization circuit, such as, for example, radio transmitter, oscillator or amplifier indicated at S. The main rectifier return circuit for the high voltage winding 2 is broken through an electromagnetic relay R which has its armature winding RA connected to the negative side of the rectifier auxiliary circuit V1. The center taps of filament windings 3 and 4 are connected to filter chokes 8 and 9 which circuit is also supplied with smoothing condensers 11 and 12. Resistances 14 and 15 are shunted across condensers 11 and 12 to drain off the charges on the condensers at no load condition of the main rectifier circuit. The positive output terminals of the rectifier are connected through switches 18 and 19 to the radio transmitter S. The low voltage center tap of the high voltage winding 5 connects to a filter choke 7, smoothing condenser 10 and variable resistance 13. The movable arm of resistance 13 connects to the negative bias supply lead of the radio transmitter at terminal A. In the operation of this device it is necessary that for the proper operation of all mercury vapor high cathode type of the main rectifier tubes, the cathode be heated to the proper temperature before the anode current is applied to the tubes. In other words, no D. C. power should be drawn from a rectifier using mercury vapor hot cathode tubes until the cathodes have been sufficiently heated by allowing the proper length of heating time. If insufficient cathode heating time is allowed, when the anode power is applied the cathode of the rectifier tubes will be damaged and the tube life is thereby shortened. As will be noted by those skilled in the art, this invention resides in the use of a high vacuum, slow heating separate cathode heater bias rectifier, which in my invention is that of the RCA 84 type tube V1 and is coupled with the interlocking magnetic action of the relay R. The cathodes of all the rectifier tubes will start heating at the same time. When the power switch 16 is closed anode voltage is applied only to the auxiliary rectifier

tube V1. However, at this time anode voltages cannot be applied through the high voltage winding 2 to the mercury vapor tubes V2, V3, V4 and V5 as the low voltage side of winding 2 is broken by relay R, and because of the slow building up of the bias voltage caused by the slow heating of the cathode in the bias rectifier tube V1 there will be a delay in closing the anode circuit of the main rectifier. Relay R stays open until the bias voltage builds up sufficiently to close the relay R which will happen ten or more seconds later and thus completes the main rectifier circuit. If switches 18 and 19 are already closed, then power for the radio transmitter is available as soon as relay R closes.

Although only one modification of this circuit is shown, it is to be understood that other types or makes of tubes may be used, also other types of rectifier tubes may be used with this invention. Also, it may be advantageous to employ tubes having longer cathode heating time than that used for the rectifier tube V1. Therefore, this invention should not be limited precisely as disclosed.

What I claim is:

1. In combination, a source of alternating current, a high voltage rectifier connected to said source, a utilization circuit connected to said high voltage rectifier, vacuum tube apparatus connected to said high voltage rectifier, an electromagnetically operated relay for completing a circuit from said vacuum tube apparatus to said high voltage rectifier, and apparatus for delaying the closure of said relay in spite of application of exciting voltages to said high voltage rectifier, said apparatus comprising a bias rectifier for supplying a negative potential to said utilization circuit having an anode, a cathode and a heater for said cathode, a circuit for connecting said heater to said source of alternating currents to be rectified, and connections for connecting said relay in series with the anode to cathode circuit of said bias rectifier whereby said relay remains open until said cathode is brought to an electron emissive condition.

2. Apparatus as claimed in claim 1, characterized by the fact that the negative grid bias for said vacuum tube apparatus is derived from a circuit connected between the anode and cathode of the rectifier operating said relay, whereby the application of high voltage to said vacuum tube apparatus is delayed until grid biasing voltages are developed.

3. A time delay system for electron discharge devices comprising a source of input voltage, a mercury vapor type rectifier and an auxiliary rectifier coupled to said source of input voltage, said auxiliary rectifier having a cathode and a heater which is of the slow heating type, a relay circuit connected to be controlled by said auxiliary rectifier, said relay being connected in series with the output circuit of the mercury vapor type rectifier, a radio transmitter including a negative grid bias circuit, said rectifier output circuit being connected to said radio transmitter, the output of said grid bias circuit being connected to said radio transmitter, the arrangement being such that the anode voltage will not be applied to the mercury vapor type rectifier until the cathode of the auxiliary rectifier tube is heated to a predetermined amount and actuates said relay through said negative grid bias circuit.

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