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ELECTRONIC BIAS SWITCH

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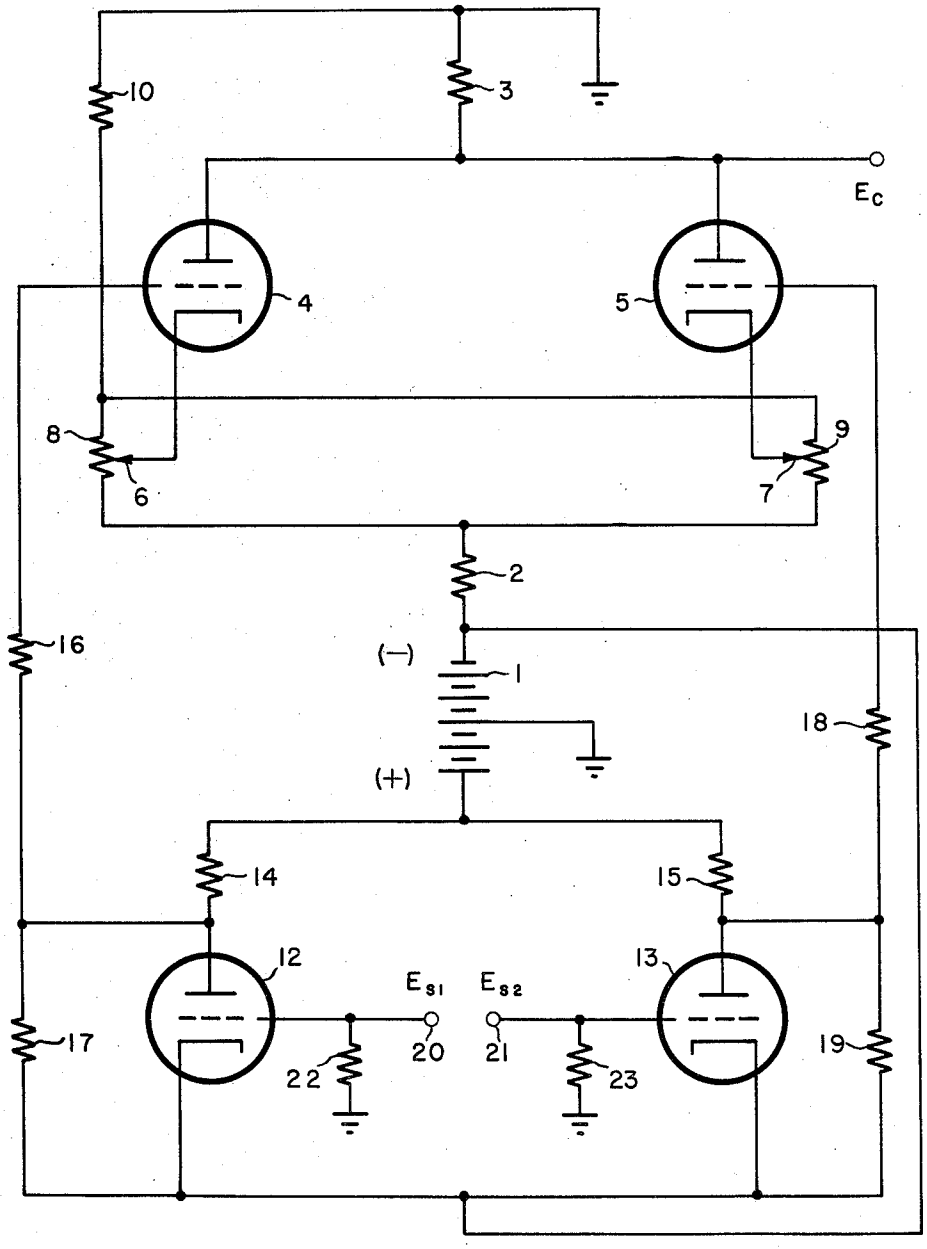

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ELECTRONIC BIAS SWITCH

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1 Claim. (Cl. 250—27)

This invention relates to a circuit for providing a bias voltage which is independently variable for two sets of conditions. Such circuits find application where it is desired to generate two apparently simultaneous displays on the screen of a cathode ray tube. Such displays may be generated by alternating the location of the origin of a sweep between two values, the alternation occurring at the end of each sweep or at the end of the generation of each display. The shift in the location of the sweep origin may be accomplished by shifting the bias voltage in a sweep displacement circuit between two values.

The invention has particular advantages for use in a situation in which the display is generated at a point remote from a control station. In that case it is not desirable to transmit power from the control station in view of losses and transient surges which are inherent in the transmission and control of large D.C. voltages over a long line. With the use of the invention bias voltage may be switched between two ranges from a remote point with a minimum of connecting conductors and without the deleterious effects of losses and transient surges.

It is an object of the invention to provide a switching circuit which will permit rapid alternation between two sources of bias voltage and will permit independent variation of the magnitude of each bias voltage as the alternation is carried on.

It is a further object of the invention to provide such a switching circuit which is simple and inexpensive.

It is another object to provide a bias voltage source impedance which can cover a wide range from a low value to a high value.

It is another object to provide a means for switching a bias voltage between two ranges from a remote point without substantial losses or transient effects.

These and other objects and advantages of the invention are realized in a switching circuit in which a pair of vacuum tubes are connected in parallel with respect to a common power supply with the bias voltage output taken across a common load resistor. Individual variable cathode resistors are employed for individually varying the respective bias voltages and the tubes are alternated between conductive and non-conductive conditions by the application of phase opposed square wave voltages to their respective control grids.

The single figure of the drawing is a schematic diagram of a circuit embodying the invention.

Referring now more particularly to the drawing, there is shown a D.C. power source indicated as a battery 1, having an intermediate point grounded. Joining the negative terminal of the battery is a resistor 2. A resistor 3 has one terminal grounded. Connected in parallel between the free terminals of resistors 2 and 3 are a pair of vacuum tubes 4 and 5. The anodes of these tubes are connected to the said free terminal of resistor 3 which acts as a common load resistor for them. The cathodes are connected to respective sliding contacts 6 and 7 on resistors 8 and 9, each of which has a terminal

connected to the said free terminal of resistor 2. The remaining terminals of resistors 8 and 9 are joined and the junction connected by way of a resistor 10 to ground.

There are also provided a pair of switching tubes 12 and 13, having their respective anodes connected by way of resistors 14 and 15 to the positive terminal of source 1 and their cathodes connected to the negative terminal of that source. The control grid of tube 4 is connected by way of a serially connected pair of resistors 16 and 17 to the negative terminal of the source 1. The control grid of tube 5 is similarly connected to the same terminal by way of serial resistors 18 and 19. The anodes of tubes 12 and 13 are connected to the junctions of resistors 16 and 17 and resistors 18 and 19 respectively.

Switching voltages E_{s1} and E_{s2}, which are oppositely phased square wave voltages, are applied to the control grids of tubes 12 and 13 respectively from terminals 20 and 21 respectively. These terminals are connected to ground through resistors 22 and 23 respectively.

In the operation of this circuit it is desired that one of the tubes 4, 5 be conductive while the other is cut off and that this set of conditions be rapidly alternated. To accomplish this it is necessary that the voltage E_{s1} and E_{s2} applied to the control grids of tubes 12 and 13 alternate between zero and a negative voltage sufficiently larger in value than the value of the voltage at the negative terminal of source 1 to cut off either of these tubes. Bias voltage for tube 4 is supplied by the voltage divider consisting of resistors 14 and 17 while that for tube 5 is supplied by the voltage divider consisting of resistors 15 and 19.

When E_{s1} has a zero value the tube 12 will draw grid current and cause its plate voltage to reach a low value. The junction of resistors 16 and 17 will become sufficiently negative to bias tube 4 beyond cut-off. This will cause potentiometer 8 to become ineffective. As long as E_{s1} has a zero value, E_{s2} must have a larger negative value which cuts off tube 13. With this tube cut off its plate voltage will be at a high positive value. The junction of resistors 18 and 19 will reach a small negative value or may become positive which will allow tube 5 to conduct. Potentiometer 9 becomes effective and will provide a variable bias voltage E_c across resistor 3.

When the circuit is switched to the other set of conditions by the change of E_{s1} from its former zero value to a larger negative value, tube 12 is now cut off. E_{s2} has at the same time reached a zero value allowing tube 13 to conduct. Since the switching circuits of tubes 12 and 13 are similar the operating conditions of the two will be reversed. The voltage at the junction of resistors 16 and 17 will be at a low negative value allowing tube 4 to conduct. At the junction of resistors 18 and 19 the voltage will reach a high negative value and cut off tube 13. With 13 cut off potentiometer 9 has no effect while potentiometer 8 becomes effective and will now control the bias voltage E_c. High resistances 16 and 18 limit the grid current in both tubes 12 and 13 if their respective bias voltages become positive.

One advantage of the invention is the fact that the source impedance can be varied over a wide range by selection of the resistor 3 and can be made very low if desired. In view of the low impedance of the source and the purely resistive nature of the impedance of the load of the tubes 4 and 5 there will be no significant introduction of transient variations into the bias voltage by reason of the switching action of these tubes.

Due to the low impedance of the source the tubes 4, 5 may be separated by a long distance from the displacement circuit being controlled without the introduction of variations into the bias voltage through pick-up of energy by the linking conductors.

Due to the exclusive use of direct coupling in the

switching circuit the switching time, or the time required to shift from the application of one level of bias voltage to the other, is very rapid. For this reason the switching frequency may be very high.

Although tubes **4**, **5**, **12** and **13** are shown as triodes, pentodes could be used if desired.

What is claimed is:

In an electronic bias switch circuit a source of supply voltage, a voltage divider in series therewith, said voltage divider having a pair of parallel resistive branches of substantially equal value connected to a negative terminal of said source, a pair of thermionic tubes, each having a cathode, an anode and a control grid, a common load resistor for said tubes connected between the anode of each of said tubes and a grounded terminal of said source, means applying biasing voltage to the said control grids in a manner such that such tubes are alternately and oppositely biased between conductive and non-conductive states, means connecting the cathode of each of said tubes to a variable tap on a respective one of said branches, and means for deriving the output from said circuit across said load resistor, said means applying biasing voltage to said control grids comprising a pair of thermionic switch tubes, a source of supply voltage for said switch tubes, means applying oppositely phase rectangular wave voltages to the inputs of said switch tubes, thereby shifting said tubes alternately and oppositely between conductive and non-conductive states and means applying the output of each of said switch tubes to a respective one of said control grids, said outputs of said switch tubes constituting the only signals applied to the first mentioned thermionic tubes.

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