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DIRECT CURRENT VOLTAGE AMPLIFIER

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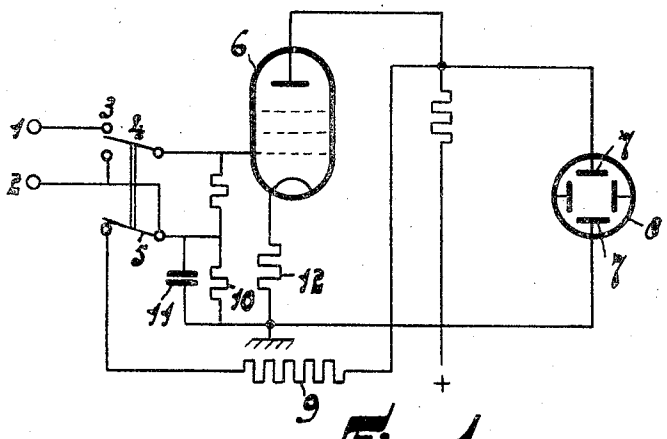

Fig. 1

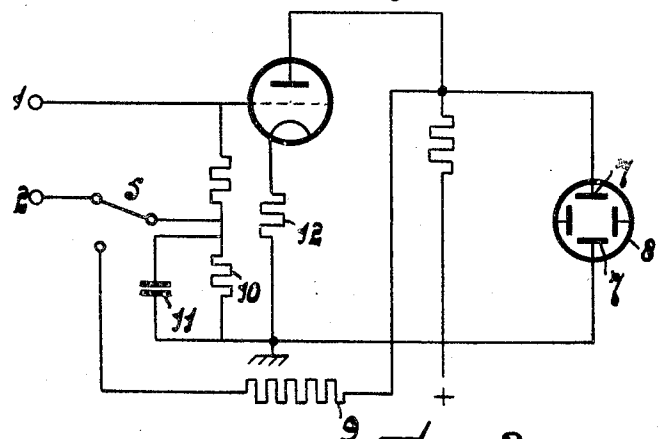

Fig. 2

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DIRECT-CURRENT VOLTAGE AMPLIFIER

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6 Claims. (Cl. 179—171)

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The invention relates to direct-current voltage amplifiers wherein the voltage required to be amplified is supplied to the input circuit of a tube-amplifier by means of a mechanically operated quick-acting switch.

Direct-current voltage amplifiers without a mechanically operated quick-acting switch exhibit the disadvantage that if the input voltage of the amplifier remains constant, a voltage which is variable with time is set up in the output circuit, said action being referred to as "drift" of the amplifier. Steps are known per se for counteracting this "drift" of the amplifier.

In a direct-current voltage amplifier comprising a mechanically operated quick-acting switch the voltage to be amplified and a constant voltage (for example, the voltage zero) are supplied successively to the input circuit of the amplifier. From the output circuit are taken two voltages the difference between which is independent of the "drift" of the amplifier.

There remains, however, the drawback, that each of the two voltages taken from the output circuit is dependent upon the "drift" of the amplifier. This drift may occur to such an extent that the absolute values of the voltages lie outside the measuring range of a measuring device responsive to these voltages, for example a cathode ray tube.

In order to eliminate this disadvantage, the invention provides a simple solution in the device under consideration.

According to the invention, the mechanically operated quick-acting switch is connected in such manner that in one position of this switch the voltage to be amplified and, in the other position, a voltage derived from the output voltage of the amplifier with the aid of a network the time constant of which is preferably smaller than the switching period of the quick-acting switch, is made operative in the input circuit of the amplifier.

The invention will be explained more fully with reference to the accompanying drawing in which:

Fig. 1 illustrates one form of an amplifier in accordance with the invention, and

Fig. 2 illustrates a modification of the arrangement shown in Fig. 1.

In Fig. 1 the voltage to be amplified is supplied via terminals 1 and 2 to a contact 3 of a mechanically operated quick-acting periodic switch, for example a vibrator switch. The arm 4 of the switch is connected to the control grid of a discharge tube 6 in the anode circuit of which is set up an amplified voltage which is supplied to deflector electrodes 7 of a cathode ray tube 8.

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A switch arm 5 is moved in synchronism with the switch arm 4 of the mechanically operated quick-acting switch. In the position of these switch arms at which the grid of the discharge tube 6 acquires the voltage of the contact terminal 2, part of the anode voltage of tube 6, which part is determined by resistances 9 and 10, is supplied by the switch arm 5 to a condenser 11 included in the grid circuit of tube 6. The time constant of the network 9, 10, 11 is chosen so as to be smaller than the switching time of the quick-acting switch. Consequently, the condenser 11 assumes a potential which is proportional to the voltage across the electrodes 7 at the time when the switch is in the position with the arms 4 and 5 connected to the respective lower contacts. At this time a negative feed back voltage is applied to the input circuit *b*, the elements 9, 10 and 11, thereby counteracting any variation of the said voltage of the electrode 7 and making the said voltage independent of the drift of the amplifier.

The time constant of the condenser 11 and the resistance 10 is so large that the condenser does not discharge to any significant extent during the period of time in which the switch occupies that position in which the grid of the tube 6 assumes the potential of the contact terminal 1. Accordingly in this position of the switch the voltage set up in the anode circuit of tube 6 will likewise be independent of the "drift" of the amplifier so that the disadvantage inherent to the known device is eliminated. If the time constant of the network 9, 10, 11 were greater than the switching frequency of the quick-acting switch, there is the danger that the control effected would not be sufficiently rapid.

It is advantageous to make the switching frequency of the quick-acting switch as high as possible, for in this case it is possible to neutralize not only slow variations of the characteristics of the amplifying tube 6 but also those variations which are due, for example, to changes in line voltage and to hum.

The period of time during which the grid of tube 6 assumes the potential of the contact terminal 1, is in general chosen so as to be longer at least by a factor 5 than that during which this grid assumes the potential of the contact terminal 2. In this case the time constant of the network 9, 10, 11 will be taken still smaller than has been mentioned above. To that end the resistance 9 may be replaced by a blocking con-

denser or the resistance 12 included in the cathode circuit may be given a higher value.

In the arrangement shown in Fig. 2, the mechanically operated switch comprises a single arm member which alternately connects the condenser-resistor network 11—10 to the terminal 2 of the source of voltage to be amplified and to the resistor 9 of the feed back path. The terminal 1 of the voltage to be amplified is fixedly connected to the grid of the amplifier tube.

The invention is not limited to the example illustrated but may, of course, also be applied to amplifiers comprising a plurality of tubes and to push-pull or cathode coupled amplifiers. If desired, an amplifiying tube may be incorporated in the circuit of the resistance 9.

What I claim is:

1. A direct-current voltage amplifier circuit arrangement comprising an electron discharge tube having a cathode, a control grid and an anode, an input circuit for applying the voltage to be amplified to the cathode and grid of said discharge tube; an output circuit coupled to said cathode and anode for producing an output voltage, mechanically actuated switching means for periodically interrupting said input circuit, and means to periodically apply said output voltage to said control grid in negative feedback relationship during the said interruption of said input circuit.

2. A direct-current voltage amplifier circuit arrangement comprising an electron discharge tube having a cathode, a control grid and an anode, an input circuit for applying the voltage to be amplified to the cathode and grid of said discharge tube, an output circuit coupled to said cathode and anode for producing an output voltage, mechanically actuated switching means for periodically interrupting said input circuit, and means to periodically apply said output voltage to said control grid in negative feedback relationship during the said interruption of said input circuit, said latter means comprising a network having a charging time constant shorter than the period of said switching means and a discharging time constant greater than the period of said switching means.

3. A direct-current voltage amplifier circuit arrangement comprising an electron discharge tube having a cathode, a control grid and an anode, an input circuit for applying the voltage to be amplified to the cathode and grid of said discharge tube, an output circuit coupled to said cathode and anode for producing an output voltage, mechanically actuated switching means for periodically interrupting said input circuit, and means to periodically apply said output voltage to said control grid in negative feedback relationship during the said interruption of said input circuit, said latter means comprising a first resistance element coupled to said cathode and grid, a capacitance element shunting said resistance element, a switching element operative in synchronism with said switching means and coupled to said first resistance element, and a second resistance element coupled between said anode and said switching element.

4. A direct-current voltage amplifier circuit arrangement comprising an electron discharge tube having a cathode, a control grid and an anode, an input circuit for applying the voltage to be amplified to the cathode and grid of said discharge tube, an output circuit coupled to said cathode and anode for producing an output voltage, mechanically actuated switching means for

periodically interrupting said input circuit in a ratio at which the voltage to be amplified is connected to said cathode and grid for a time interval greater than about five times the period of said interruption, and means to periodically apply said output voltage to said control grid in negative feed-back relationship during the said interruption of said input circuit, said latter means comprising a first resistance element coupled to said cathode and grid, a capacitive element shunting said resistance element and forming therewith a network having a time constant greater than said time interval, a switching element operative in synchronism with said switching means and coupled to said first resistance element, and a second resistance element coupled between said anode and said switching element and forming with said capacitive element a network having a time constant less than said period of interruption.

5. A direct-current voltage amplifier circuit arrangement comprising an electron discharge tube having a cathode, a control grid and an anode, an input circuit comprising a first conductor and a second conductor for applyng the voltage to be amplified to the cathode and grid of said discharge tube, an output circuit coupled to said cathode and anode for producing an output voltage, mechanically actuated first switching means for periodically selectively connecting said first and second conductors to said grid comprising a switch arm member connected to said grid, a first contact member connected to said first conductor and a second contact member connected to said second conductor, and means to periodically apply said output voltage to said control grid in negative feedback relationship during the interval when said grid is connected to said second conductor, said means comprising a first resistance element coupled to said cathode and grid, a capacitance element shunting said resistance element, a second resistance element coupled to said output circuit and second switching means operative in synchronism with said first switching means to periodically connect said second resistance element to said first resistance element.

6. A direct current voltage amplifier circuit arrangement comprising an electron discharge tube having a cathode, a control grid and an anode, an input circuit comprising a first conductor connected to said grid and a second conductor for applying the voltage to be amplified to the cathode and grid of said discharge tube, an output circuit coupled to said cathode and anode for producing an output voltage, mechanically actuated switching means for periodically interrupting said input circuit comprising a switch arm member coupled to said cathode and a first contact member coupled to said second conductor, and means to periodically apply said output voltage to said control grid in negative feedback relationship during the said interruption of said input circuit, said means comprising a first resistance element interposed between said switch arm member and said cathode, a capacitance element shunting said first resistance element, a second contact member selectively engaging said switch arm member during interruption of said input circuit and a second resistance element coupled between said output circuit and said second contact member.

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