

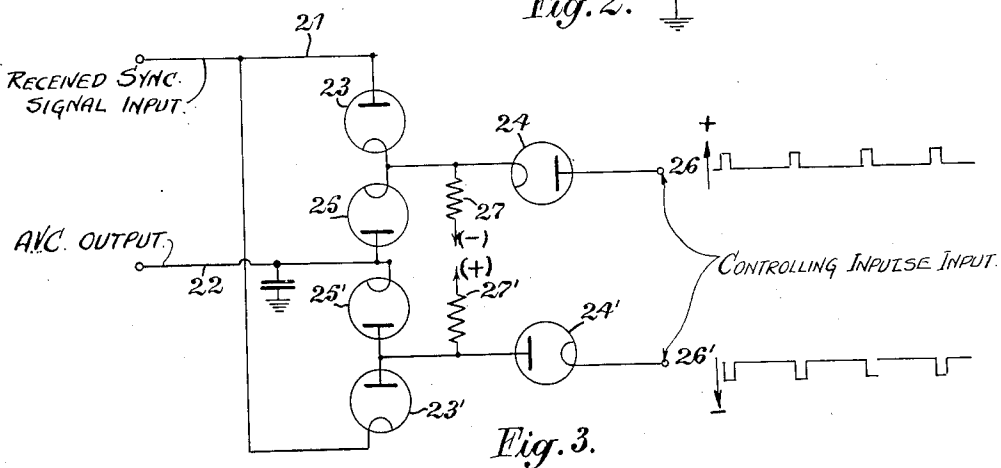
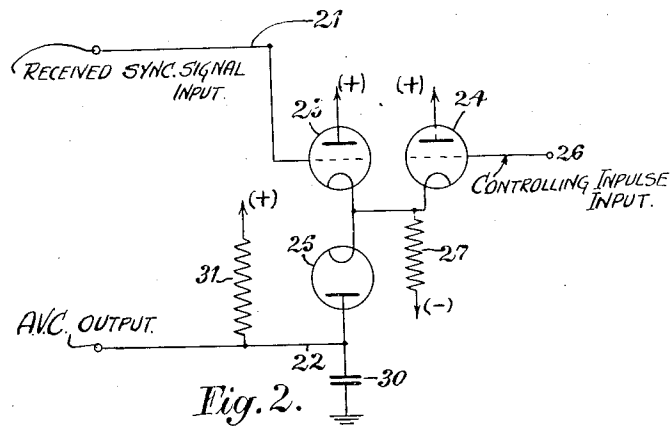
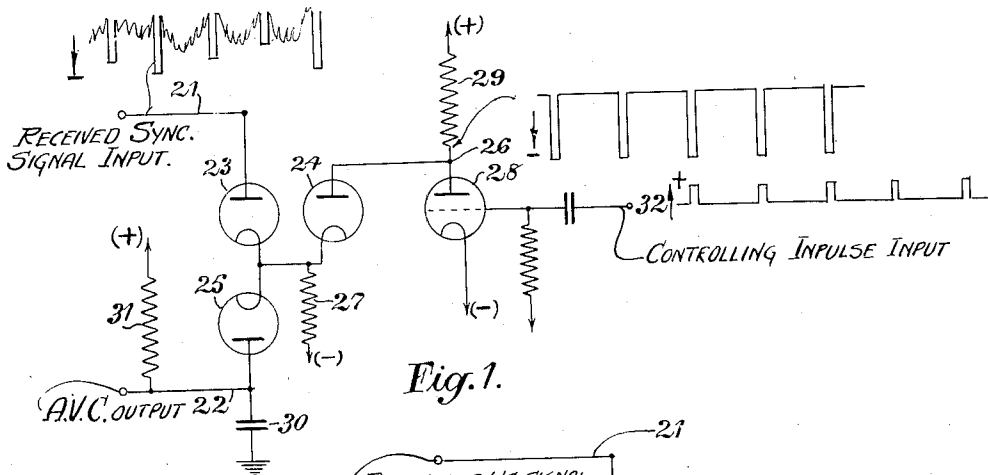
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A. D. BLUMLEIN ET AL

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ELECTRIC SIGNAL PULSE CONTROLLING CIRCUITS

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INVENTORS
A. D. BLUMLEIN
E. L. C. WHITE
BY *H. S. Sines*
ATTORNEY

UNITED STATES PATENT OFFICE

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ELECTRIC SIGNAL PULSE CONTROLLING CIRCUITS

Alan Dower Blumlein, Ealing, London, and Eric Lawrence Casling White, Hillingdon, England, assignors to Electric & Musical Industries Limited, Hayes, Middlesex, England, a company of Great Britain

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2 Claims. (Cl. 178-7.3)

This invention relates to electric signal pulse controlling circuits and is concerned with improvements in or modifications of the invention described in co-pending application Serial No. 194,542 filed March 8, 1938 in the name of W. S. Percival and E. L. C. White.

In the said application there is disclosed a switch which may be employed for a variety of purposes. This arrangement comprises a pair of uni-directional conducting devices which under the operation of controlling impulses act as an uni-directional switch. One of the electrodes of one of said uni-directional devices is connected to a like electrode of the second uni-directional conducting device, the common electrodes being connected to a conductive impedance. Switching pulses are applied to one or more of the electrodes of said arrangement so that the switch is rendered conductive or insulating.

The object of the present invention is to provide an improved switch of this type which requires controlling pulses of smaller amplitude than those of the co-pending arrangement and which operates in a quicker and improved fashion.

The switch described in the co-pending application is a uni-directional conducting device and a further object of the present invention is to provide an improved bi-directional conducting switch.

According to the present invention an electrical switching circuit adapted to be controlled by switching pulses is provided comprising three uni-directional conducting devices having effectively a common electrode which is connected to an impedance, the arrangement being such that when a controlling pulse is applied to one of said devices, one or both of the other devices is or are switched from a substantially non-conducting condition to a conducting condition, or vice versa.

In one form of the invention the three cathodes of three diode valves may be connected together and the controlling pulse may be applied to an anode of one of the diodes, if desired, from a further valve. Alternatively, three diode valves with their anodes connected together may be used, the pulses being applied to the cathode of one of the diodes. In another form of the invention triode or other multi-electrode valves may be used with the cathodes connected together. This last arrangement has the advantage that as the controlling potentials are applied to the control electrode, or electrodes, of the valve or valves, the

device places substantially no load on the controlling circuits.

The invention may be employed to provide a unidirectional conducting switch or a switch which is bi-directionally conductive. In the latter case two sets of three valves may be employed, the cathodes of one of said sets being connected together, whilst the anodes of the other set are similarly connected together, the two sets being connected back-to-back. Controlling pulses are applied to the cathode of one valve of one set and similar controlling pulses reversed in phase are applied to the anode of one valve of the other set.

In a modification of this bi-directional conducting switch, instead of applying the controlling pulses through the two diodes, these diodes are omitted and the controlling pulses are applied through suitable impedances.

In order that the said invention may be clearly understood and readily carried into effect it will now be more fully described with reference to the drawing wherein:

Figure 1 shows one form of the present invention, and

Figures 2 and 3 show modifications of the circuit shown in Figure 1.

Figure 1 shows an arrangement using three thermionic diode rectifiers 23, 24 and 25 (which may be a triple-diode valve) the cathodes of which are joined to a resistance 27 connected to a source of negative potential (not shown). Any other form of rectifier may be used, but if high speeds of switching are required rectifiers of low capacity are desirable. The three diodes form a switch adapted to effectively connect the line 21 with the line 22 (the potentials of the two lines are made identical) under the control of controlling pulses applied to terminal 32 and thus effectively at point 26. The anode of diode 23 is connected to the line 21 and the anode of valve 25 is connected to line 22. The terminal 32 is associated with the control grid of valve 28 to which it is coupled by a suitable condenser and grid leak. The cathode of valve 23 is taken to a suitable negative potential and the anode of the valve is connected to a positive source of potential via resistance 29. The resistance 29 is preferably lower in value than the impedance 27, which latter may be inductive, its function being to take a substantially constant current from diode cathodes to a negative potential. If the potential of point 26 is made more positive than the potentials of 21 and 22 then all the current in impedance 27 flows through diode 24.

Should point 26 now be driven negatively the current in the impedance 27 tends to make diodes 23 and 25 conduct since the cathodes of these diodes are driven in a negative direction, thus providing conducting paths between lines 21 and 22 and the common cathodes. If 21 and 22 are greatly different in potential the current in the impedance 27 will only flow through one or the other of diodes 23 or 25, but this current will tend to draw the lines 21 and 22 together in potential.

In a particular application it may be necessary to charge, or alter the potential on, a condenser 30 (shown connected between line 22 and earth) to a potential which is representative of the potential of the line 21 during certain periods of time when the device is made operative. The ungrounded plate of condenser 30 is connected to a source of positive potential by a high resistance 31. In this case the anode of diode 24 is normally maintained positive with respect to its cathode by means of the resistance 29. The current from impedance 27 then flows through diode 24 and the diodes 23 and 25 are non-conducting, since the anode of diode 24 and consequently the cathode of 24 makes the cathodes of diodes 23 and 25 positive with respect to their anodes. The valve 28 is arranged to drive the anode point 26 in a negative direction when a positive controlling pulse is applied to the grid of valve 23. When point 26 is driven negatively the anode of diode 24 and therefore its cathode are also driven negatively. The cathode potential of diode 24 falls negatively until diode 23 or 25 conducts and robs diode 24 of the current flowing in impedance 27. Suppose, for instance, that during the operative period the potential of line 21 is less than the potential of line 22. The diode 25 will conduct and decrease the potential of condenser 30 negatively until the anode of diode 25 drops in potential to the same potential as the anode of diode 23. This latter diode will then conduct and if 21 is connected to a low impedance potential source (the potential of which may be varying), the change in the potential of condenser 30 will cease and lines 21 and 22 will have been effectively joined, i. e. they are both brought to the same potential. If the potential of line 22 is negative with respect to line 21 however, and if line 21 is connected to a low impedance source of potential so that the current through impedance 27 cannot bring the potential of line 21 to that of line 22, the two lines will not be effectively joined. A leak resistance 31 from a source of positive potential is therefore connected to line 22 in order to make the potential of condenser 30 more positive, so that each time the device is operative a more negative charge is applied to condenser 30, so that the potential of line 22 follows that of line 21 during the operative period.

The diodes of Fig. 1 may, if desired, be connected in a reverse sense so as to charge 30 positively instead of negatively. With all three diodes reversed, i. e., with the cathodes separate and the anodes connected together, the impedance 27 must be taken to a source of positive potential and resistance 31 to a source of negative potential. The valve 28 will then require a negative pulse to be applied to its grid in order to switch the device into the operative condition.

The arrangement illustrated in Fig. 2 is a modification of the circuit of Fig. 1. In this figure the diodes 23 and 24 are replaced by triode valves the grid of valve 23 being connected to line 21 and the grid of valve 24 being taken to point 26. The

anodes of the two triodes are taken to suitable sources of positive potentials. The end of the common impedance 27 is taken to a suitable negative potential. The impedance of 27 should preferably be larger than the reciprocal of the mutual conductance of the valves 23 and 24 and thus the cathode potentials of the valves 23 and 24 tend to follow the potentials applied to their grids. For this reason the valves 23 and 24 will be termed "cathode follower rectifiers." The action of this circuit is similar to the three diode arrangement of Fig. 1 except that no load need be thrown on line 21 or on point 26. The condenser 30 will not be charged or have applied thereto a potential exactly equal to that of line 21 as there will be a difference of potential representing the grid bias on valve 23 necessary to pass the current through impedance 27. An advantage of this arrangement is that the pulses applied at 26 need not be very large in amplitude and they need not be as large as the signals on line 21. For example, if point 26 is driven in a positive direction in order to keep the device inoperative, and a large signal on line 21 drives the grid of valve 23 very positive, then 23 will conduct and the current flowing through valve 24 will be reduced. This will not affect the condenser 30 since the cathode of valve 25 will be made positive with respect to its anode. If line 21 makes a large negative excursion, it will have no effect on the potential of the cathode of valve 23 or of valve 25. If, however, point 26 is driven negatively so that valve 24 insulates for any working potential of condenser 30, the current in impedance 27 will alter the charge on condenser 30 in a negative direction through diode 25 until the cathode of valve 25 and therefore the cathode of valve 23 falls so low in potential that valve 23 passes all the current through impedance 27. Similar remarks apply to the arrangement of Fig. 1 except that large positive potentials on line 21 will make valve 23 conduct thus loading line 21. Of course, if 21 is fed from a low impedance source this is immaterial. If, however, it is required not to load line 21 when the switch is inoperative, a sufficiently positive potential must be applied to the cathode of valve 23 to prevent it from conducting for any positive potential excursion of line 21.

The arrangement of Fig. 2 may be adapted to be use for "observing devices" as required in British Patent No. 458,585 and as switched conductors as in British Patent No. 449,242. In the latter case, the diode 25 is connected to the condenser in the signal lead and the grids of valves 23 and 24 to a fixed potential and to the pulse source.

The arrangement of Figure 2 can be modified by replacing either valve 23 or valve 24 by a diode valve, in which case a valve of the so-called double-diode-triode type may be employed for the three unidirectional conducting devices.

Fig. 3 shows two devices such as are shown in Fig. 1 connected back to back to form a two-way (bi-directionally conductive) switch. When operative, diodes 23, 25, 23' and 25' serve to effectively join lines 21 and 22 for current flow in both directions. Negative and positive potentials are applied to impedances 27 and 27' respectively and to maintain the device inoperative (that is, to open-circuit the switch) positive and negative controlling potentials are applied to terminals 26 and 26' respectively. If terminals 26 and 26' are made respectively negative and positive of the potentials of line 21 and

22, the currents in impedances 27 and 27' are diverted into the diodes 23, 25 and 23', 25' in such a direction as to draw the potentials of 21 and 22 together. If the rectifiers differ slightly in the potentials at which they begin conducting there may be a possible potential difference between 21 and 22 where, say, 23 and 23' are conducting and 25 and 25' are insulating due to these differences in the rectifiers. This difficulty can be overcome by inserting small resistances directly in series with the rectifiers 23, 25, 23', and 25'. Such resistances increase the resistance of the switch between 21 and 22 but prevent any such effect as that described. It will be appreciated that push-pull pulses are required at terminals 26 and 26' and such pulses may be obtained from such a push-pull amplifier or by any other suitable form of push-pull pulse generator.

Similarly the arrangement of Figure 2 can be adapted to form a two-way conducting switch by connecting two such arrangements back-to-back.

According to a modification of the invention the two diode valves 24 and 24' of Fig. 3 can be omitted and the controlling pulses can be applied to the ends of the impedances 27 and 27' in push-pull; alternatively, the pulses may be applied directly to the cathodes of the valves 23 and 25 and to the anodes of valves 23' and 25', also in reversed phase, from a high impedance push-pull source of pulses in parallel with the impedances 27 and 27', which in effect is equivalent to applying pulses in series with impedances 27 and 27' of slightly lower values.

The device of Fig. 3 may be used for charging a condenser, for example, at 22 to the potential of line 21 during the operative period, the device being capable of charging and discharging the condenser so that no leak resistance is required.

Various other modifications may be made in the present invention without departing from the spirit and scope thereof, and it is desired that any and all such modifications be considered within the purview of the present invention except as limited by the hereinafter appended claims.

We claim:

1. An electron switch circuit comprising a pair of electron discharge devices each including a cathode and an anode, means for connecting each of the cathodes together, means for connecting the anodes to a pair of conductors of dissimilar potential, means including a high impedance for maintaining one of the conductors at a positive potential with respect to a point of fixed potential, a condenser connected between the said one conductor and the point of fixed potential, a third electron discharge device in-

cluding a cathode and an anode, means for connecting the cathode of said third electron discharge device to the cathodes of the said pair of devices, means including an impedance for connecting all of the cathodes to a source of potential negative with respect to said point of fixed potential, means for maintaining the anode of said third discharge device positive with respect to said cathodes and with respect to said pair of conductors, the other of said pair of conductors being adapted to have a varying potential applied thereto, and means for intermittently impressing negative control potential impulses on the anode of said third discharge device whereby, during the application of the control impulses, the potential of the said one conductor may be intermittently brought to the potential then present on said other conductor.

2. An electron switch circuit for use in a television receiving circuit wherein picture and synchronizing signals are received and wherein an automatic volume control voltage is developed in accordance with the intensity of the received synchronizing signals comprising a pair of electron discharge devices each including a cathode and an anode, means for connecting each of the cathodes together, means for connecting the anodes to a pair of conductors of dissimilar potential, means including a high impedance for maintaining one of the conductors at a positive potential with respect to a point of fixed potential, a condenser connected between the said one conductor and the point of fixed potential, a third electron discharge device including a cathode and an anode, means for connecting the cathode of said third electron discharge device to the cathodes of said pair of devices, means including an impedance for connecting all of the cathodes to a source of potential negative with respect to said point of fixed potential, means for maintaining the anode of said third discharge device positive with respect to said cathodes and with respect to said pair of conductors, the other of said pair of conductors being adapted to have the received synchronizing signals applied thereto, and means for intermittently impressing negative control potential impulses on the anode of said third discharge device in synchronism with the application of the received synchronizing signals to said other conductor whereby, during the application of the control impulses, the potential of the said one conductor may be intermittently brought to the potential then present on said other conductor to develop an automatic volume control voltage across said condenser in accordance with the intensity of the synchronizing signals as received.

ALAN DOWER BLUMLEIN.

ERIC LAWRENCE CASLING WHITE.