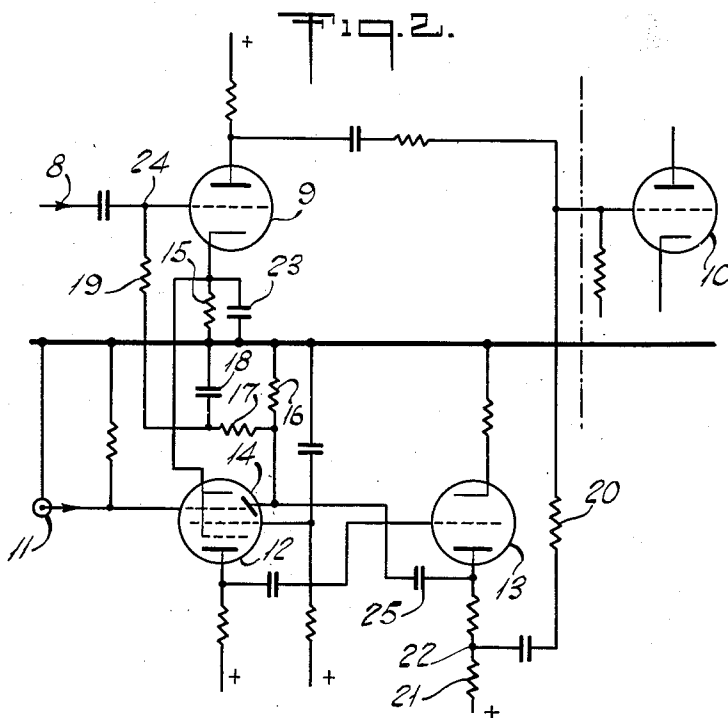
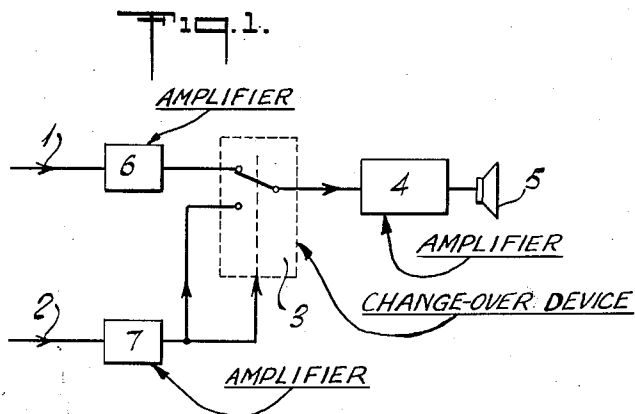


Oct. 9, 1956

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AUTOMATIC SWITCHING DEVICE FOR RADIO, AMPLIFICATION, AND
SIMILAR SYSTEMS
Filed Nov. 12, 1952

2,766,378



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AUTOMATIC SWITCHING DEVICE FOR RADIO, 5 AMPLIFICATION, AND SIMILAR SYSTEMS

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Application November 12, 1952, Serial No. 319,818 10

4 Claims. (Cl. 250—27)

The present invention relates broadly to electrical switching apparatus and in particular to an automatic switching device which at the exclusion of manually operated means of any kind permits automatic change-over from signals of one kind to signals of another kind and vice-versa, e. g. from reproduction of broadcasting performance signals to temporary announcements by means of a microphone.

Electrical switching apparatus of the aforementioned type have in the past found numerous applications, particularly in vehicles in public communication, such as busses, trams, underground trains and the like, in which the passengers normally are furnished with any radio programme, while the driver has the possibility of interrupting such radio reception in order to submit certain announcements to the passengers by means of a microphone, e. g. the name of the next stop or station. The heretofore known apparatus suffer under the disadvantage that each change-over from reception of a radio programme to such temporary announcements and vice-versa inevitably requires manual actuation of some switching facility which, of course, severely affects the traffic safety in general and in particular in cases when there is a frequent need for such announcements, since it must be borne in mind that the driver apart from his normal duties with respect to the vehicle per se often must attend to further duties, such as the opening and closing of the doors, coin exchange, receipt of the fare and the like, and that the switch in question is not always readily available to the driver.

It is the main object of this invention to overcome the above mentioned drawbacks and inconveniences and to provide a signal change-over device, wherein any transition from one kind to another kind of signals may be performed wholly automatically, that is, in absence of manually operated switches or the like.

This object is realized according to the invention by the provision of an automatic switching device for radio, amplification or similar systems, wherein the change-over means is adapted to be actuated in response to a D. C. voltage, which is obtained by the rectification of one part of a first signal which previously has been sufficiently amplified and exceeds a certain threshold potential and which during the persistence of said signal is caused to render a further amplifier for a second signal non-conducting, whereby on the one hand the threshold potential is subjected to a certain decrease, on the other hand the gain of an amplifier for said first signal is increased and that this first signal is fed to a succeeding amplifier, e. g. a final amplifier and a following loudspeaker, to which is also connected said amplifier capable of being rendered non-conductive through any suitable mixer circuit, so that a change-over takes place from said second signal to said first signal and said first signal acquires predominance over said second signal.

The invention will be more readily understood from the following description when taken in conjunction with the attached drawing, in which:

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Fig. 1 schematically illustrates the operating principles underlying the invention, while

Fig. 2 shows a detailed circuit diagram applicable to one embodiment according to the invention.

With reference to Fig. 1 it will be assumed that signals of one kind, e. g. received broadcasting signals, are fed continuously via a circuit 1 into a corresponding amplifier 6 and thence through a change-over device 3 and a final amplifier 4 to a loudspeaker 5, and that signals of another kind arriving over a circuit 2, e. g. from a microphone, may be impressed on a special amplifier 7 for further transmission through the change-over device 3 and the final amplifier 4 to the said loudspeaker 5 under simultaneous suppression of the signals of the first mentioned kind. The manner in which the principles of this mode of operation may be achieved will now be described in the following with special reference to Fig. 2.

Signals emanating from the corresponding stage of a radio receiver and arriving over a conductor 8 are normally supplied to the control grid of an amplifying valve 9, which preferably exhibits a steep characteristic of mutual conductance, wherein these signals are amplified and fed to a succeeding low frequency amplifying valve 10 in conventional manner, to which may be connected a loudspeaker (not shown). Whenever it may be desired to interrupt the abovementioned transmission in order to provide a temporary announcement, the operator or attendant submits the corresponding speech waves to his nearby microphone 11, thereby giving rise to an amplified speech voltage in a thermionic tube 12, preferably a variable- μ pentode. Concurrent with a further amplification in an amplifying valve 13 the speech voltage will be subject to rectification in the diode 14 provided that the resulting speech voltage exceeds the threshold potential developed across a cathode resistor 15. There is, accordingly, obtained across a resistor 16 a negative direct voltage which is proportional to that part of the speech voltage which exceeds said threshold potential. The A. C. component of this direct voltage is substantially removed by filter means comprising a resistor 17 and a capacitance 18, and the smoothed direct voltage is then supplied through a resistor 19 to the control grid of the amplifying valve 9 which thereby tends to be non-conducting and to attenuate the radio signals through this valve. The consequent reduction of the plate current through this valve results in a decrease of that cathode voltage which is common to the valve 9 and the tube 12 and in an increased gain in the amplifying section of tube 12, while at the same time the threshold potential becomes reduced. It is thus possible by a proper choice of valves and plate resistors to obtain a cathode current in the valve 9, which is large in comparison with that of tube 12 and which, therefore, determines the magnitude of the voltage across the common cathode resistor. The increased speech voltage conjoint with the decreased threshold potential provide a further increase of the aforementioned direct voltage until the valve 9 is rendered wholly non-conducting and the radio signals have fully decayed, while at the same time the tube 12 creates a relatively higher gain in accordance with the reduction of the grid bias. The relatively low level of the radio signals at the input of valve 10 and the further reduction thereof at the point 22 due to voltage division in the resistors 20 and 21 prevent periodical self-blocking of the radio signals. The cathode capacitor 23 is required by the same reasons.

The fact, that the microphone may not be located near the loudspeaker, particularly in cases of full amplification, in order to obviate acoustical feed-back, also eliminates any self-blocking tendency of the radio signals at the

prevailing threshold potential and the lower amplification of the microphone signals.

The speed with which a change-over to microphone operation or announcement takes place will be determined substantially by the values of the resistors and capacitors, such as 17 and 18, respectively, which participate in the negative charge at the point 24 of the grid supply lead to the valve 9. Experimental tests carried out on automatic switching devices of the type described above have evidenced that this transition speed or time is of sufficiently short duration to insure a perfectly clear perception of the first spoken word in the loudspeaker, whether this word commences with a vowel or a consonant. It is true, that clicks and/or bounces in the microphone may be heard, but interferences of this type are generally of a duration which is too short for causing radio signals to be blocked.

The speed of restoration to normal reception of radio broadcasting signals and their reproduction in the loudspeaker will substantially depend upon the values of those elements, such as the capacitor 25, the resistor 16 etc., which participate in the discharge at the aforementioned point 24. The values of the capacitor 25 and of the resistor 16 should conveniently be so chosen, that a short delay of, say between 2 and 3 seconds, is introduced in order to prevent this automatic switching operation in response to a short interruption of speech supply to the microphone.

The above-mentioned speeds during a change-over to microphone announcement as well as in connection with a restoration to radio reception are likewise dependent upon the intensity of speech supplied to the microphone, but these automatic switching operations occur with an adequate softness free of any items of disturbance in an automatic switching device according to this invention which, however, is not possible in prior art installations of this type which have been bound to employ some kind of manually operable switches for effecting the desired change-over action.

The valve amplifier 13 embodied in Fig. 2 may be omitted in this circuit arrangement in cases when the level of microphonic signals is sufficiently high in the output of tube 12 to insure the requisite blocking voltage.

Some possible applications of the above described automatic switching device have already been indicated in the introductory section of this specification merely by way of an example. However, there is a wide range of further applications for devices of this kind, of which some few possibilities will be stated below, viz. public address systems particularly in connection with central radio receiving plants in schools, restaurants, industrial factories, on sport places, ships and the like, whenever it will be desirable to submit temporary announcements or messages to the public during a current transmission of a radio programme or gramophone music and to suppress this transmission without the necessity of actuating any manually operable switches or the like. Moreover, a device according to this invention allows an automatic change-over from radio reception to gramophone performance merely by placing the pick-up needle on the rotating disc.

While the principles of the invention have been described above in connection with a specific embodiment thereof, it is to be clearly understood that this description is made only by way of an example and not as a limitation on the scope of the invention.

What is claimed is:

1. In a switching device of the character indicated, a first amplifier including an input circuit adapted normally to accept a first signal, a second amplifier including an input circuit adapted normally to accept a second signal, biasing-resistor means common to both amplifiers and normally biasing said first amplifier for passage of said first signal therethrough and for biasing said second amplifier at less than an optimum operating gain, means including a rectifier responsive to said second signal, a bias-controlling connection from said rectifier to said first amplifier and independent of said biasing-resistor means, the sense of said bias-controlling connection being such as to reduce the gain of said first amplifier in accordance with the magnitude of rectifier-output voltage, whereby in the presence of said second signal the gain of said first amplifier may be reduced relatively to the gain of said second amplifier, and signal-processing means responsive simultaneously to the outputs of both said amplifiers.

2. A switching device according to claim 1, in which said rectifier includes filtering means having a relatively short time constant, whereby changeover from response of said signal-processing means to said first signal to a response thereof to said second signal may be effected relatively quickly.

3. A switching device according to claim 1, in which said rectifier includes energy-storing means characterized by relatively long-decay-time constant, whereby changeover from response of said signal-processing means to said second signal to a response thereof to said first signal may be effected relatively slowly.

4. In a switching device of the character indicated, a first vacuum-tube amplifier including a grid and a cathode and adapted normally to accept a first signal, a second vacuum-tube amplifier including a grid and a cathode and adapted normally to accept a second signal, a common cathode-resistor connection to said cathodes, whereby a threshold voltage may be established across said resistor, and a rectifier responsive to the extent to which output of said second amplifier exceeds said threshold voltage and in negative-biasing relation with the grid of said first amplifier; whereby, on development of a second signal exceeding said threshold voltage, said first amplifier becomes biased and thereby lowers the threshold voltage and increases the gain of said second amplifier, thus accelerating cut-off of said first amplifier and enhancing the output of said second amplifier.

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