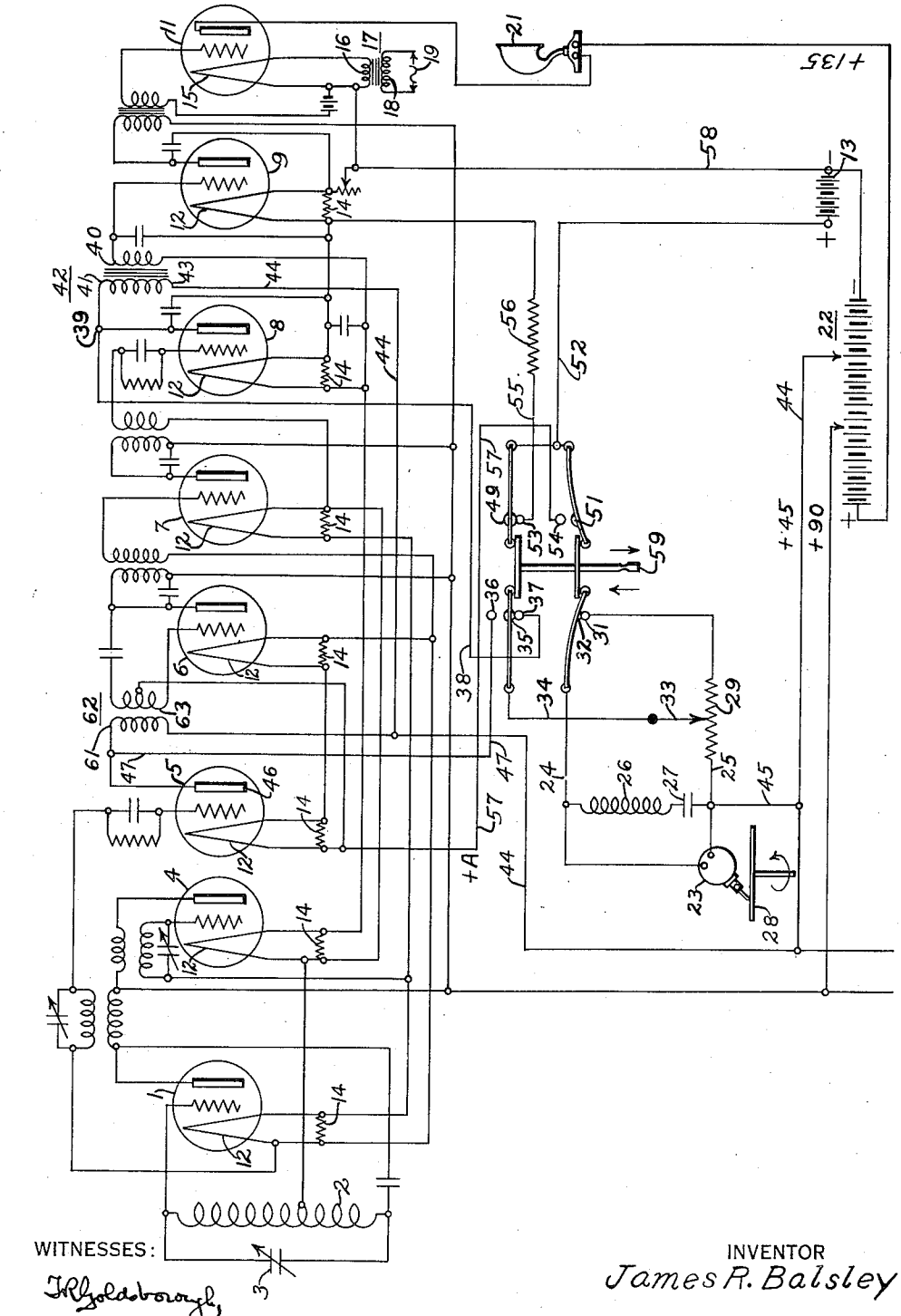
July 1, 1930. J. R. BALSLEY 1,768,658

AMPLIFYING SYSTEM

Filed Sept. 13, 1926



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Patented July 1, 1930 1,768,658

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AMPLIFYING SYSTEM

Application filed September 13, 1926. Serial No. 134,974.

My invention relates to amplifying systems, and particularly to systems in which the output from either a radio-receiver or a sound-record-actuated device may be applied at will to a single amplifier.

One object of my invention is to provide, in systems of the type referred to above, a control device that will enable the user to adjust the volume of sound generated.

Another object of my invention is to provide a single current-limiting device adapted to control the output of either the radio receiver or the sound-record-actuated device.

Another object of my invention is to provide, in systems of the type first referred to, switching means for simultaneously deenergizing the radio receiver and connecting the sound-record-actuated device to the amplifier.

Another object of my invention is to provide means for preventing excess voltage from being applied to the amplifier upon deenergization of the radio receiver.

Still another, and more specific object of my invention is to provide means whereby a single switching device may be utilized to simultaneously deenergize and disconnect a radio receiver from an amplifier, transfer a current-limiting device from the radio receiver to the sound-record-actuated device, and connect in circuit the excess-voltage preventing means above referred to.

My invention broadly consists in so arranging a resistor that it may be utilized either as a shunt resistor across the output circuit of one of the thermionic tubes in a radio-receiver, or may be associated as a potentiometer with the output circuit of a magnetic pick-up device actuated by a phonograph record or the like. In the latter case, suitable connections are provided whereby any desired portion of the voltage drop across the resistor may be employed to energize an amplifier, permitting perfect control of the sound output.

The novel features which I believe to be characteristic of my invention, including features not included in the brief statement of the objects thereof, are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, will best be understood by reference to the following description taken in connection with the accompanying drawing, the single figure of which is a diagrammatic view of a preferred form of my invention as applied to a combined radio-receiver, magnetic-pick-up, sound-record actuating means, amplifier and loud-speaker, usually known in the art as a "radio-phonograph".

The radio receiver may embody any of the standard and well-known circuits, or may be of the super-heterodyne type, the latter being the form chosen for purposes of illustration. The super-heterodyne receiver, as usually constructed, comprises a radio-frequency amplifying tube 1, provided with an incut circuit comprising an inductor 2 and a condenser 3, an oscillator tube 4, a detector tube 5, one or more intermediate-frequency amplifier tubes 6 and 7, a second detector tube 8, and one or more amplifying tubes 9 and 11. The filaments 12 of the first seven tubes may be connected in series with a source 13 of direct current or of rectified alternating current, a resistance 14 being shunted across the filament of each tube to fix the voltage applied thereto. The filament 15 of the last power-amplifying tube 11 need not be energized by direct current, but may be fed from a secondary 16 of a transformer 17, the primary 18 of which is energized by a source of alternating current 19. A loud speaker 21 is connected in the output circuit of the tube 11, and is energized from a source of potential 22, which may also supply plate potential to the other tubes.

A magnetic pick-up 23, having output conductors 24 and 25 across which may be connected a filter comprising an inductor 26 and a condenser 27 for the purpose of by-passing current variations due to "scratch", is arranged to be actuated by a phonograph record 28. A resistor 29 having a value of approximately 25,000 ohms is connected to the output conductor 25, the circuit back to the other conductor 24 being completed through a fixed contact 31 and a movable contact 32.

The manner in which the movable contact 32 is actuated will be later explained.

A contact-arm 33 is associated with the resistor 29, a conductor 34 leading from the arm 33 to a second movable contact 35, with which are associated upper and lower fixed contacts 36 and 37. A conductor 38 leads from the lower fixed contact 37 to a terminal 39 of the primary 41 of an audio-frequency transformer 42 associated with the output circuit of the second detector tube 8, another terminal 43 of the primary 41 being connected by a conductor 44 to the source 22 of plate potential, which source is also connected to the magnetic pick-up output conductor 25 by means of a conductor 45.

The plate 46 of the first detector tube 5 is directly connected, by a conductor 47, to the upper fixed contact 36 associated with the movable contact 35, for a purpose which will later be explained.

Two movable contacts 49 and 51 are associated with the filament-potential source 13 through a conductor 52, a fixed contact 53 being associated with the upper contact 49, and another fixed contact 54 being associated with the lower contact 51. The upper fixed contact 53 is connected to the filament 12 of the first audio-frequency amplifying tube 9 through a conductor 55, having a resistor 56 in series therewith. This resistor should be equal in value to the combined resistances of the filaments of the tubes 1, 4, 5, 6, 7, and 8, and the shunting resistors 14 referred to previously.

A circuit can be traced from the lower fixed contact 54 by way of a conductor 57 through the filaments of the tubes 5, 6, 1, 7, 4, 8 and 9, in the order named, a conductor 58, through the filament potential source 13, the conductor 52, and back to the movable contact 51.

Each of the four movable contacts is preferably operated simultaneously by a single movement of a switching device 59, the latter being made of insulating material.

In the operation of my device, assuming that it is desired to utilize the radio receiver to actuate the loud-speaker 21, the switching device 59 is operated to close the contacts 35 and 36 and the contacts 51 and 54, and to separate the contacts 31 and 32, contacts 35 and 37, as well as contacts 49 and 53. This operation energizes the filaments of the radio receiver, through the circuit previously traced, and also connects the resistor 29 between the plate 46 of of the first detector tube 5 and the source of plate potential 22, thereby shunting the primary 61 of output transformer 62, the secondary 63 of which serves as the input for the intermediate frequency amplifier tube 6. The potential applied to the plate 46 of the detector tube 5 then depends upon the position of the contact arm 33, and may accordingly be varied as desired in order to vary the amount of energy supplied to succeeding tubes of the system.

When it is desired to utilize a phonograph record or other sound record as the source of current variations to be amplified, the switching device 59 is operated to close the contacts 31 and 32, the contacts 35 and 37, as well as the contacts 49 and 53, at the same time separating the contacts 35 and 36 and the contacts 51 and 54. The filament-potential supply circuit for the first six tubes is accordingly broken, the first audio-frequency amplifying tube 9 alone being energized directly from the source 13. The resistor 56 compensates for the resistance of the filaments of the deenergized tubes and the resistors associated therewith, in order to prevent excess filament potential from being applied to the filament of the audio-frequency amplifying tube 9.

A circuit through the magnetic pick-up is completed by the closing of contacts 31 and 32, permitting the current variations set up thereby to be impressed across the large resistor 29, while the closing of contacts 35 and 37 causes that portion of the resistor 29 included between the contact arm 33 and the conductor 45 to be shunted directly across the primary 41 of the audio frequency transformer 42. Potential variations existing along the resistor 29 may accordingly be impressed on the primary 41, the position of the contact arm 33 controlling the amplitude of such potentials.

The secondary 40 of the audio-frequency transformer 42 serves as the input for the first audio-frequency amplifier tube 9, the output from which energizes the power amplifier tube 11, which in turn, actuates the loud-speaker 21.

It is thus apparent that I have provided a highly efficient system for volume control that is applicable to any of the usual and well-known radio receivers, when used in combination with a sound record-actuated device for the reproduction of either radio programs or phonograph records. A single movement of a single control device serves to shift from radio to phonograph actuation, and a single resistor is used in either case for output volume control.

By shifting the resistor from the primary of the first audio-frequency transformer to one of the tubes carrying radio-frequency when it is desired to receive a radio program, I am enabled to obtain better and more uniform control of the loud-speaker output, than if the resistor were permitted to remain across the audio-frequency transformer. At the same time, overloading of the intermediate-frequency-amplifying tubes and the second detector, with consequent signal distortion, is largely prevented.

Although I have described my invention in connection with a radio circuit of a single

specific type, and have illustrated a switching device particularly adaptable for use therein, it is obvious to those skilled in the art that it is not restricted thereto. It is my intention, therefore, that my invention shall not be limited except in so far as is necessitated by the prior art and as indicated by the spirit of the appended claims.

I claim as my invention:

1. In combination, a radio-receiving system, an amplifying device, a source of audio-frequency currents, a current-limiting device, means comprising a multi-contact switch for connecting either the radio-receiving system or the source to said amplifying device, said connecting means serving to actuate additional means for connecting said current-limiting device in circuit with either said radio-receiving system or said audio-frequency-current source, and means for deenergizing the radio-receiving system when disconnected from said amplifying device.

2. In combination, a radio-receiving system comprising a plurality of thermionic devices having cathodes adapted to be energized by a source of current, an amplifying device, a source of audio-frequency currents, a current-limiting device, means comprising a multi-contact switch for connecting either the radio-receiving system or the source to said amplifying device, said connecting means including additional means for disconnecting said source of cathode energy from said radio-receiving system, and simultaneously operable means for connecting said current-limiting device in circuit with either said radio-receiving system or said source of audio-frequency currents.

3. In a radio receiving system, a thermionic device arranged to amplify incoming signals at high frequencies, a thermionic device arranged to demodulate said signals, a thermionic device arranged to amplify at audio-frequencies, a pick-up device adapted to translate the undulations of a phonograph record into electrical fluctuations, a volume-control device, and means for associating either said pick-up device or said demodulating device with said audio-frequency amplifier, the said means also functioning to associate the volume-control device with the output circuit of the thermionic device that amplifies at high frequencies when the demodulating device is associated with the audio-frequency amplifier and to associate the volume-control device with the pick-up device when the said pick-up device is associated with the audio-frequency amplifier.

4. In combination, a plurality of sources of variable electric currents, an amplifier, means for controlling the amplitude of said currents, means comprising a multi-contact switch for rendering a pre-selected one of said sources inactive and for connecting another of said sources to said amplifier, and means actuated by said last mentioned means for operatively associating the amplitude-controlling means with the current-source that is connected to the amplifier.

5. In a radio receiving system, a first device capable of amplifying currents at radio frequencies, a second device capable of demodulating said currents, an output circuit for the first device, an output circuit for the second device, volume-control means, switching means for associating said volume-control means with either of said output circuits, said switching means including instrumentalities for positively rendering said first device inoperative whenever the volume-control means is associated with the output circuit of the second device.

In testimony whereof, I have hereunto subscribed my name this 3rd day of September, 1926.

JAMES R. BALSLEY.