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SAFETY DEVICE

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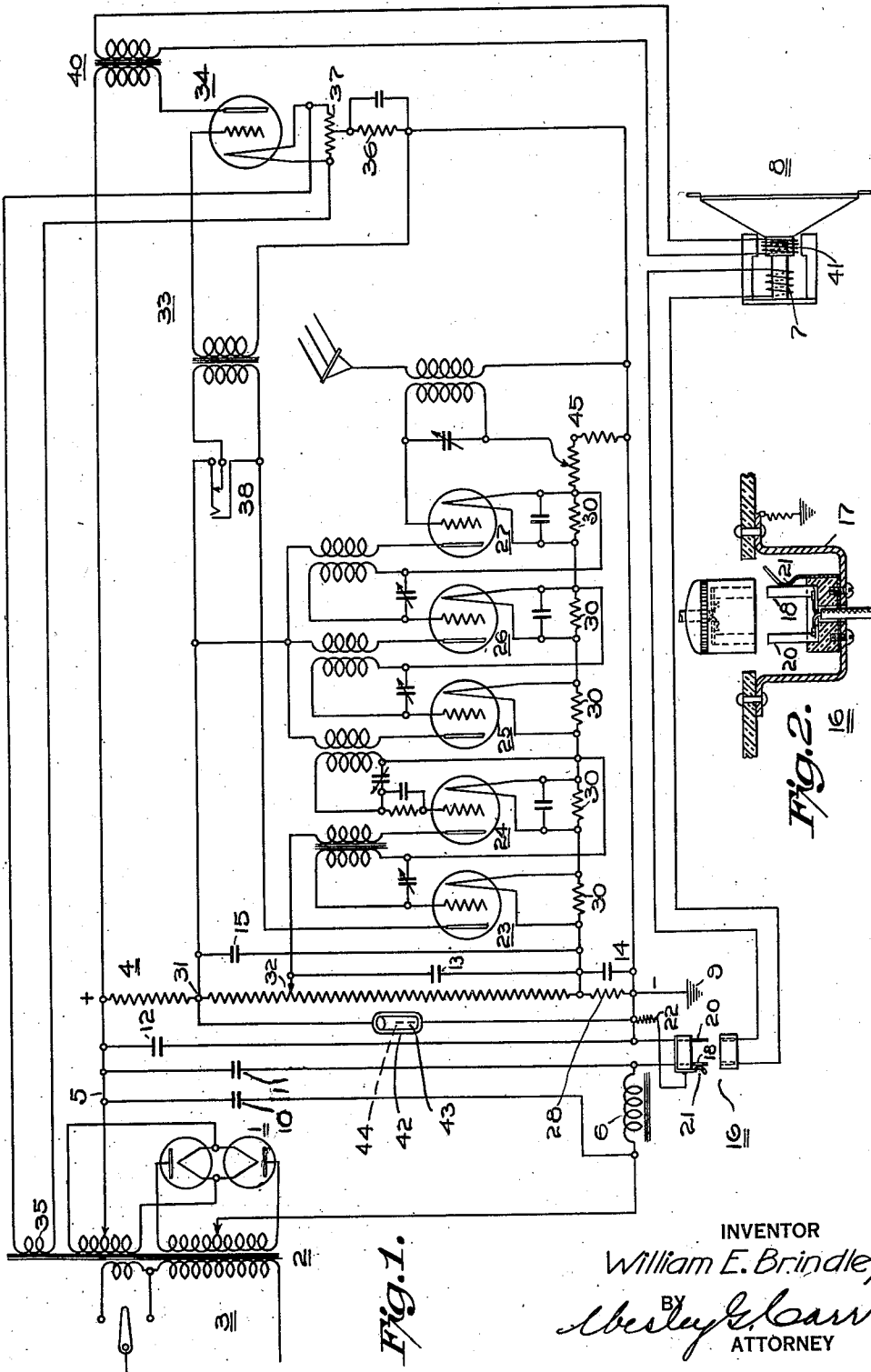


Fig. 1.

Fig. 2.

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SAFETY DEVICE

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My invention relates to current-distribution systems, and it has particular relation to systems for rectifying current derived from an alternating-potential source, and for supplying such rectified current to a load in which only minor potential-fluctuations are permissible.

There has been recently, in the radio art, a very decided trend toward dispensing with batteries for energizing the filaments and anodes of thermionic devices, use being made instead of so-called "A" and "B" battery eliminators which derive unipotential currents from any convenient alternating-current supply source. In some instances the A and B eliminators are included within the cabinet of the receiving set proper, and the field winding of a separately housed electrodynamic loud speaker has been utilized as a constituent part of the filter circuits necessarily included in the said battery substitutes. For convenience in handling and shipping, the loud speaker has usually been separably connected to the receiving set by a plug-and-socket device so disposed as to be easily accessible.

Receiving sets of the type described have, in general, given a fair degree of satisfaction. At the same time, the elimination of the alternating-current hum has not been entirely complete, thermionic-tube failures have been unduly frequent, and the by-pass condensers comprised in the filter circuits often broke down from causes that were obscure.

It is, accordingly, one object of my invention to provide a current-distribution system for thermionic devices that shall be substantially free from objectionable disturbances.

Another object of my invention is to provide a current-distribution system for thermionic devices that shall be conducive to long tube-life.

Another object of my invention is to provide a radio receiving system, and a battery-substitute therefor, the combined apparatus incorporating protective devices for preventing failure of the filter elements included in the said battery substitute.

Another object of my invention is to provide a radio receiving system, and a battery-

substitute therefor, the combined apparatus incorporating devices for preventing injury to the thermionic tubes when a reactive element is removed from the said battery substitute during such time as the set is in operation.

In one specific commercial embodiment of my invention, I accomplish the aforementioned objects by connecting the filaments of a plurality of thermionic devices in series across a minor portion of the output resistor of a rectifier-filter assembly and by connecting a potential-stabilizing device of the gaseous type across the entire output resistor. In addition, I associate a circuit-reestablishing device, with the plug-and-socket elements utilized to connect the field winding of a separately housed loud speaker into the filter-circuit, in order that unduly high voltages shall not be applied to the condensers comprised in the filter-circuit, and in order that the potential supply to the several thermionic devices shall not be interrupted, when the loud-speaker winding is removed from the circuit.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with further objects and advantages thereof, will best be understood by reference to the following description of a specific embodiment, taken in connection with the accompanying drawings.

Fig. 1 of the drawings is a diagrammatic view of the circuits and apparatus involved in radio receiving apparatus comprising preferred embodiment of my invention.

Fig. 2 is a view, partly in section, of the plug-and-socket elements utilized for removably connecting an inductor into the filter circuit.

The apparatus illustrated in the drawings comprises a rectifying device 1 energized, through a power transformer 2, from any convenient source 3 of alternating current. The high-potential-output terminals of the rectifier are connected to a resistor 4 by means of a conductor 5 and through a plurality of

iron core inductors 6 and 7, the inductor 7 constituting the field winding of a sound-producing device 8. The low potential end of the resistor 4 has a ground connection 9.

A plurality of by-pass condensers 10, 11, 12, 13, 14 and 15 are connected in shunt to the rectifier terminals, and in shunt to the resistor, for the purpose of absorbing potential fluctuations across the said output.

The field winding of the loud speaker 8 is connected into the filter circuit by means of a plug-and-socket device 16, which device is illustrated in detail in Fig. 2. The device 16 comprises a casing element 17 which insulatingly carries a plurality of terminals 18 and 20, these terminals being connected respectively to the output circuit of the rectifier and to the negative terminal of the resistor 4. The member 16 also carries a resilient contact device 21 which may be permanently connected direct to ground, or be connected thereto through a resistor 22. The contact device 21 is so disposed as to make contact with the terminal 18 when the plug is removed from the socket. The purpose of this grounding device will be later explained more in detail.

A plurality of thermionic devices 23, 24, 25, 26 and 27, having grids, filaments and anodes, are arranged with their filaments connected in series around a minor portion 28 of the negative end of the resistor 4. Each filament has a resistor 30 connected in shunt thereto, the magnitudes of the several resistors decreasing progressively toward the grounded end of the resistor 4.

Anode potential for the thermionic devices 23, 25, 26 and 27 is derived from a point 31 on the resistor 4 which is adjacent to the upper or positive end thereof.

Anode potential for the thermionic device 24, which functions as a detector, is obtained from a point 32 on the resistor having a less positive potential than the point 31 from which potential for the remaining tubes is obtained. The primary winding of an audio-frequency transformer 33 is connected in the anode supply circuit of the thermionic device 23, one terminal of the secondary winding of this transformer being connected to the grid of a power-amplifying device 34. The filament of the thermionic device 34 is energized from a secondary winding 35 of the power transformer 2. The other terminal of the transformer secondary is connected, through a resistor 36, to the midpoint of a resistor 37 which is connected in shunt to the filament of the power amplifier.

A telephone jack 38 is included in the circuit associated with the primary winding of the transformer 33, in order that a pair of telephones (not shown) may be utilized for signal reception instead of the loud speaker 8.

Anode potential for the power amplifier tube 34 is derived from the most positive end of the resistor 4, the circuit therefor being

traced from the resistor, through the primary of an output transformer 40, to the anode. The secondary of the power transformer 40 is connected to a movable coil 41 carried by the diaphragm of the loud speaker 8, which coil lies in an air-gap in a magnetic circuit energized from the field winding 7.

In order that the grids of the several tubes shall be maintained at the proper biasing potentials, the grid-return conductors therefrom are connected to points in the filament supply circuit which are, in general, more negative than the filaments with which the said grids are respectively associated.

A potential-stabilizing device 42 is connected between the point 31 on the resistor 4 from which anode potential for the thermionic devices 23, 25, 26 and 27 is obtained and the lower, or grounded, end of the said resistor.

The voltage-stabilizing device 42, in a preferred embodiment of my invention, comprises a vitreous container, which may be of glass, having a plurality of coaxial electrodes 43 and 44 mounted therein. The electrode 43 is preferably cylindrical in form and encircles the electrode 44, which may well be a single straight wire. The envelope contains a gas at low pressure, the gas being preferably of such nature that it does not attack the electrode-materials. Devices of this character are well known in the art and have the characteristic of maintaining the potential drop across their electrodes substantially constant, even though the current there-through varies materially.

In a preferred embodiment of my invention, the total potential impressed across the resistor 4 by the rectifying device is 530 volts, the potential drop across the minor portion utilized for supplying the filaments of the tubes being preferably of the order of 30 volts.

The resistor 36 in the grid circuit of the power-amplifier tube is preferably so chosen that the space current in the said tube, when flowing at its normal value, causes a drop thereacross of 80 volts, which is amply sufficient to properly bias the grid of the device.

The thermionic devices 23, 24, 25, 26 and 27 are preferably of the type commercially known as UX 199, which have a filament current consumption of .06 amperes, with a voltage drop of 3 volts. In order, therefore, to utilize the entire 30 volts drop across the minor portion of the resistor, an additional resistor 45 is included in the filament supply circuit, the magnitude of this resistor being so chosen that the voltage drop across it is the same as that across the several tubes and their associated resistors.

Small changes in the potential applied from the rectifier across the resistor 4 are largely absorbed by the voltage-stabilizing device 42 and they, accordingly, give rise to

extremely small changes across the minor portion 28 of the said resistor. Furthermore, since the filaments are connected in series across the said minor portion, each filament is subjected to only a fractional part of the entire voltage change across such portion.

The field winding 7 of the loud speaker, when connected into the filter circuit by means of the plug and socket device 16, carries a current of 100 milliamperes. If the plug should be abruptly removed from the socket, either intentionally or accidentally, when the set is in operation, an abnormal potential would be applied across the filter condensers 10 and 11, were it not for the presence of the circuit-reestablishing contact 21 and the resistor 22. If these latter elements are omitted, as they were in certain prior-art devices with which I am familiar, the potential applied to the by-pass condensers was, in many instances, sufficient to rupture the insulation thereof. The resistor 22, if present, is preferably so chosen that it has a magnitude approximately the same as the inductive reactance of the field winding, in order that the removal of the said field winding shall cause only a slight change in the potential applied across the resistor 4. Such being the base, there is substantially no change in the filament treating current of the several thermionic devices when the loud-speaker winding is removed from circuit, and there is no marked change in the plate potentials applied thereto. This state of affairs is conducive to longer tube life since, as is well known to those skilled in the art, thoriated-filament tubes deteriorate rapidly if the said filaments are subjected to temperatures different from their normal operating temperature.

The grounding device associated with the socket in which the conductors from the loud speaker are inserted, serves also to protect the operator against shock when the plug is either inserted or removed.

It will thus be apparent to those skilled in the art that I have provided, by my invention, a combined radio receiving set and battery eliminator that has numerous novel features. The plug-in arrangement, whereby the field winding of a separately housed loud speaker may be utilized in the filter-circuit portion of the device, is a convenience, both in the operation of the set and in its shipment. The circuit-reestablishing means associated with the socket prevents abnormal voltages from building up across the filter-circuit condensers, and, at the same time, obviates the necessity of manually closing the said circuit to effect operation of the receiving set after the loud speaker has been removed.

The resistor 4 may, of course, be replaced by an inductive reactor, if it is desired to

make frequent use of the receiving set with telephones instead of with a loud speaker.

By connecting the filaments of the thermionic devices serially across a resistor which is protected against potential changes by a gaseous conduction device, I am enabled to maintain the filaments at substantially a constant temperature, thus insuring good signal quality and, at the same time, preventing the said filaments from deteriorating rapidly.

Although I have illustrated and described only one specific embodiment of my invention, many other modifications thereof will be apparent to those skilled in the art. My invention, therefore, is not to be limited, except insofar as is necessitated by the prior art or by the spirit of the appended claims.

I claim as my invention:

1. In combination, a source of unidirectional fluctuating current, a filter comprising a plurality of inductors and a capacitor for sensibly lessening said fluctuations, one of said inductors serving also as the field coil of a sound producing apparatus, means for disconnecting said field coil from said filter, and means for preventing the building up of abnormal potentials on said capacitor upon the disconnection of said field coil.

2. In combination, a source of unidirectional fluctuating current, a filter comprising a plurality of inductors and a capacitor for sensibly lessening said fluctuations, one of said inductors serving also as the field coil of a sound producing device and being removable at will from said filter, and means including a grounding device and a resistor for preventing the building up of abnormal potentials on said capacitor upon the disconnection of said inductor.

3. In a current distribution system, a source of fluctuating potential, a resistor connected across said source, a potential-stabilizing device connected across a portion of said resistor, and a load connected across a minor portion of said resistor, said load including a plurality of similar units in series, whereby any change in the potential across the whole of said resistor will produce little change across said minor portion and only a small fraction of said change will occur across any one of said units.

4. In combination, a source of unidirectional fluctuating current, a filter comprising a reactor and a capacitor for sensibly lessening said fluctuations, means for removing said reactor from said filter and means for preventing abnormal potentials from building up across said filter when said reactor is removed from the circuit.

5. In combination, a source of unidirectional fluctuating current, a filter comprising a reactor and a capacitor for sensibly lessening said fluctuations, sound-producing means having a winding which is constituted by said reactor, a plurality of thermionic de-

vices associated with said filter, means for disconnecting said reactor from said filter circuit, means for preventing abnormal potentials from being applied across said filter upon the disconnecting of said reactor, said means also serving to prevent the dissociation of said thermionic devices from said filter.

6. In combination, a source of high-potential fluctuating current, a resistor shunting said source, a plurality of thermionic devices associated with said resistor for deriving both plate and filament excitation therefrom, and means comprising a voltage-regulating device for stabilizing the excitation supplied to said plates and filaments.

7. In a current-distribution system, a source of fluctuating potential, a resistor connected across said source, potential-stabilizing means connected across a portion of said resistor, a load comprising the filaments of a plurality of thermionic devices connected across a portion of said resistor included in the portion thereof across which said stabilizing means is connected, the plate excitation for said thermionic devices also being obtained from said portion of said resistor across which said stabilizing means is connected.

In testimony whereof, I have hereunto subscribed my name this first day of February, 1928.

WILLIAM E. BRINDLEY.

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