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TRIPLEX CIRCUIT FOR RADIOPHONE TRANSMITTERS

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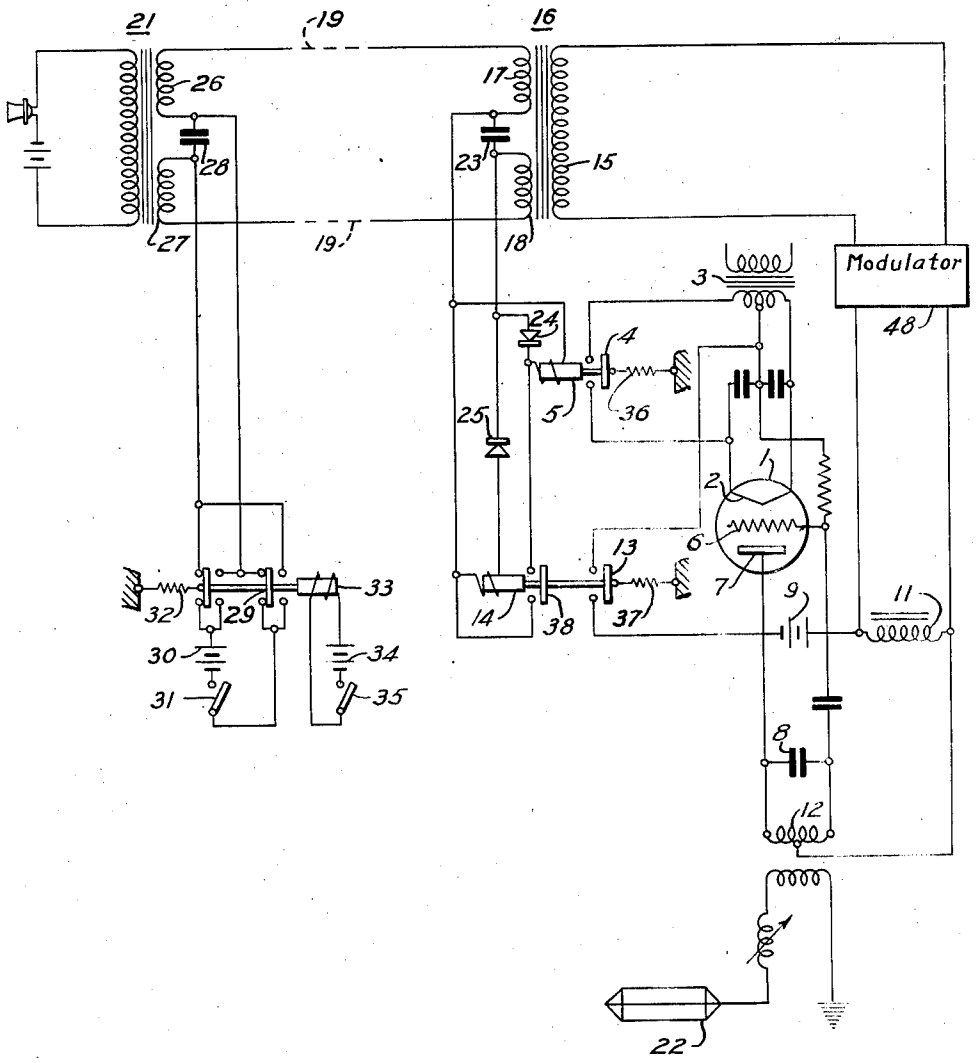

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TRIPLEX CIRCUIT FOR RADIOPHONE TRANSMITTERS

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My invention relates to arrangements for the remote control of radio transmitters and, in particular, to arrangements for employing a single transmission line, both for remotely controlling the energization of the filament circuit and the plate circuit of the radio transmitter and for transmitting special currents.

One object of my invention is to provide circuit connections whereby control-currents for switching on and off the current to heat the cathodes of a radio transmitter may be conducted over the same line as is used for transmitting speech currents to modulate the output of the radio transmitter.

Another object of my invention is to provide an arrangement whereby control-currents for switching on and off the plate voltage of a radio transmitter located at a distant point may be conducted over the same line that carries the speech currents for modulating the transmitter output.

A third object of my invention is to provide an arrangement whereby both the objects specified in the two preceding paragraphs may be effected simultaneously with a minimum of disturbance to the connections of the transmission line which carries the speech currents.

Other objects of my invention will become apparent from reading the following specification, in which the single figure of drawing illustrates the circuit arrangements at the input and output ends of a telephone line equipped to carry out my invention.

For certain fields of service, such as police radio telephony, it is desirable to have a radio transmitter located at a point distant from that at which the speaker and microphone originating the messages to be broadcast are to be located. For the sake of economy and for other obvious reasons, it is desirable that the cathode heating current and the plate voltage should be applied to the radio transmitter only at such times as it is desired to broadcast a message. In accordance with the prior art, it has been customary to provide a transmission line between the microphone, usually located at a police station, and the radio transmitter over which controlled currents, switched on and off at the microphone-station, operate relays to open and close the cathode-heating circuit and the plate circuit of the radio transmitter tubes at the will of the operator at the microphone-station. It has then been the practice to provide a second transmission line connected between the microphone and the control grid of the transmitter over which the telephone speech-currents may flow. Since cities operating police radio systems do not usually build their own transmission lines, but prefer to lease telephone lines from the telephone companies operating as a public service in their community, the above-described practice has made it necessary for the cities to lease two telephone lines at a very considerable annual rental.

My invention is directed to the provision of means whereby the leasing of a second telephone line is made unnecessary, and a single leased line is equipped to carry both the speech currents from the microphone and the currents for performing the necessary switching operations at the transmitter.

The above-described result is produced by inserting a pair of condensers in series with the secondaries of transformers located respectively at the microphone-station and at the transmitter-station, shunting the condenser at the microphone-station with a pair of leads from a double-pole double-throw switch energized from a direct-current source, and shunting the condenser at the transmitter-station with a pair of relay circuits respectively provided with rectifiers so poled that one relay circuit which controls the cathode-heating current of the transmitter responds only to one polarity of direct current on the transmission line and the other relay which controls the plate circuit of the transmitter responds only to the opposite polarity of current on the transmission line. By this arrangement, the direct current used for controlling the aforesaid relays at the transmitter is kept by the two transformers from flowing in the microphone circuit and the modulator circuit, whereas the speech currents are substantially by-passed by the low impedance of the capacitors and substantially kept out of the switching and relaying circuits at the microphone-station and at the transmitter.

With the foregoing principles in mind, the single figure of drawing shows a triode 1 which may be taken as symbolic of one or more high-frequency generating tubes at a telephone transmitter. The tube 1 is provided with a thermionically-emissive cathode 2 which is supplied with current from a source 3 under control of a switch 4 which is opened and closed by a slow-release relay 5. The tube 1 has the conventional control grid 6 and plate 7 and may be caused to generate high-frequency oscillations by a network 8—12 of a type too well known in the art to require separate description. The circuit between the cathode 2 and the plate 7 includes a source of voltage 9, a choke coil 11, an output transformer 12 and a control switch 13 arranged to be opened and closed by a slow-release relay 14. The inductance 11 may be bridged through modulator 48 by the secondary 15 of a transformer 16 having two equal primary windings 17 and 18 which are connected in a manner above described to a transmission line 19 which leads to a transformer 21 located at the microphone-sta-

tion. The primary of the transformer 21 is connected to the microphone into which the messages to be broadcast are spoken, and these messages being transmitted over the line 19 are impressed by secondary winding 15 of transformer 16 across the terminals of choke coil 11 and thereby modulate the output from the output-transformer 12 to the broadcasting antenna 22 in a manner too well known in the art to require separate description.

Between the two windings 17 and 18 is connected a capacitor 23 having a low impedance to currents of audio frequency. Across the terminals of the capacitor 23 are connected a pair of line wires which are connected to the terminals of the relay 5 through a rectifier 24, and are likewise connected to the terminals of the relay 14 through a rectifier 25. The rectifiers 24 and 25 are connected with opposite polarities so that, while one of them conducts current only when one of the terminals of condenser 23 is positive in polarity, the other conducts current only when the opposite terminal of condenser 23 is positive in polarity.

The transformer 21 is, like transformer 16, provided with two equal windings 26 and 27 between the inside terminals of which is connected a capacitor 28 having a low impedance to audio-frequency currents. Across the terminals of the capacitor 28 are connected a pair of line wires which lead, respectively, to the outgoing terminals of a double-throw double-pole switch 29. The input of hinge terminals of the switch 29 is connected through a single-pole switch 31 to a source of direct current 30 of sufficient voltage to cause operation of the relays 5 and 14 at the transmitter-station. The switch 29 is biased to one closed position by a spring 32 and is arranged to be moved against said bias to its other closed position by a relay solenoid 33 connected to a source of voltage 34 and a single-pole switch 35.

The relays 5 and 14 are biased to open-circuit position, respectively, by springs 36 and 37, and the relay 5 is provided with a means which interposes a time delay to its opening after it has once been moved to closed-circuit position. Relay 14 is provided with contacts 38 which energize the magnet of relay 5 as soon as relay 14 closes and before relay 5 releases, thereby maintaining heating current in the cathode 2 after current previously flowing to relay 5 through rectifier 24 has ceased to flow.

The mode of operation of the above-described arrangement is as follows: When no message is being broadcast from the transmitter, the switches 31 and 35 stand open, and as a result of the action of their biasing springs 36 and 37, the switches 4 and 13 maintain the circuits of filament 2 and plate 7 in transmitter tube 1 open and deenergized. The spring 32 on switch 29 holds the latter closed in its left-hand position, as indicated in the drawing.

When it is desired to broadcast a message, switch 31 is first closed, thereby energizing the transmission line 19 with direct current with the lower line in the drawing positive and the upper line negative. As a result, the line connected with the lower terminal of condenser 23 is positive and the line connected with the upper terminal thereof is negative. The rectifier 24 will then transmit current through the relay 5, moving switch 4 to closed position, but the rectifier 25 will conduct no appreciable current to the relay 14 because it is of the wrong polarity to do so, and switch 13 will remain open. As a result of closure of switch 4, the cathode of the tube 7 is quickly raised to the thermionically-emissive temperature. After sufficient time for this has elapsed, the attendant at the microphone-station closes the switch 35, thereby moving the switch 29 to its right-hand position on the drawing, thus reversing the polarity of the voltage impressed on transmission line 19 and making its upper line in the drawing positive. A similar change in polarity occurs in the lines connected to the terminals of condenser 23, and as a result, current flows to the relay 14 through rectifier 25 but ceases to flow through rectifier 24 to relay 5. Relay 5 is provided with a time-delay element which does not open immediately. However, relay 14 closes switch 13 in the plate circuit of tube 7, thereby causing the latter to generate oscillations and to cause radio waves to be broadcast from antenna 22. Contact 38 of relay 14 energizes relay 5 before it has time to release thereby maintaining cathode energy as long as plate energy is supplied. Any message which may now be spoken into the microphone at the microphone-station will be broadcast likewise in a manner well known in the art. Should it be desired to suspend broadcasting for a brief period only, switch 35 at the microphone-station is opened, thereby cutting off direct current from relay 14, and momentarily from relay 5 through contacts 38, but before relay 5 can release, rectifier 24 supplies coil energy for maintaining the cathode temperature. When it is no longer desired to continue broadcasting, the switches 31 and 35 at the microphone-station are opened, thereby cutting off the direct current from the relays 5 and 14 and causing the switches 4 and 13 to open the circuits of the tube 1 and return the system to the standby initial condition first described.

It will thus be seen that I have provided a system in which the switching on and switching off of a remotely-located radio transmitter may be carried out by a simple arrangement of relays using only the same single pair of transmission line wires which carry the special currents.

While I have described a single practical modification of my invention, this is for purposes of illustration only, and the principles thereof are of broader application in ways that will be evident to those skilled in the art. I, accordingly, desire that the following claims shall be given the broadest interpretation of which their terms are reasonably susceptible.

I claim as my invention:

1. In combination, a transmission line comprising two metallic conductors respectively connected to the opposite terminals of the secondary of a transformer having its primary energized by speech currents to be transmitted, a capacitor in series with said transmission line near its input and means for impressing a direct-current potential of one polarity at one time on said condenser and for impressing a potential of opposite polarity at other times on said condenser, a receiving transformer at the other end of said transmission line having its secondary connected to a broadcast transmitter and having a primary winding connected in series with a capacitor, a first relay arranged to close one operating circuit in said broadcast transmitter and responsive only to one polarity of the last-mentioned capacitor, and a second relay arranged to close another operating circuit of said transmitter and

responsive only to the opposite polarity of said last-mentioned condenser.

2. In combination, a transmission line comprising two metallic conductors respectively connected to the opposite terminals of the secondary of a transformer having its primary energized by speech currents to be transmitted, a capacitor in series with said transmission line near its input and means for impressing a direct-current potential of one polarity at one time on said condenser and for impressing a potential of opposite polarity at other times on said condenser, a receiving transformer at the other end of said transmission line having its secondary connected to a broadcast transmitter and having a primary winding connected in series with a capacitor, a first relay arranged to close the cathode circuit of said transmitter, and responsive only to one polarity of the last-mentioned condenser, and a second relay arranged to close the plate circuit of said transmitter and responsive only to the opposite polarity of said last-mentioned capacitor.

3. In combination, a transmission line comprising two metallic conductors respectively connected to the opposite terminals of the secondary of a transformer having its primary energized by speech currents to be transmitted, a capacitor in series with said transmission line near its input and means for impressing a direct-current potential of one polarity at one time on said condenser and for impressing a potential of opposite polarity at other times on said condenser, a receiving transformer at the other end of said transmission line having its secondary connected to a broadcast transmitter and having a primary winding connected in series with a capacitor, a first relay arranged to close the cathode circuit of said transmitter, and responsive only to one polarity of the last-mentioned condenser, said first relay being slow-acting, and a second relay arranged to close the plate circuit of said transmitter and responsive only to the opposite polarity of said last-mentioned capacitor.

4. In combination, a transmission line connected to the secondary of a transformer having its primary energized by speech currents to be transmitted, a capacitor in series with said transmission line near its input, a direct-current source energizing a double-throw switch biased and connected to impress a voltage of one polarity upon said capacitor at one time, and connected to reverse the polarity of the voltage impressed on said capacitor when said switch is moved to its other closed position, a receiving transformer at the other end of said transmission line having a secondary connected to modulate the output of a radio transmitter and having its primary connected in series with a capacitor, a pair of line wires connecting the terminals of said capacitor to a first relay through a rectifier, said relay controlling the closure of the cathode circuit of a tube in said transmitter, a second relay connected to the last-mentioned conductors through a rectifier of opposite polarity to the rectifier first mentioned, said second relay controlling the closure of the plate circuit of said tube.

5. In combination, a transmission line connected to the secondary of a transformer having its primary energized, by speech currents to be transmitted, a capacitor in series with said transmission line near its input, a direct-current source energizing a double-throw switch biased and connected to impress a voltage of one polarity upon said capacitor at one time, and connected to reverse the polarity of the voltage impressed on said capacitor when said switch is moved to its other closed position, a receiving transformer at the other end of said transmission line having a secondary connected to modulate the output of a radio transmitter and having its primary connected in series with a capacitor, a pair of line wires connecting the terminals of said capacitor to a first relay through a rectifier, said relay controlling the closure of the cathode circuit of a tube in said transmitter, a second relay connected to the last-mentioned conductors through a rectifier of opposite polarity to the rectifier first mentioned, said second relay controlling the closure of the plate circuit of said tube, the first-mentioned relay being of the slow-acting type.

6. In combination, a transmission line connected to the secondary of a transformer having its primary energized by speech currents to be transmitted, a capacitor in series with said transmission line near its input and means for impressing a direct-current potential of one polarity at one time on said condenser and for impressing a potential of opposite polarity at other times on said condenser, a receiving transformer at the other end of said transmission line having its secondary connected to a broadcast transmitter and having a primary winding connected in series with a capacitor, a first relay arranged to close the cathode circuit of said transmitter, and responsive only to one polarity of the last-mentioned condenser, said first relay being slow releasing, and a second relay being also slow releasing arranged to close the plate circuit of said transmitter by one set of contacts, and energize the winding of said first relay by another set of contacts, said second relay being responsive only to the opposite polarity of said last-mentioned capacitor.

7. In combination, a transmission line connected to the secondary of a transformer having its primary energized by speech currents to be transmitted, a capacitor in series with said transmission line near its input, a direct-current source energizing a double throw switch biased and connected to impress a voltage of one polarity upon said capacitor at one time, and connected to reverse the polarity of the voltage impressed on said capacitor when said switch is moved to its other closed position, a receiving transformer at the other end of said transmission line having a secondary connected to modulate the output of a radio transmitter and having its primary connected in series with a capacitor, a pair of line wires connecting the terminals of said capacitor to a first relay through a rectifier, said relay controlling the closure of the cathode circuit of a tube in said transmitter, a second relay connected to the last-mentioned conductors through a rectifier of opposite polarity to the rectifier first mentioned, said second relay controlling the closure of the plate circuit of said tube by one set of contacts, and the winding of said first relay by another set of contacts.

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