

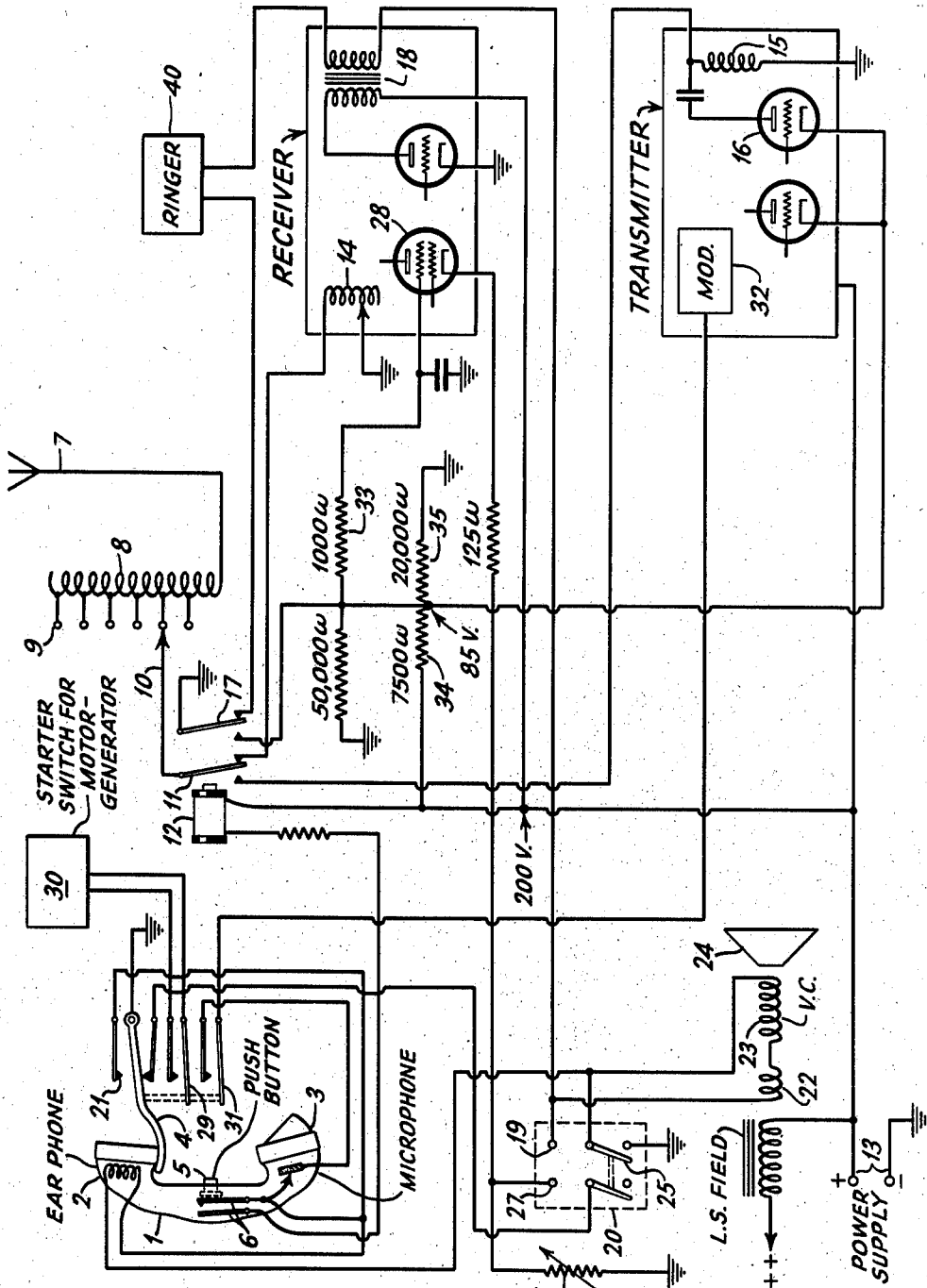
July 14, 1942.

H. B. MARTIN

2,289,794

CIRCUIT ARRANGEMENT FOR TWO-WAY RADIO TELEPHONE SYSTEMS

Filed Nov. 30, 1940



BY

INVENTOR.
HERSCHEL B. MARTIN
H. B. Martin
ATTORNEY.

UNITED STATES PATENT OFFICE

2,289,794

CIRCUIT ARRANGEMENT FOR TWO-WAY
RADIO TELEPHONE SYSTEMSHerschel B. Martin, Brooklyn, N. Y., assignor to
Radio Corporation of America, a corporation
of Delaware

Application November 30, 1940, Serial No. 367,930

6 Claims. (Cl. 250-13)

This invention relates to circuit arrangements for two-way telephone systems. A fundamental feature of the invention resides in the provision of apparatus which facilitates the use of a telephone hand set alternatively with a loud speaker and which enables any one to manipulate a push-button on the hand set when talking, for the purpose of desensitizing the receiver while causing the transmitter to emit a modulated carrier wave. By releasing the push-button on the hand set the conditions necessary for reception are restored and the transmitter is silenced. By manipulation of a double-pole double-throw switch reception may be had on a loud speaker.

It is an object of my invention to provide a novel form of circuit arrangement which may be found useful in connection with complete two-way radio telephone systems.

It is a more specific object of my invention to provide a relay-operated circuit which in the simplest form carries out the necessary transfer of controls from receiver to transmitter and vice versa in response to the actuation of a push-button mounted on the telephone hand-set.

Other objects and advantages of my invention will become apparent in the following detailed description which is accompanied by a drawing, the sole figure of which represents a preferred embodiment of apparatus which I have found useful.

Referring to the drawing, I show a hand-set 1 which includes an earphone 2 and microphone 3. This hand-set is standard equipment and needs no further description. When not in use it may be hung on a hook 4 which actuates a number of switch springs for control purposes such as to turn on and off the power for the transmitter and, if desired, for the receiver too. Other functions are to be performed by the actuation of the switch hook, as will be hereinafter set forth in more detail.

The hand-set is also provided with a push-button 5 which when depressed closes a circuit through its two contact springs 6 to a relay 12.

The circuit diagram shows an antenna 7 which is used both for transmission and for reception of a two-way communication. Connected with the antenna is an antenna tuning coil 8 preferably having taps which connect with a selector switch having a plurality of segments 9 over which the contact brush 10 wipes. The brush 10 is connected with a movable contact spring 11 which may be actuated by relay 12 in response to the depression of the push-button 5 and the closing of the contacts 6. Current is fed

to the relay 12 from a suitable power supply source conventionally indicated by the plus and minus signs at 13. The minus terminal of the power supply source is indicated as at ground potential.

The back contact for the movable contact spring 11 is shown connected with a tuning coil 14 for the first stage of amplification in the receiver. This tuning coil is grounded at an appropriate point and is associated with other conventional tuning elements not shown. In fact, many of the details of the receiver and transmitter circuits are omitted for the sake of simplicity of disclosure, since my invention relates to features other than what are to be found in conventional receivers and transmitters.

The front contact for the movable relay spring 11 is connected to a tuning coil 15 to which is coupled the output circuit of a power amplifier tube 16.

It will be seen from the foregoing paragraphs that, in response to the actuation of the push-button 5 when talking, the output from the transmitter may be impressed on the antenna 7, but, when receiving a conversation, the antenna 7 is connected to the radio receiver. Other functions, however, are performed by the relay 12 as follows:

This relay is provided with a movable contact spring 17 having a back contact which is connected to one terminal of a secondary winding on the receiver output transformer 18. The relay contact spring 17 is grounded and thus completes a circuit through the secondary of transformer 18 to a switch terminal 19 appropriate to a double-pole double-throw switch indicated generally at 20. When this switch is closed in the upper position the loud speaker voice coil 23 is shorted out, but the receiver output circuit may be traced to the coil of the earphone 2 and thence to ground through the upper contact 21 with which the grounded switch hook 4 engages when the hand-set is off the hook.

When the switch 20 is closed in the lower position the output circuit from the receiver may be traced through a hum bucking coil 22 and a voice coil 23 of loud speaker 24 and thence to ground through the left hand switch blade 25.

When using either the earphone or the loud speaker the volume of the received signal may be adjusted by means of a potentiometer 26 connected between the ground and the upper left hand terminal 27 of the switch 20. This terminal, however, is used only to short-circuit the potentiometer 26 when the switch blades are in

the upper position, since the left hand switch blade is connected to ground through the switch hook 4 when the hand-set 1 is hung thereon. When the switch 20 is set in the lower position rheostat 26 is connected only between ground and the cathodes of certain tubes such as tube 28 in the receiver. For the sake of simplicity, the full complement of receiver tubes, as ordinarily used, is not shown in the drawing. The potentiometer, therefore, serves to adjust the bias on tube 28 at least and furthermore, the potentiometer meets the following operating requirements:

1. With the hand-set hung up the loud speaker may be used to monitor calls.
2. With the hand-set off hook, the loud speaker may be used for reception of speech.
3. With the hand-set off the hook the earphone may be used for reception.

A special feature is provided in that, when the switch 20 is in the upper position and the hand-set is hung-up, the receiver operates at full sensitivity in order to accommodate to the fullest advantage a bell ringer 40 which may be used to indicate incoming calls.

When the relay contact spring 17 is engaged with its front contact, a ground potential is applied to the cathodes of all the tubes in the transmitter. Without this ground connection the transmitter tubes do not function, since the transmitter tube cathodes are connected to the positive receiver screen grid voltage supply which acts as a blocking voltage for the transmitter tubes. Hence the transmitter is at all times silenced except in response to the actuation of the push-button 5.

When the relay 12 is energized for the transmission of speech and its movable contact spring 17 engages with its front contact, it is desirable to apply ground potential to the screen grid circuit for at least one receiver tube 28 so as to render the receiver inactive. The screen grid or grids of the receiver are, therefore, connected to the front contact of spring 17 through resistor 33. For normal operation of the receiver, however, a screen grid potential of preferably 75 to 85 volts is obtained from the 200 volt power supply through sections 34 and 35 of a potentiometer section 35 leading to ground. Where the resistor 33 is directly connected to the junction between potentiometer portions 34 and 35 a potential of approximately 85 volts will prevail provided potentiometer section 35 is not short-circuited by the relay spring 17.

The lifting of the hand-set 1 off of its hook 4 results in other operations as follows:

A movable spring 29 engages with its stationary contact for closing a circuit to a starter switch 30 for starting up a motor generator which is presumed to be fed with current from any convenient source, such as a ship's power line. The power supply 13 may be considered as provided by this motor generator. The starter switch 30 is arranged to maintain the motor generator in operation as long as the hand-set 1 remains off its hook. Upon de-energizing the relay of the starter switch 30, however, the motor generator will be shut down.

The movable contact spring 31 on the switch hook is arranged to close a microphone circuit when the hand-set 1 is lifted. This circuit may readily be traced from the microphone to a modulator 32 indicated by a block diagram in the transmitter.

It will be understood that in the operation of

the arrangement shown it may be desired to transmit and receive a telephone conversation on any one of a number of different assigned carrier frequencies. Facilities for adjusting the apparatus to operate at these assigned frequencies is indicated by the adjustability of the switch brush 10 over its contacts 9. A unit control arrangement may be provided, however, whereby this and other adjustable elements will take care of the tuning of the necessary circuits both in the receiver and in the transmitter, and ordinarily will include the selection of any one of a plurality of piezo-electric crystals, both in the transmitter oscillator circuit and in the receiver oscillator circuit so that the frequency of operation may be maintained within allowable tolerances. The details of such circuit arrangements are not, however, herein shown since they are well known in the art and are not specifically claimed as part of this invention.

Various modifications of my invention may be made without departing from the spirit and scope thereof. What I believe to be novel is, however, defined by the claims to follow.

I claim:

1. In a two-way radio telephone system, a transmitter and a receiver each having discharge tubes which are rendered operable by suitable potentials applied to their electrodes, including certain of their cathodes when maintained at ground potential, and certain of their screen grids when maintained at a positive potential with respect to ground, a permanent connection between said cathodes of the transmitter tubes and said screen grids of the receiver tubes, a hand-set instrument comprising a microphone, an earphone and a push-button, a transmitter-modulator circuit connected to said microphone, a receiver-output circuit connected to said earphone, and means operable by said push-button for applying ground potential to said permanent connection, thereby to de-sensitize said receiver and to actuate said transmitter.

2. A two-way radio telephone system comprising transmitting and receiving units, a hand-set comprising a microphone connected to said transmitting unit and an earphone connected to said receiving unit, a loud speaker also connected to said receiving unit, a switch hook operable by the weight of said hand-set, switching means for feeding output energy from the receiver at times to said earphone and at times to said loud speaker, a volume control device operable to adjust the radio frequency sensitivity in said receiver, and means operable when said hand-set is supported by said switch hook at the same time that said switching means is set for earphone reception for adjusting said volume control device to a condition of maximum sensitivity.

3. A two-way radio telephone system comprising transmitting and receiving units, a hand-set comprising a microphone connected to said transmitting unit and an earphone connected to said receiving unit, said units comprising electron discharge tubes certain of which contain cathodes and screen grids, the cathodes of said tubes in the transmitting unit being in circuit with the screen grids of said tubes in the receiving unit, and means for applying either one of two different potentials to said cathodes and screen grids simultaneously, thereby, at one potential, to de-sensitize the receiving unit while modulating the output from said transmitting unit from said microphone, and, at the other potential, to de-

sensitize the transmitting unit while delivering received signals from the receiving unit to said earphone.

4. A system in accordance with claim 3, wherein the said means includes a push-button on said hand-set and a relay operable by said push-button, said relay having a grounded movable contact, and a front contact connected to said cathodes in the transmitting unit and said screen grids in the receiving unit.

5. A two-way radio telephone system comprising transmitting and receiving units, a hand-set comprising a microphone connected to said transmitting unit and an earphone connected to said receiving unit, said units comprising electron discharge tubes certain of which contain cathodes and screen grids, the cathodes of said tubes in the transmitting unit being connected through an impedance to the screen grids of said tubes in the receiving unit, a push-button mounted on said hand-set, a relay operable by said push-button when talking into said microphone, said relay having a movable contact and front and back contacts therefor, a potentiometer, and a source of potential positive with respect to ground connected through said potentiometer to the screen grids of said receiving tubes, also to the cathodes of said transmitting tubes and to the front contact opposed to said movable contact, said movable contact being grounded and operative when engaged with its back contact to complete an output circuit for

said receiving unit while permitting a blocking potential to be applied to said transmitting tube cathodes and an operating potential to be applied to said receiving tube screen grids, and when said movable contact is engaged with its front contact to de-sensitize said receiving unit and to energize said transmitting unit.

6. A radio transceiver system including transmitting apparatus having a signal amplifier which comprises discharge tubes the cathodes whereof are connected to an intermediate point on a potentiometer, said point being normally maintained at a potential with respect to which the normal grid potential of said tubes constitutes a cut-off bias, said system including receiving apparatus having amplifier discharge tubes at least one of which is of the screen grid type, a resistive screen grid connection to said intermediate point on the potentiometer, said connection normally serving to maintain an operative screen grid potential on the screen grid or grids of the receiving tubes, a telephone hand-set having a push-button mounted thereon, a relay operable by said push-button, and means controlled by said relay when it is operated by the push-button for applying a ground potential to said intermediate point on the potentiometer, said ground potential being effective to temporarily de-sensitize the receiving apparatus and to remove the cut-off bias from the amplifier tubes of the transmitting apparatus.

HERSCHEL B. MARTIN.