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H. F. SHOFFSTALL

SUPERVISORY CIRCUITS

Filed Nov. 12, 1921

2 Sheets-Sheet 1

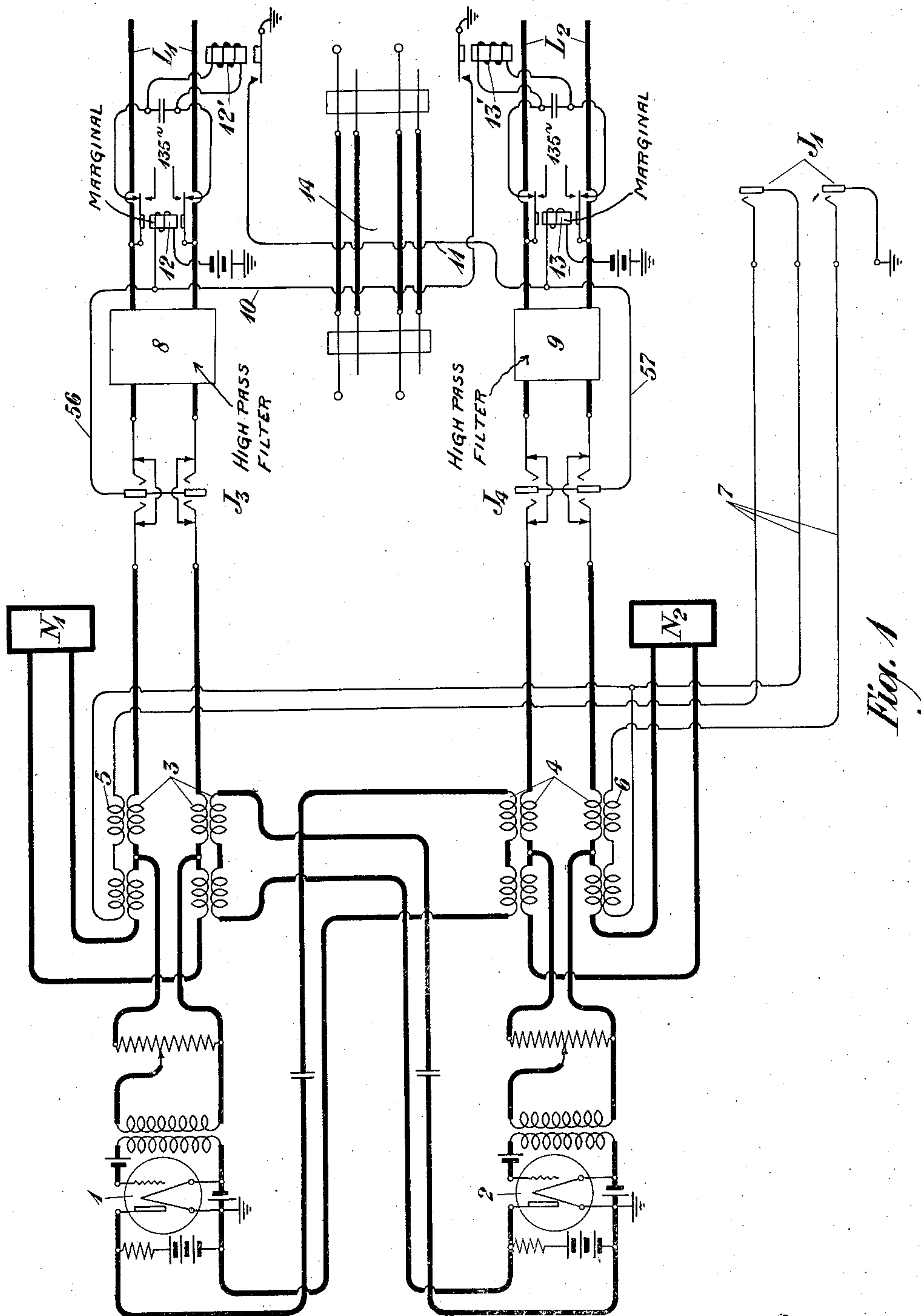


Fig. 1

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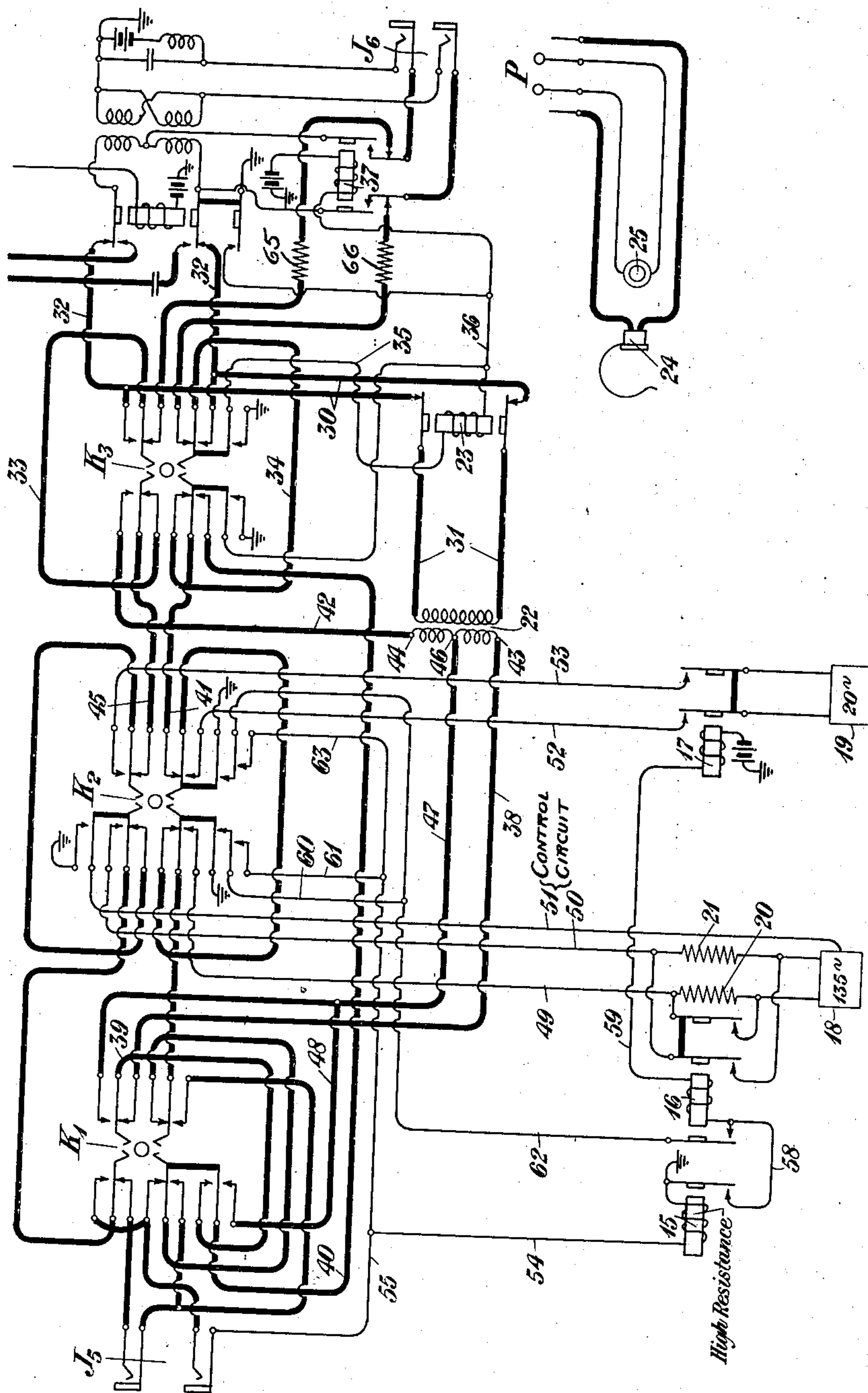


Fig. 2

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Patented Nov. 10, 1925.

1,560,610

UNITED STATES PATENT OFFICE.

HUGH F. SHOFFSTALL, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

SUPERVISORY CIRCUITS.

Application filed November 12, 1921. Serial No. 514,695.

To all whom it may concern:

Be it known that I, HUGH F. SHOFFSTALL, residing at New York, in the county of Bronx and State of New York, have invented certain Improvements in Supervisory Circuits, of which the following is a specification.

This invention relates to an improved type of supervisory circuit and apparatus adapted to be utilized with telephone lines.

In a co-pending application filed June 18, 1921, in the name of Ray S. Wilbur, Serial No. 478,494, there is illustrated a telephone circuit including a two-element, two-way repeater, together with arrangements whereby supervisory apparatus may be associated therewith. In this application the supervisory circuit is associated with the telephone line through an additional winding on the output transformers of the repeaters. It is a special feature of this invention to provide supervisory apparatus and circuit arrangements which are particularly adapted to be associated with the circuits of the aforementioned application, although they may also be utilized with other types of telephone lines.

With the supervisory arrangements of this invention the repeater attendant may monitor both ways on the repeater set without operating any keys. It is also possible to monitor either on the east or west output coil alone by variantly operating the monitoring key provided in the arrangements.

The invention furthermore provides improved arrangements for talking from the supervisory circuit on the repeater circuit, in that a talking key is provided whereby the telephone set of the repeater attendant may or may not be connected to the supervisory windings through an inequality ratio repeating coil. With this arrangement it is possible to talk over the circuit either through the inequality coil or not, as desired.

A further feature of the invention consists in the provision of improved ringing arrangements in the supervisory circuit. With these arrangements it is possible to transmit ringing current over the lines directly through the supervisory windings. However, when intermediate ringing apparatus is associated with the repeater set for relaying ringing current around the telephone repeaters, it may not be possible to

ring on the circuit through the supervisory windings of the output coils. In such circumstances with the arrangements of this invention, means are provided whereby the ringing apparatus itself may be controlled by the repeater attendant from the supervisory apparatus. Arrangements are also provided when ringing takes place directly through the supervisory windings of the output coil for preventing the ringing current from magnetizing or injuring said coil or its windings. Other features and purposes of the invention will appear more fully from the detailed description hereinafter given.

The invention may be more fully understood from the following description, together with the accompanying drawing, in Figures 1 and 2 of which is illustrated a circuit diagram embodying a preferred arrangement of the invention.

In Fig. 1 there is illustrated two line sections L_1 and L_2 , which are interconnected through a two-element, two-way repeater comprising the vacuum bulb amplifiers 1 and 2 which are well-known in the art. The output circuits of the amplifiers 1 and 2 are coupled to the lines L_1 and L_2 through the usual type of three-winding transformers, such as the transformers 3 and 4. Associated with these transformers are the balancing networks N_1 and N_2 . For the purpose of supervising on the lines L_1 and L_2 , an additional winding is provided on each of the output transformers 3 and 4, such as the windings 5 and 6. These windings are connected over the circuit 7 to the supervisory jacks J_1 , whereby the supervisory circuit of Fig. 2 may be connected to the lines, as will be pointed out later. As the repeater apparatus is generally provided as a separate unit, it is usually connected to the line sections L_1 and L_2 through line jacks such as jack J_3 and jack J_4 . Furthermore, in some instances ringing apparatus may be associated with the line in order to relay ringing current around the repeater apparatus. Such apparatus is well-known in the art and no further description thereof will be given. When such apparatus is associated with the lines, high pass filters such as 8 and 9 may be associated with the line between the ringing apparatus and the repeater apparatus to prevent the ringing currents from entering the repeater apparatus. These filters, however, will readily al-

low the transmission of the relatively high frequency telephonic currents and may be of the type illustrated in the U. S. patent to G. A. Campbell, 1,227,113. The relays 12, 13, 12' and 13' are ringing relays which would normally be found in many well-known types of composite ringer apparatus. The leads 10 and 11 interconnect the relays of the parts of the ringing apparatus of each line in the customary manner. A patching cord 14 is shown for connecting the supervisory apparatus either to the line jacks J_3 and J_4 or to the supervisory jacks J_1 , as will be pointed out later.

In Fig. 2 is illustrated the supervisory circuit and arrangements of the invention. In this circuit there is provided the operator's telephone set, consisting of the transmitter 25 and the receiver 24. There is also provided a talking key K_3 and a monitoring key K_1 . The supervisory circuit is provided with the jacks J_5 . When the supervisory circuit is connected through the patching cord 14 to the supervisory jacks J_1 and the monitoring key K_1 is in its normal position as shown, the operator's telephone receiver 24 will be so connected to the supervisory windings 5 and 6 that the repeater attendant may monitor both ways on the repeater set without operating any keys. By throwing the key K_1 to the left, the attendant may connect the receiver 24 directly to the supervisory winding 6 and hence may monitor on the line L_2 alone. By throwing the key K_1 to the right, the telephone receiver 24 may be directly connected to the supervisory winding 5 and the attendant may monitor on the line L_1 alone. Resistances 65 and 66 may be provided in series with the receiver to reduce the current to the desired value when monitoring. Associated with the talking key K_3 is an inequality ratio repeating coil 22. This inequality ratio coil is provided to secure maximum talking efficiency on the lines, in some instances the talking current being transmitted through all of the coil and in other instances the talking current being transmitted merely through a portion of the coil. When the key K_3 is thrown to the left, the talking set 25 will be connected to the lines through the inequality coil 22 in the following manner: The talking set will normally be connected over conductors 30, contacts and armatures of relay 23 and conductors 31 to the right-hand winding of coil 22. The circuit for connecting the left-hand windings of coil 22 to the jacks J_5 is as follows: From terminal 43 of the coil 22, conductor 38, right-hand break contact of key K_1 , conductor 39, left-hand break contact of key K_1 , conductor 40, left-hand make contact of key K_1 , conductor 41, and thence in the usual manner to the lower tip contact of jack J_5 , and from the terminal 44 of the coil 22, over conductor 42, left-hand make con-

tact of key K_3 to conductor 45, and thence in the usual manner to the upper tip contact of jack J_5 . Accordingly, when the key K_3 is thrown to the left, the operator's talking set 25 will be connected through the inequality coil 22 to both of the lines L_1 and L_2 , so that the operator may talk over both of said lines at the same time. When key K_3 is thrown to the left a circuit is closed from ground through the winding of relay 37 to battery, operating relay 37 and changing receiver leads from normal position to induction coil for talking position. If when the key K_3 is thrown to the left and the talking set is connected through the coil as described, it should be desired to talk on either of the lines L_1 and L_2 alone, the key K_1 will be thrown either to the right or to the left. If the key K_1 is thrown to the right in order to talk over the line L_1 , only one of the left-hand windings of the coil 22 will be utilized. The circuit arrangement therefor will be as follows: from terminal 46, conductor 47, right-hand make contact of key K_1 , conductor 39, left-hand break contact of key K_1 , conductor 40, left-hand make contact of key K_1 to conductor 41, and thence in the usual manner to the upper sleeve contact of jacks J_5 , and from the terminal 44, over conductor 42, left-hand make contact of key K_3 to conductor 45, and thence in the usual manner to the upper tip contact of jacks J_5 . Accordingly, when the key K_3 is thrown to the left and the key K_1 is thrown to the right, the operator's talking set 25 will be connected only to the line L_1 , and transmission will take place only through the upper left-hand half of the inequality ratio coil 22, thereby providing for maximum talking efficiency on a connection with only one of the lines. If, under such conditions, it should be desired to talk on the line L_2 alone, the key K_1 would be thrown to the left. Under these circumstances, the upper left-hand winding of the inequality coil 22 would be connected to the contacts of jack J_5 in the following manner: from terminal 46, conductors 47 and 48, left-hand make contact of key K_1 , conductor 40, left-hand make contact of key K_3 to conductor 41, and thence in the usual manner to the upper sleeve contact of jack J_5 , and from terminal 44, over conductor 42, left-hand make contact of key K_3 to conductor 45, and thence in the usual manner to the lower tip contact of jack J_5 . When the key K_3 is thrown to the right, the transmitter 25 will be connected directly to the lines without the inclusion of the coil 22, in the following manner: from conductors 32, over the right-hand make contacts of key K_3 , over conductors 33 and 34 to the left-hand break contact of key K_3 , and thence over the talking conductors of the supervisory circuits and the contacts of keys K_3 and K_1 in the usual manner. By throwing the key K_1

either to the left or to the right after the key K_3 has been operated, the transmitter 25 may be selectively associated with either of the coils 5 and 6, and hence may be connected to either of the lines L_1 and L_2 alone. It is pointed out that when the key K_3 is thrown to the right, the following circuit will be closed: from ground, lower-right-hand make contact of key K_3 , conductor 35, winding of relay 23, conductor 36, winding of relay 37 to battery and ground. This circuit will energize the relays 23 and 37, which will disconnect the conductors 30, leading to the talking set 25 from the right-hand winding of the coil 22 and will change the connection of the receiver from its normal position to the induction coil for talking.

Associated with the ringing key K_2 is a source 18 of 135 cycle ringing current, a source 19 of 20 cycle ringing current, and the relays 15, 16 and 17. The relay 15 is connected over conductors 54 and 55 to the lower sleeve contact of jack J_5 and has a winding of relatively high resistance for purposes which will be pointed out later. The source 18 of 135 cycle current is normally connected through the resistance elements 20 and 21, and conductors 49 and 50 to the left-hand contacts of key K_2 . The resistance elements 20 and 21 are provided, so that when ringing takes place directly through the supervisory windings 5 and 6, the full force of the ringing generator 18 will not be applied through said coils, so that said coils are not apt to be magnetized or injured. These resistance elements may be short-circuited upon the operation of relay 16 when ringing takes place directly over the line, as will be pointed out later. The source 19 of 20 cycle ringing current is associated with the right-hand contacts of key K_2 over conductors 52 and 53, but is normally disconnected therefrom, the connection being controlled by the contacts of the relay 17. When the jack J_5 is connected to the jack J_1 and it is desired to ring directly through the supervisory windings, such as 5 and 6, the key K_2 will be operated. It is pointed out that in general it is the practice to ring through such windings only with current in the nature of 135 cycles, and accordingly, the key K_2 would be thrown to the left. When the key K_2 is thrown to the left, a circuit will be closed from ground and the upper make contact of key K_2 , over conductor 51 to the generator 18, thereby starting the generator into operation. Ringing current will then be applied from the generator through the resistance elements 20 and 21, and over conductors 49 and 50 to the left-hand make contacts of key K_2 , and thence over the contacts of key K_1 to the contacts of jack J_5 . It is pointed out that by operating the key K_1 in conjunction with the key K_2 , this ringing current may be sent

out over either of the lines L_1 and L_2 alone, or over both of said lines in substantially the same manner as has been described previously with respect to the talking current.

At stations where intermediate ringing apparatus is employed for relaying the ringing current around the telephone repeaters, it may not be possible to ring on the circuit directly through the supervisory windings on the output coils. In such cases, the jack J_5 will not be patched to the jack J_1 , but will be patched directly to one of the line jacks, such as jack J_3 or jack J_4 . The reason that it may not be possible to ring directly through the supervisory windings when intermediate ringing apparatus is associated with the lines is because when such apparatus is provided, there may be provided in the line, between such apparatus and the line jacks, apparatus such as 8 and 9, which may be a filter adapted to readily allow the transmission of telephonic currents, but which prevents the transmission of currents of ringing frequency. In accordance with this invention, the sleeve contacts of the line jacks are connected by the conductors 56 and 57 to the operating circuits of the ringing relays of the ringing apparatus, such as the relays 12 and 13. Accordingly, should it be desired to ring over a line such as the line L_1 when intermediate ringing apparatus is provided between the line L_1 and the line L_2 , the jack J_5 will be connected by the patching cord 14 to the jack J_3 and the key K_2 would be operated. When the key K_2 is thrown to the left the following circuit will be closed: from ground, lower left-hand make contacts of key K_2 , conductor 61, conductor 55, lower sleeve contact of jack J_5 , sleeve contact of jack J_3 , conductor 56, winding of relay 12 to battery and ground. The closing of this circuit serves to operate the relay 12. The operation of the relay 12 will apply 135 cycle ringing current to the line L_1 . The key K_2 might also be thrown to the right. This would apply current from conductors 63 and 55 to the relay 12, and operate relay 12 in substantially the same manner as has already been described. The relay 12, under certain conditions, might be adapted to send out over the line L_1 20 cycle ringing current instead of 135 cycle ringing current. The ringing operation, should the jack J_5 be connected to the jack J_4 in order to ring over the line L_2 , would be substantially the same as has been described with respect to the line L_1 and no further description thereof will be given.

Should the lines L_1 and L_2 not be provided with intermediate ringing apparatus the high pass filters 8 and 9 would be omitted and the conductors 56 and 57 would be directly connected to a source of current such as a battery similar to that shown associated

with relay 12. Under these conditions the operation of ringing directly out over the lines L_1 and L_2 would be as follows—Should it be desired to ring out over line L_1 , the jack J_5 would be connected by the patching cord 14 to the jack J_3 . This would close the following circuit: from ground and battery, conductor 56, sleeve contacts of jack J_3 , through the patching cord 14, lower sleeve contact of jack J_5 , conductors 55 and 54, winding of relay 15, to ground. The relay 15 is provided with a high resistance winding so that when the jack J_5 is connected with a line including intermediate ringing relays, such as 12, as heretofore described, the relay 12 will not operate. The relay 15, upon operation, will close the following circuit: from ground, armature and contact of relay 15, conductor 58, winding of relay 16, conductor 59, winding of relay 17 to battery and ground. This will operate the relay 16 and the relay 17. The operation of relay 16 will close short-circuits about the resistance elements 20 and 21 so that the full force of the ringing generator 18 may be applied to conductors 49 and 50 and thence to the line. The operation of relay 17 will directly connect the source 19 to the conductors 52 and 53. If it is desired to ring out over the line with 135 cycle current the key 2 will be thrown to the left and the following circuit will be closed. From ground and upper left hand contact of key K_2 , over control circuit 51 to the apparatus 18, thereby starting it in operation to apply 135 cycle current to conductors 49 and 51. The following circuit will also be closed: from ground, left hand make contact of key K_2 , conductors 60 and 62, contact and armature of relay 16, winding of relay 16, conductor 59, winding of relay 17 to battery and ground, thereby holding the relays 16 and 17 in energized condition independently of the operation of relay 15. The 135 cycle ringing current will then be applied in full force to conductors 49 and 50 and thence over the contacts of keys K_2 and K_1 , in a manner already described, to the contacts of jack J_3 and thence to the line L_1 . Should it be desired to ring out over line L_1 with 20 cycle current the key K_2 would be thrown to the right. This would apply 20 cycle current from source 19 to conductors 52 and 53 and thence over contacts of keys K_2 and K_1 and jacks J_5 and J_3 to the line in an obvious manner. The ringing operation, should the jack J_5 be connected to the jack J_4 in order to ring out over the line L_2 , would be substantially the same as has been described with respect to the line L_1 and no further description thereof will be given.

While the invention has been disclosed in certain specific arrangements which are deemed desirable, it is understood that it is capable of embodiment in other and widely

varied forms without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. The combination with a repeater circuit comprising supervisory windings on the output transformers of the repeater, and monitoring jacks associated with said windings; of a supervisory circuit comprising switching means for connecting said supervisory circuit with said jacks, an operator's talking set, a talking key, and an inequality ratio repeating coil associated with said talking set, said coil being operatively connected with said talking set by the operation of said key.

2. The combination with a two-element two-way repeater circuit comprising supervisory windings on the output transformers of said circuit and monitoring jacks associated with said windings; of a supervisory circuit comprising switching means for connecting said supervisory circuit with said jacks, an operator's talking set, a talking key, a monitoring key, an inequality ratio repeating coil in said supervisory circuit, means controlled by said talking key for operatively associating said coil with said talking set, and means controlled by said monitoring key for varying the ratio of the windings of said coil.

3. The combination with a repeater circuit comprising supervisory windings on the output transformers of said circuit and monitoring jacks associated with said windings, of a supervisory circuit comprising switching means for connecting said supervisory circuit with said jacks, operators' equipment, a talking key and a monitoring key, and means controlled by the joint operation of said keys whereby said operators' equipment may be operatively associated with said windings in a selective manner.

4. The combination with a two-way two-element repeater circuit comprising supervisory windings on the output transformers of said circuit and monitoring jacks associated with said windings; of a supervisory circuit comprising switching means for connecting said supervisory circuit with said jacks, a monitoring key, a ringing key, a source of ringing current, and means controlled by the joint operation of said keys whereby current from said source may be applied to said windings in a selective manner.

5. The combination with a two-way two-element repeater circuit comprising supervisory windings on the output transformers of said circuit and monitoring jacks associated with said windings; of a supervisory circuit comprising switching means for connecting said supervisory circuit with said jacks, operators' equipment, a talking key and a monitoring key, means controlled by

the joint operation of said keys whereby said operators' equipment may be operatively associated with said windings in a selective manner, a ringing key, a source of
5 current associated therewith, and means controlled by the joint operation of said ringing key and said monitoring key whereby current from said source may be applied to said windings in a selective manner.

10 6. The combination with a repeater circuit comprising two line sections interconnected by repeater apparatus, supervisory windings on the output transformers of said repeaters, monitoring jacks associated with
15 said windings, and line jacks in said line sections; of a supervisory circuit comprising switching means for connecting said supervisory circuit with either of said jacks, a monitoring key, a ringing key, a plurality
20 of sources of different types of ringing current associated with said ringing key, means controlled by the joint operation of said keys when said supervisory circuit is connected to said monitoring jacks whereby
25 ringing current may be applied to said supervisory windings in a selective manner, and means controlled by said ringing key alone when said supervisory circuit is associated with one of said line jacks whereby ringing
30 current from either of said sources may be applied to said line section.

7. The combination with a circuit comprising two line sections interconnected by repeater apparatus composite ringer apparatus interconnecting said line sections for
35 ringing around said repeater apparatus, supervisory windings on the output transformers of said repeaters, monitoring jacks associated with said windings, and line jacks in said line sections between said composite
40 ringer apparatus and said repeater apparatus; of a supervisory circuit comprising switching means for connecting said supervisory circuit with either of said jacks, a monitoring key, a ringing key, a source of
45 ringing current associated with said ringing key, means controlled by the joint operation of said keys when said supervisory circuit is connected to said monitoring jacks whereby ringing current may be applied to
50 said supervisory windings in a selective manner, and means associated with said line jacks and said supervisory circuit and controlled by said ringing key alone when said supervisory circuit is associated with one of
55 said line jacks whereby said composite ringer apparatus may be actuated to send ringing current out over said line section.

In testimony whereof, I have signed my name to this specification this 10th day of
November 1921.

HUGH F. SHOFFSTALL.