J. F. TOOMEY.

COMPOSITE RINGING APPARATUS.

APPLICATION FILED OCT. 30, 1917.

1,290,808.

Patented Jan. 7, 1919.

2 SHEETS—SHEET 1.

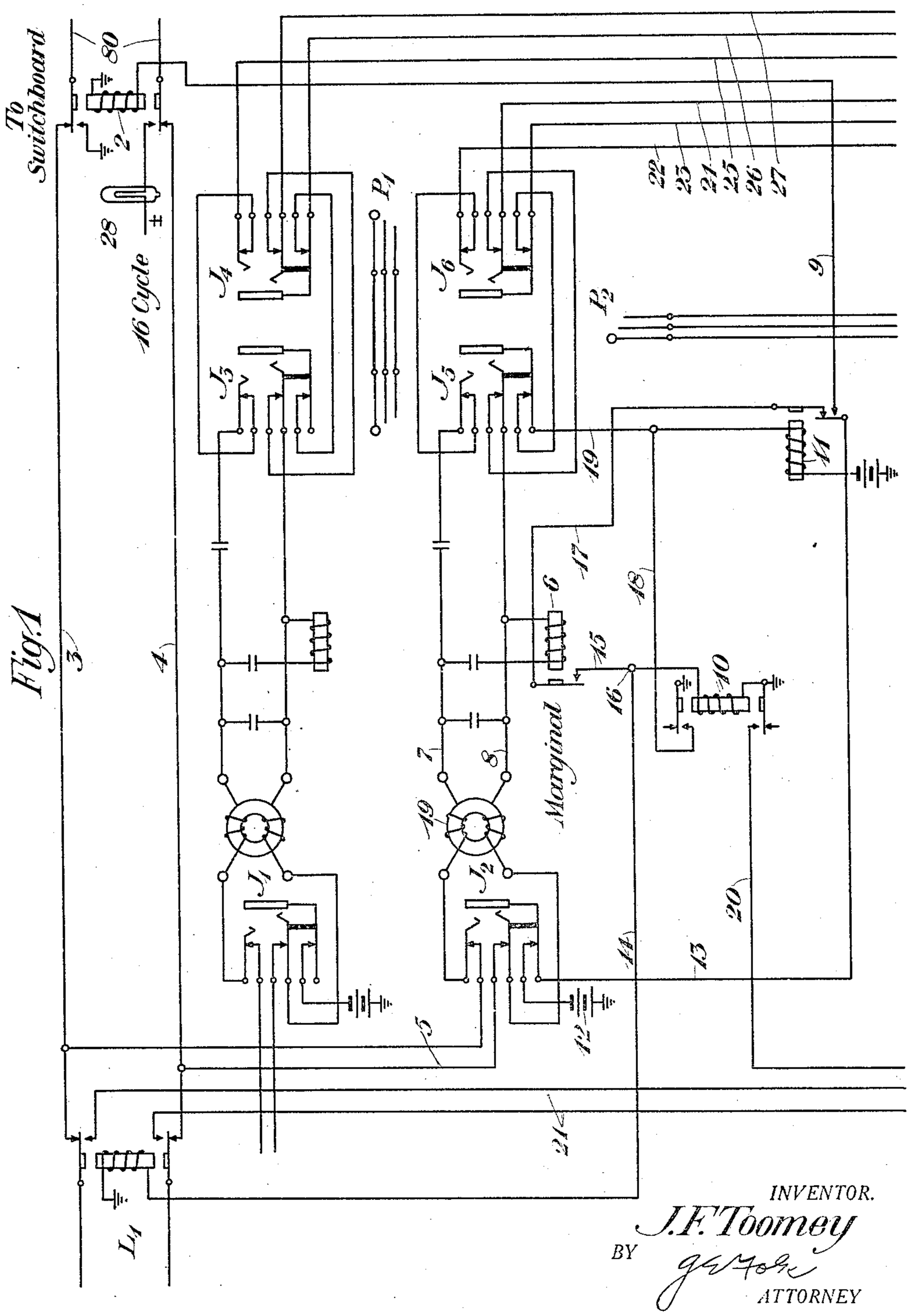

Fig. 1

INVENTOR.

J. F. Toomey

BY

ATTORNEY

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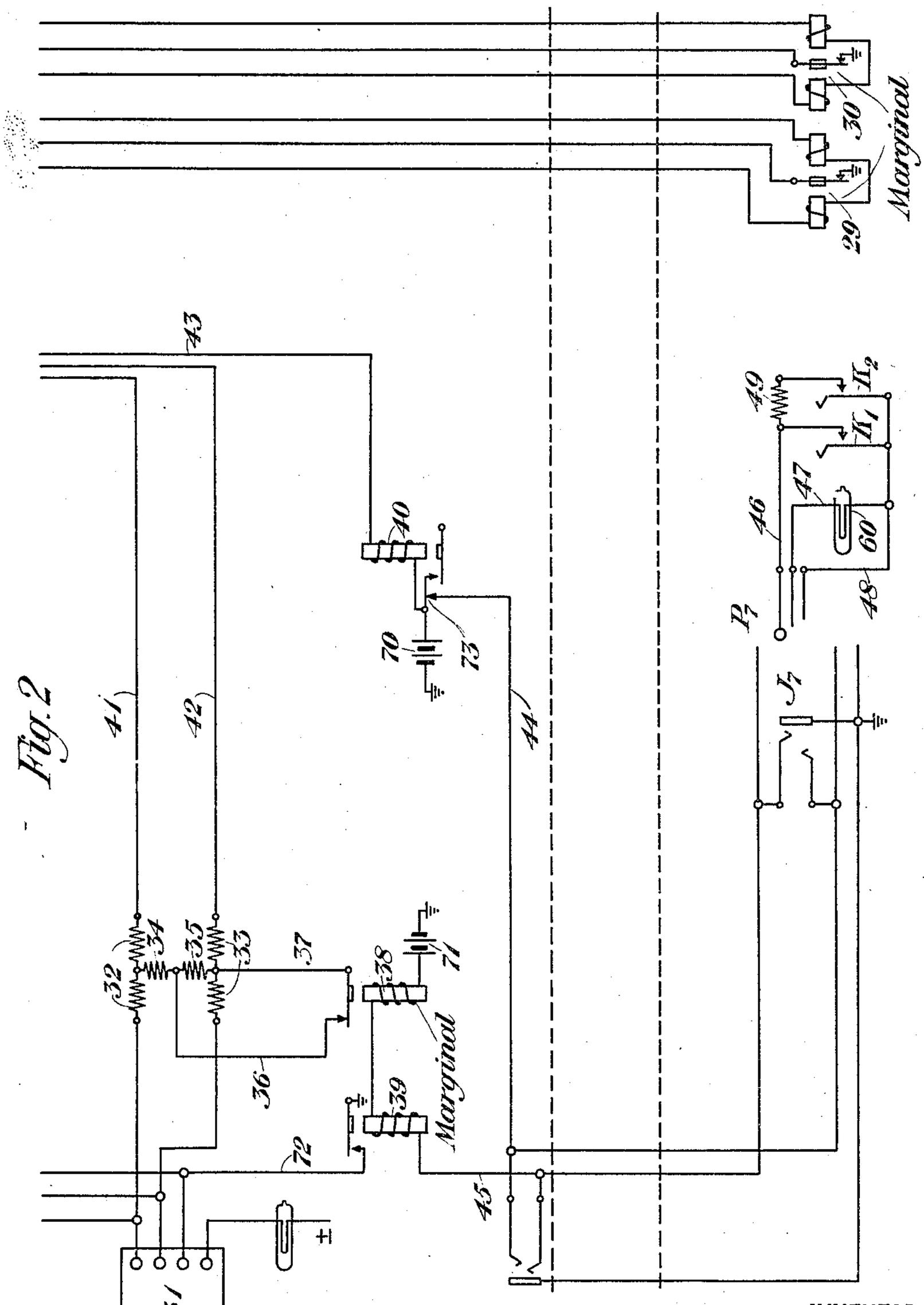

Fig. 2

INVENTOR.

J. F. Toomey

BY

ATTORNEY

UNITED STATES PATENT OFFICE.

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

COMPOSITE RINGING APPARATUS.

1,290,808. Specification of Letters Patent. Patented Jan. 7, 1919.

Application filed October 30, 1917. Serial No. 199,317.

To all whom it may concern:

Be it known that I, JOHN F. TOOMEY, residing at New York, in the county of New York and State of New York, have invented certain Improvements in Composite Ringing Apparatus, of which the following is a specification.

This invention relates to ringing apparatus and more particularly to ringing apparatus for use in connection with composited telephone and telegraph lines.

It is one of the objects of the invention to provide an arrangement whereby the frequency of the ringing current coming in over a transmission line may be translated into a frequency better adapted for use in operating the customary ringing apparatus associated with a switchboard. A further object is to provide means whereby the frequency of the ringing current commonly used at the switchboard may be translated into a frequency better adapted to be sent out over a transmission line. A further object of the invention is to provide a composite ringing apparatus which may be disconnected from the line when the ringer is not required and better transmission is desired for talking purposes. Another object consists in the provision of means whereby the marginal relays of the composite ringing set may be tested and adjusted. Further objects of the invention will be clear from the detailed description to be given later.

When a transmission line is used solely for telephone purposes the ringing current transmitted thereover may be of a frequency in the neighborhood of 16 cycles, and the ringing apparatus at the switchboard is constructed to generate and to respond to currents of approximately this frequency. When, however, the transmission line is composited and used for both telephone and telegraph purposes, it has been found that ringing currents having a frequency of the order above mentioned can not be transmitted out over such a line from the switchboard, nor can they be transmitted over such a line to the switchboard. This is because the frequency of these ringing currents is approximately the same as the frequency of the currents used for telegraphic purposes, and the filter or apparatus devised to keep these telegraphic currents from entering and interfering with the telephone apparatus, also serves to attenuate and practically extinguish these ringing currents of similar frequency. Accordingly, the ringing current to be well adapted for use over a composited transmission line must be of a frequency above the limit shut out by this filter, and it has been found that a ringing current having a frequency in the neighborhood of 133 cycles is well adapted for use over such a transmission line, although any frequency above the limit of this filter may be satisfactory.

In order to change the low frequency ringing current generated at the switchboard into a higher frequency ringing current suitable for use over the transmission line and vice versa, arrangements are employed known as composite ringing sets. Such sets include suitable switching means for associating the apparatus with the transmission line, and a plurality of marginal relays. One type of these marginal relays is adjusted to respond only to the ringing current coming in over the transmission line and its actuation serves to connect to the conductors leading to the switchboard apparatus a local source of ringing current suitable to operate such apparatus. The other type of marginal relay is adjusted to respond only to ringing current impressed on the line at the switchboard and its actuation serves to connect to the outgoing transmission line a source of ringing current suitable for use thereover. In former types of composite ringing sets the switching means for associating the set with the transmission line have usually been included serially in the line and this has often served to impair the quality of the transmission for talking purposes. In the composite set embodied in the present invention these switching means are associated with the transmission line by means of conductors bridged in shunt across the line and by the operation of these means the composite set may be entirely disconnected from the line and the quality of the transmission be improved for talking purposes. Further it has been found that the type of marginal relay used in such composite sets, requires delicate adjustment so that only currents of a desired frequency will cause it to operate. Accordingly the arrangements of this invention comprise means for testing and adjusting

such relays and also include suitable switching means whereby, when one of these relays becomes out of order, other relays of a similar type may be substitued therefor.

The invention may now be more fully understood by reference to the accompanying drawing, the Figures 1 and 2 of which when taken together illustrate diagrammatically the preferred form of the invention. In the Fig. 1 the incoming portion of a transmission line L_1 is shown connected by means of conductors 3 and 4 to the conductors 80 leading to the telephone switchboard. The apparatus of the composite ringer set is associated with the transmission line by means of the conductors 5 which are bridged in shunt across the conductors 3 and 4 and terminate in the jack J_2. Leading from the jack J_2 and terminating in the jack J_5 are the conductors 7 and 8. Associated with these conductors is the retardation coil 19 adapted to render the composite ringer set of high impedance to telephone currents. Bridged across these conductors 7 and 8 is the marginal relay 6, which is adjusted to respond only to ringing current of a frequency similar to that of the current at the telephone switchboard, and which may in practice be 16 cycles. Accordingly the ringing current sent out from the switchboard over the conductors 80 will cause the relay 6 to operate. The operation of this relay serves to close a circuit through the relays 1 and 10 and causes them to operate. The functioning of relay 1 disconnects the line L_1 from the conductors 3 and 4 and connects the line to the conductors 21 leading to the apparatus 31. The apparatus 31 serves to generate ringing current having a frequency suitable for use over the transmission line L_1, which may in practice be 133 cycles. The apparatus 31 is caused to operate by the functioning of the above mentioned relay 10. Accordingly the ringing current sent out from the switchboard causes, by the operation of these relays, the apparatus 31 to send out over the line L_1 by means of the conductors 21 a ringing current having a frequency suitable for transmission over such a composited transmission line.

Normally connected to the jack J_5 is the jack J_6 from the contacts of which are shown the conductors 22, 23, and 24, leading to the marginal relay 29. This marginal relay is adjusted to respond only to ringing current having a frequency similar to that of the ringing current transmitted over the transmission line L_1, which in practice might be 133 cycles. The energization of the marginal relay 29 by the ringing current coming in over the line L_1 causes its armature to retract and breaks the normally closed circuit through the relay 11. The deënergization of this relay operates to close a circuit through the relay 2 by means of which the conductors 80 leading to the telephone switchboard are disconnected from the conductors 3 and 4 and connected to a local source 28 of ringing current having a frequency suitable for operating the telephone apparatus at the switchboard.

A second composite ringing set is shown including a marginal relay 30 similar in type to the marginal relay 29 and associated with a jack J_4 by the conductors 25, 26, and 27. The jack J_4 is connected to the jack J_3 and said jack is connected in turn to a jack J_1 whereby the composite ringing set may be associated with another transmission line. This composite ringing set is of the same type as the one associated with the transmission line L_1 and in practice a number of such composite sets may be so arranged that all of their jacks will terminate at one test board. With such an arrangement there is also provided a switching cord P_1 by means of which, when one of the marginal relays gets out of order another similar relay of one of the other composite sets may be substituted therefor, as for example, if the relay 29 becomes defective, the relay 30 may be substituted therefor by inserting the terminals of the cord P_1 into the jacks J_5 and J_4. Similarly by inserting the terminals of the cord P_1 into the jacks J_3 and J_6 the relay 29 may be substituted for the relay 30 if the latter becomes defective.

In order to test and adjust the marginal relays of the type of relays 29 and 30, apparatus is provided including a plug P_2 adapted to be inserted in the jacks J_6 or J_4 or other jacks relating to the relay to be tested. From the tip and ring contacts of plug P_2 are conductors leading to the generating apparatus 31 heretofore mentioned. Included in these conductors is an artificial line adapted to simulate the impedance of the transmission line L_1, said artificial line comprising the resistances 32, 33, 34 and 35, the resistances 34 and 35 being bridged across the mid-points of resistances 32 and 33. Associated with the resistance 35 is a short circuit under the control of the marginal relay 38 to be hereinafter described. From the sleeve contact of plug P_2 is a conductor leading to the relay 40 which controls the test signal 60 in a manner to be hereinafter described. At the test board and also at the racks where the marginal relays are located and which in practice may be remote from the jacks at the test board are provided multiple jacks J_7 and J_8, so arranged as to be easily accessible from any apparatus associated with the composite ringers. A portable control set comprising the keys K_1 and K_2, the signal lamp 60, the resistance 49, and the plug P_7 is provided which may be associated with any of the multiple jacks J_7 or J_8, thus connecting the signal apparatus to relays 38, 39 and 40. The relay 39 is actu-

ated by the operation of either key K_1 or key K_2 and its actuation controls the operation of the generating apparatus 31. The relay 38 is marginal and is only actuated by the operation of the key K_1, but is not actuated by the operation of the key K_2, as the circuit closed by the operation of the latter key contains the resistance 49 which serves to so reduce the current that the marginal relay 38 will not respond. The relay 40 becomes energized when the plug P_2 is inserted in the jack J_6 or the jack J_4.

When the plug P_2 is inserted in the jack J_6 and the plug P_7 is inserted in one of the jacks J_7 or J_8 and the key K_2 is operated, the relay 39 is actuated and starts the generating apparatus in operation. However as the relay 38 does not respond upon the operation of the key K_2 the shunt resistance 35 remains shortcircuited, and, the resistance in the shunt circuit bridged across the outgoing circuit being thereby decreased, the current transmitted to the marginal relay 29 from the apparatus 31 will be less than the current to which it is desired to have the marginal relay respond. The actuation of the marginal relay 29 is indicated by the functioning of the signal lamp 60. Accordingly if the signal lamp 60 functions upon the operation of the key K_2 it will indicate that the marginal relay is responding to a current of less than the desired strength and needs adjustment.

The operation of the key K_1 serves to energize both relay 39 and relay 38. The energization of the latter relay opens the short circuit affecting the resistance 35 and the increased resistance now in shunt of the outgoing circuit of the apparatus 31 causes a current which is greater and of the desired strength to be transmitted to the marginal relay 29. If the relay now operates, as will be indicated by the signal lamp 60, it is correctly adjusted to respond to a current of the desired strength.

The invention may now be more fully understood from the following description of its operation. High frequency ringing current coming in over the line L_1 is transmitted to the marginal relay 29 over the following circuit; over conductors 5, which are bridged in shunt of the lines 3 and 4, to the contacts of jack J_2, thence through the windings of retardation coil 19 and over conductors 7 and 8 to the tip and ring contacts of jack J_5, thence over the conductors leading to the tip and ring contacts of jack J_6, and thence over conductors 22 and 24 to the windings of the marginal relay 29. The relay 29 is thereby energized and causes its armature to pull up and break the following normally closed circuit; from ground, contact and armature of relay 29, conductor 23, sleeve contact of jack J_6, conductor leading to sleeve contact of jack J_5, conductor 19, winding of relay 11, to battery and ground. The deënergization of relay 11 allows its armature to retract and closes the following circuit; from ground to battery 12, sleeve contact of jack J_2, conductor 13, contacts of relay 11, conductor 9, winding of relay 2 to ground. The closing of this circuit energizes relay 2 which accordingly pulls up its armatures, thereby disconnecting the conductors 80 from the conductors 3 and 4 and connecting to the conductors 80 a local source 28 of low frequency ringing current suitable to operate the ringing responsive apparatus at the switchboard.

When the operator at the telephone switchboard wishes to send high frequency ringing current out over the line L_1 she applies low frequency ringing current to the conductors 80 at the switchboard. This low frequency current is transmitted over the conductors 3 and 4 as well as the conductors 5 bridged in shunt thereof to the contacts of jack J_2. From thence it is transmitted through the windings of the retardation coil 19 over conductors 7 and 8 and through the marginal relay 6 which is bridged in shunt across conductors 7 and 8. The marginal relay 6 is accordingly energized and pulls up its armature, thereby closing the following circuit; from ground and battery 12, sleeve contact of jack J_2, conductors 13 and 17, armature and contact of relay 6, conductor 15, winding of relay 10 to ground. The actuation of the marginal relay 6 also closes the following circuit; from ground and battery 12, sleeve contact of jack J_2, conductors 13 and 17, armature and contact of relay 6, conductor 15 to connecting point 16, thence over conductor 14, and winding of relay 1 to ground. The closing of the two above described circuits serves to energize relays 1 and 10. The actuation of relay 1 serves to disconnect the line L_1 from the conductors 3 and 4 and to connect the line L_1 to the conductors 21 leading to the generating apparatus 31. The actuation of relay 10 closes a circuit from ground, lower armature and contact of relay 10, conductor 20 to the generating apparatus 31. This starts in operation the apparatus 31 which generates ringing current of a frequency suitable for transmission over the line L_1. This ringing current is transmitted to the line L_1 by way of the conductors 21 as formerly pointed out. The energization of the relay 10 also serves to close a circuit from ground, upper armature and contact of relay 10, conductor 18, winding of relay 11 to battery and ground. This serves to lock the normally energized relay 11, which as has been formerly pointed out becomes deënergized upon the actuation of the marginal relay 29. Accordingly, in the event that the marginal relay 29 should become energized by the low frequency ringing current generated at the switchboard,

which might happen if it were improperly adjusted, the relay 11 will still remain energized and prevent the breaking of any of the above mentioned circuits at the point where the armature of relay 11 is in contact with conductor 13.

As the operation of the second composite set with respect to ringing currents transmitted from another transmission line or switchboard is substantially the same as the operation above described, the description of its operation will be omitted.

In order to test the marginal relay 29 to see if it is properly adjusted to respond only to ringing current of a frequency similar to that of the ringing current transmitted over the line L_1 the plug P_2 is inserted in the jack J_6. This serves to close a circuit from ground and battery 70, winding of relay 40, conductor 43, sleeve contacts of plug P_2 and jack J_6, conductor 23, armature and contact of relay 29 to ground. Relay 40 is energized over this circuit and disconnects conductor 44 from the conductor leading to the battery 70. The plug P_7 is now inserted in the jack J_7 and the key K_1 is operated. This closes the following circuit; from ground and battery 71, windings of relays 38 and 39, conductor 45, tip contacts of jack J_7 and plug P_7, conductor 46, contacts of key K_1, conductor 48, sleeve contacts of plug P_7 and jack J_7, to ground. The closing of this circuit energizes relays 39 and 38. The actuation of relay 39 causes it to pull up its armature and close a circuit from ground, armature and contact of relay 39, conductor 72, to the generating apparatus 31, thereby starting it in operation. The actuation of relay 38 causes it to pull up its armature, and thus open the short circuit around the resistance 35. The opening of this short circuit increases the total resistance in shunt between the conductors 41 and 42 and allows a larger portion of the current generated by the apparatus 31 to be transmitted out over the conductors 41 and 42. This current is then transmitted by way of the tip and ring contacts of plug P_2 and jack J_6 and over conductors 22 and 24 to the windings of the marginal relay 29. The marginal relay 29 if properly adjusted is accordingly energized and pulls up its armature which serves to break the circuit through relay 40, which as has formerly been pointed out is normally energized upon the insertion of plug P_2 into jack J_6. The deënergization of relay 40 allows its armature to retract and closes the following circuit; from ground and battery 70, contact 73, conductor 44, ring contacts of jack J_7 and plug P_7, conductor 47, filament of signal lamp 60, conductor 48, sleeve contacts of plug P_7 and jack J_7, to ground. The closing of this circuit causes the signal lamp 60 to glow, thereby indicating that the marginal relay 29 has responded to a current of the desired strength. If the relay does not properly respond to this test it should be adjusted until it does.

The key K_1 is now released and the key K_2 is operated. This closes the following circuit; from ground and battery 71, windings of relays 38 and 39, conductor 45, tip contacts of jack J_7 and plug P_7, conductor 46, resistance 49, contacts of key K_2, conductor 48, sleeve contacts of plug P_7 and jack J_7, to ground. The above described circuit is substantially similar to the circuit closed when the key K_1 is operated, except that it includes the additional resistance element 49. This resistance serves to so reduce the current flow through the circuit that the marginal relay 38 will not respond when the key K_2 is operated and the short circuit about the resistance 35 will remain closed. By the closing of this circuit however the relay 39 is energized and in the same manner as formerly pointed out starts the generating apparatus 31 into operation. Due to the fact that the short circuit around the resistance 35 remains closed the total resistance in shunt of the conductors 41 and 42 is less than when the key K_1 was operated and accordingly the strength of the current transmitted over the conductors 41 and 42 from the apparatus 31 is less than the strength of the current transmitted thereover upon the operation of the key K_1, which current was of the value to which it is desired that the relay respond. This current is transmitted to the relay 29 in the same manner as the current sent out from the apparatus 31 upon the operation of key K_1 and if the relay responds thereto the signal lamp 60 will be caused to glow. Accordingly if the signal lamp glows upon the operation of the key K_2 it will indicate that the relay 29 is responding to a current of less than the desired strength, and is in need of adjustment. Adjustment is accordingly made until the relay no longer responds to the action of key K_2.

In order to test the marginal relay 30 the plug P_2 is inserted in the jack J_4. The operation is then substantially the same as when the relay 29 is tested and the description of the operation will be omitted.

While the invention has been disclosed as embodied in certain forms which are considered desirable, it will be understood that it may be embodied in many widely different organizations without departing from the spirit of the invention.

What is claimed is:

1. In a telephone system the combination with a transmission line leading to a telephone switchboard; of a composite ringing set including switching means and a plurality of ringing responsive means, said switching means being included in a bridge

shunted across said transmission line, one of said responsive means responding only to ringing current coming in over said transmission line and another of said responsive means responding only to current coming in from said telephone switchboard.

2. In a telephone system the combination with a transmission line leading to a telephone switchboard; of a composite ringing set including switching means and a plurality of ringing responsive means, said switching means being included in a bridge shunted across said transmission line, one of said responsive means responding only to ringing current coming in over said transmission line, and means under control of said responsive means for associating with the conductors leading to said telephone switchboard a local source of current suitable for operating the ringing responsive apparatus at the switchboard, another of said responsive means responsive only to ringing current generated at said switchboard, and means under control of said responsive means for associating with the transmission line a local source of ringing current suitable for use thereover.

3. In a telephone system the combination with a transmission line and a composite ringing set associated therewith including means responsive only to ringing current transmitted over said transmission line; of a testing set, a source of current therefor, and means for associating said testing set with said responsive means whereby the currents from said source may be applied to said responsive means.

4. In a telephone system the combination with a transmission line and a composite ringing set associated therewith including means responsive only to ringing current transmitted over said transmission line; of a testing set, a source of current therefor, means for applying current from said source to said responsive means, and controlling means whereby the amplitude of the current applied from said source to said responsive means may be varied, and means to indicate the response of said responsive means to said currents.

5. In a telephone system the combination with a transmission line and a composite ringing set including a marginal relay adjusted to respond to ringing current coming in over said transmission line; of an apparatus for testing the operation of said marginal relay, a source for said apparatus generating current suitable for transmission over said transmission line, means included in the output circuit of said source for simulating said transmission line, a controlling set and means under the control thereof for varying said simulating means whereby the current transmitted from said source to said marginal relay may be equal to or less than the strength of the current to which it is desired to have said marginal relay respond, and means in said controlling set to indicate the response of said marginal relay to the currents from said source.

6. In a telephone system the combination with a plurality of transmission lines and composite ringing sets associated therewith, said composite sets including means responsive to ringing currents transmitted over said transmission lines and switching means included in bridges shunted across said transmission lines and associated with said responsive means; of a test board at which said switching means may be located, means at said test board for interconnecting said switching means whereby the responsive means included in one of said composite sets may be substituted for the responsive means of another of said composite sets.

7. In a telephone system the combination with a transmission line; of a composite ringing set included in a bridge shunted across said transmission line, and switching means in said bridge between said line and said composite set operating to open said bridge and to disconnect said composite ringing set from said line when better transmission is desired thereover.

8. In a telephone system the combination with a plurality of transmission lines and composite ringing sets associated therewith, said composite sets being included in bridges shunted across said transmission lines and including means responsive to ringing currents transmitted over said transmission lines; of switching means in said bridges whereby the responsive means included in one of said composite sets may be substituted for the responsive means of another of said composite sets.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 24th day of October, 1917.

JOHN F. TOOMEY.

Witnesses:
ALFRED KAUFMANN,
MARY A. ROGERS.