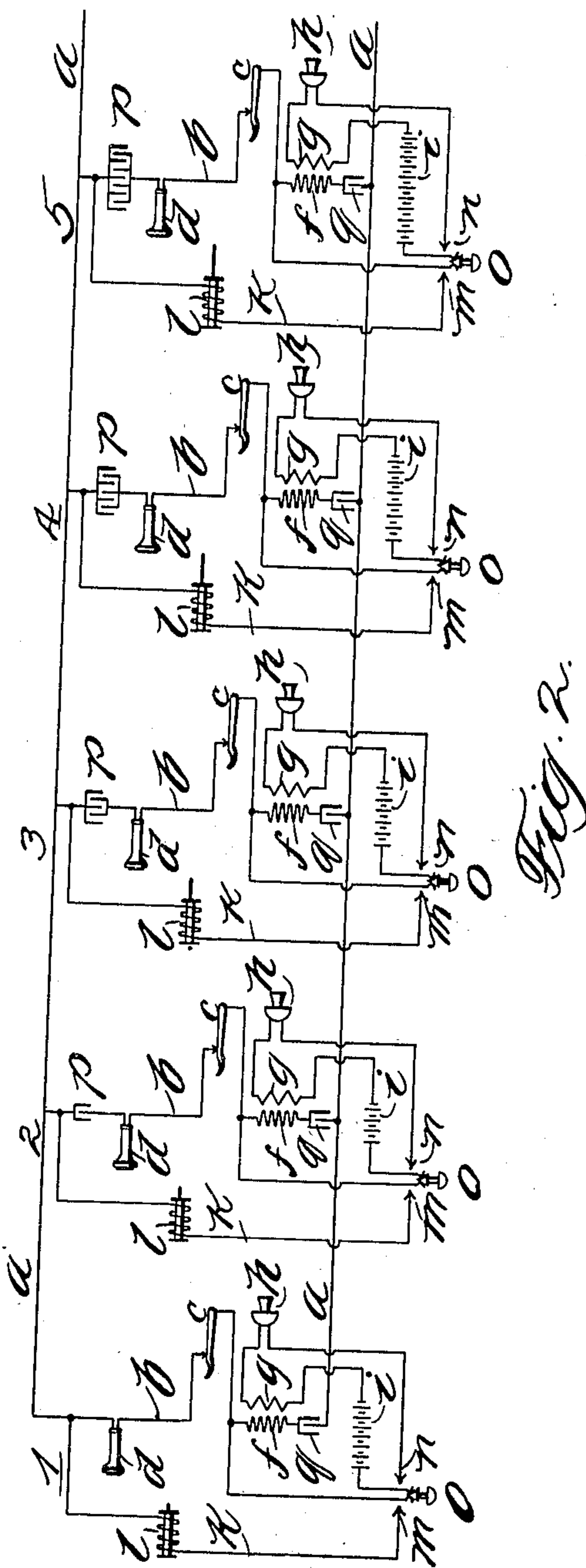
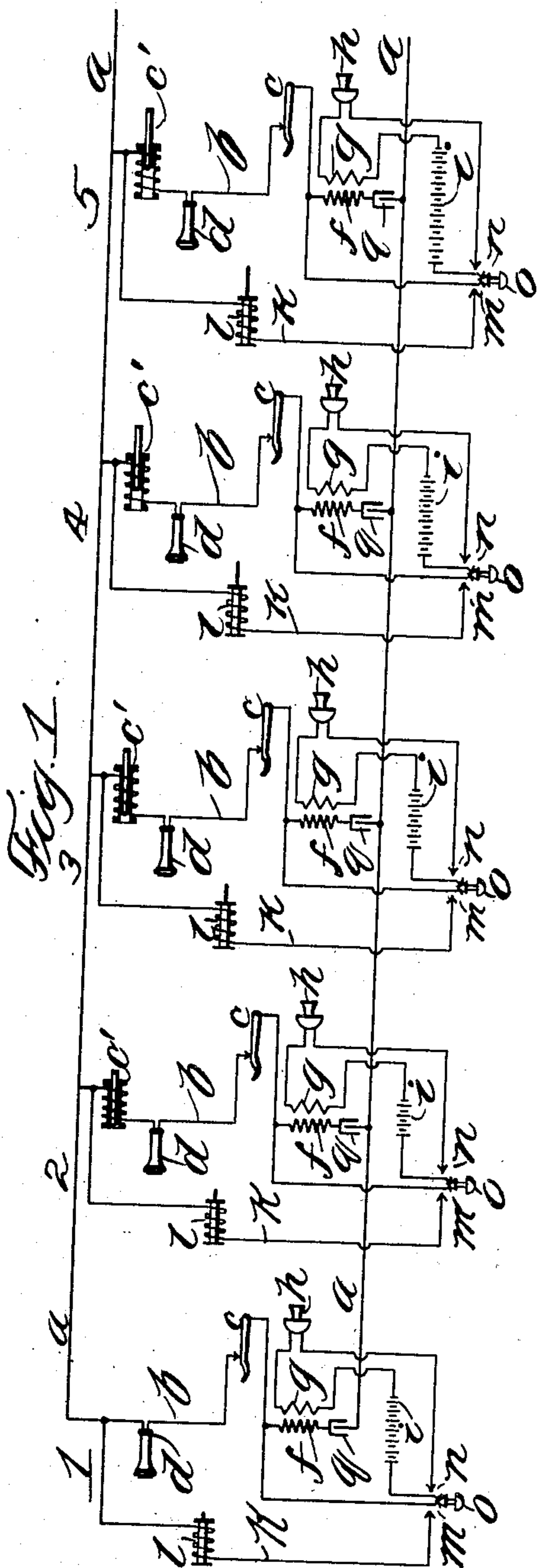


925,756.

Patented June 22, 1909.



Witnesses:
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UNITED STATES PATENT OFFICE.

GEORGE C. CUMMINGS, OF WESTERN SPRINGS, ILLINOIS.

TELEPHONY.

No. 925,756.

Specification of Letters Patent.

Patented June 22, 1909.

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To all whom it may concern:

Be it known that I, GEORGE C. CUMMINGS, citizen of Canada, and subject of King Edward VII, residing at Western Springs, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Telephony, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to telephony, certain features thereof being applied to a telephone system including a telephone line, a transmitting station at which voice currents are impressed upon the line, a plurality of receiving stations having telephone receivers included in conductors in bridge of the telephone line, and which conductors offer differing degrees of effective resistance to the voice currents impressed thereupon by the transmitting station, each bridge conductor that is nearer the transmitting station having more effective resistance than each more distant bridge conductor.

Other features of my invention are preferably applied to the telephone system generally outlined, though I do not wish to be limited to the precise application of these latter features of my invention.

My invention will be well understood by reference to the accompanying drawing, in which—

Figure 1 shows one embodiment thereof, and Fig. 2 another embodiment thereof.

The telephone system to which I have adapted my invention includes a metallic circuit *a* which is shown as connecting a telephone station 1 (which, for example, may be a train despatcher's office) with four or other number of telephone stations, 2, 3, 4 and 5. Each telephone station includes a bridge conductor *b* uniting the metallic sides of the telephone line *a* (though it is to be understood that I do not limit my invention to metallic telephone circuits), within which bridge conductor there is included at each station a telephone switch-hook *c*, a receiver *d*, the secondary *f* of an induction coil and a condenser *g*. Each bridge conductor *b* at the stations 2, 3, 4 and 5 also includes a retardation coil *c'* that serves to determine the effective resistance offered to the talking current impressed upon said bridge conductor at the line. The primary *g* of the induction coil at each telephone station is shown included in a local circuit with a transmitter *h*

and a battery *i*. The retardation coils *c'* at the different line stations are provided with adjustable cores, whereby the inductance afforded by said coils *c'* may be adjusted, the adjustment of the coils *c'* being such that the effective resistance of the bridge conductor at station 2 is caused to be greater by the retardation coil *c'* than the effective resistance of the bridge conductors *b* at the other train line stations that are more remote from the despatcher's office 1; the effective resistance of the bridge conductor *b* at train line station 3 is made less than the effective resistance of the bridge conductor at the train line station 2, but greater than the effective resistances of the bridge conductors at stations 4 and 5; that are more remote from the despatcher's office 1 than stations 2 and 3; the effective resistance of the bridge conductor at station 4 is less than the effective resistance of the bridge conductors at stations 2 and 3 and greater than the effective resistance of the bridge conductor *b* at station 5.

By varying the effective resistances of the bridge conductors at the different train line stations, the effectiveness of the voice currents received at each of such stations may be made approximately equal. This is due to the fact that the impedance or effective resistance of the different bridges is tapered in value from the despatcher's end of the line to the other end thereof. For example, it is possible with this arrangement to so adjust the effective resistance of the conductor *b* at station 2, that it is equal to the effective resistance of the corresponding conductor of the station at the other end of the line plus the line resistance.

In accordance with one feature of my invention, there is provided at each station a shunt conductor *k*, which includes a retardation coil *l* of low ohmic resistance. The conductor *k* and the local circuit for the transmitter *h* includes each a pair of contacts *m* and *n*, respectively, the contacts of each of the sets *m* and *n* being normally in separated relation. The contacts of both sets are simultaneously engaged upon the operation of a key *o*, the operation of which key is to occur when the receiver *d* of the associate station is removed from its switch-hook *c* and when the party at such station is to talk. When the party at such station is to listen, the button *o* is released. If the train despatcher or other party is talking at the

station 1, the receiver thereat is shunted by the conductor k upon the operation of the button o , the associate transmitter circuit $g h i$ being at the same time closed. By the closure of the contacts m at station 1, a conductance path of comparatively low effective resistance is established about the telephone receiver d . By this feature of my invention I am enabled to eliminate a large portion of the effective resistance to the outgoing voice currents that are impressed upon the secondary f as a consequence of the operation of the transmitter h . The conductor k at each of the stations 2, 3, 4 and 5 not only establishes a shunt about the telephone receiver d at each of said stations when said conductor k is closed at m at each station, but said conductor k at each station is also so connected as to shunt the retardation coil c^1 thereat as well. By shunting the receiver d and retardation coil c^1 , when talking, the effective resistance offered to the flow of impressed voice currents from the secondary f to the line is not only reduced, but side tones at the receivers d are eliminated, which is also the case with the receiver at station 1 when the shunt conductor k thereat is closed at m . It is to be understood that the key o at a station is operated only when voice currents are to be impressed upon the line at such station and that such key o is to be released when voice currents are to be received at such station, the strength of the batteries i incidentally being saved by opening the transmitter circuits during the time the receivers have the shunts removed therefrom. The retardation coil l included in each shunt conductor k has an adjustable core to vary the effect of the shunt upon the circuit including the receiver. The purpose of this adjustable impedance which is normally low in value, is to permit voice currents to pass through the receiver, provided the despatcher desires to interrupt the person talking at any one of the stations. It being desirable to have this impedance low so as not to dissociate outgoing voice currents from the stations, it is found preferable to make it adjustable so that the "break in" feature described above may be obtained. In practice, it is found only necessary that the person talking should receive enough current to know that the despatcher is on the line, in which event the party talking releases the key o and releases the full talking current from the line. The effective resistance offered by the small retardation coil l at each train line station that is nearer the transmitting station, is caused to be greater than that offered by each more distant impedance coil l , whereby the objects of my invention are more fully realized.

The system shown in Fig. 2 is the equivalent of the system shown in Fig. 1, the condensers p being substituted for the retardation

coil c^1 , the capacity of these condensers increasing with the distance of the train line stations from the despatcher's office. In other respects the system shown in Fig. 2 is similar to the system shown in Fig. 1.

In the description of the operation thus far given, station 1 has been considered as the sending or transmitting station, for by the features of the system so far described the voice currents emanating from such sending or transmitting station were divided equally among the other listening stations, which thus became receiving stations.

In considering another feature of my invention now to be described, each of the outer or line stations 2, 3, 4 and 5 may be taken as a sending or transmitting station, and station No. 1 as a central or receiving station, it being an object of my present invention to cause the telephone receiver at such receiving station to be operated with the same degree of effectiveness by all of the remaining, or transmitting, stations, so that conversation may be transmitted from the distant stations to the receiving station with the same effectiveness as from the nearer stations. In accomplishing the present object of my invention, the voltages of the batteries i at the different outlying or transmitting stations are adjusted with regard to the resistances intervening between the receiving station and the other stations upon the line, the voltage of each battery i that is nearer the receiving station being less than the voltage of each more distant battery i . By way of example, let it be assumed that the resistance of each side of the metallic circuit a between stations 1 and 2 is twenty-five ohms, the resistance of each side of the metallic circuit a between stations 1 and 3 is one hundred fifty ohms, the resistance of each side of the metallic circuit a between stations 1 and 4 is two hundred seventy-five ohms, the resistance of each side of the metallic circuit a between stations 1 and 5 is five hundred twenty-five ohms; in such case the voltages of the batteries at stations 1 to 5, inclusive, may be ten volts for station 1, six volts for station 2, nine volts for station 3, twelve volts for station 4, and sixteen volts for station 5. The apparatus that may well be employed at each of the stations may be a #233 or #229 Western Electric Company transmitter, a #13 Western Electric induction coil, and a #128 Western Electric Company receiver, which are standard devices to be found upon the market. The condensers q that are desirably included in the bridge conductors b may be two microfarad condensers; the retardation coils c^1 may be of two hundred ohms resistance each, and the retardation coils l^1 may be of one ohm resistance each. By having the batteries i at the different transmitting stations of properly different voltages, the inequality of the re-

sistances between the transmitting stations and the receiving station may be compensated for, whereby the telephone receiver *d* at the receiving station 1 is operated with the same degree of effectiveness by voice currents of similar value generated at the transmitting stations irrespective of the distances of such stations from the receiving station, for the wattage or energy traversing the receiver *d* at the receiving station 1 is the same with respect to the currents flowing from the transmitting stations under the conditions named.

My invention may be adapted to any telephone line having a receiving station and a plurality of transmitting stations within reasonable distance of the receiving station, the voltages of the batteries at the transmitting stations being suitably proportioned with respect to the resistances intervening between said transmitting stations and the receiving station, so that the wattage of the current traversing the telephone receiver at the receiving station will be the same as a consequence of the generation of voice currents of similar value at the transmitting stations.

It will be seen that I have provided a telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, and means for equalizing the voice currents or wattage received at one station as a result of equivalent transmitter operations at other stations.

While I have herein shown and particularly described preferred embodiments of my invention and the adaptation thereof to train line circuits, I do not wish to be limited thereto, as changes may readily be made without departing from the spirit of the invention.

Having thus described my invention, I claim as new and desire to secure by Letters Patent the following:—

1. A telephone system including a telephone line, a transmitting station at which voice currents are impressed upon the line, a plurality of telephone stations having telephone receivers included in conductors in bridge of the telephone line, and which conductors offer differing degrees of effective resistance to the voice currents impressed thereupon by the transmitting station, each bridge conductor that is nearer the transmitting station having more effective resistance than each more distant bridge conductor, transmitters also at the latter stations, circuits for the transmitters, induction coils having primaries in the transmitter circuits and secondaries in the bridge conductors containing the receivers, shunts about the effective resistance in said bridge conductors for conveying outgoing voice currents impressed upon the secondaries, and switching devices for opening and closing said shunts and the associate transmitter circuits.

2. A telephone system including a tele-

phone line, a transmitting station at which voice currents are impressed upon the line, a plurality of telephone stations having telephone receivers included in conductors in bridge of the telephone line, and which conductors offer differing degrees of impedance to the voice currents impressed thereupon by the transmitting station, each bridge conductor that is nearer the transmitting station having more impedance than each more distant bridge conductor, transmitters also at the latter stations, circuits for the transmitters, induction coils having primaries in the transmitter circuits and secondaries in the bridge conductors containing the receivers, shunts about impedance in said bridge conductors for conveying outgoing voice currents impressed upon the secondaries, and switching devices for opening and closing said shunts and the associate transmitter circuits.

3. In a telephone system, the combination with a telephone receiver, of a telephone transmitter, circuits for said receiver and transmitter, an induction coil whose primary is in the transmitter circuit and whose secondary is in the receiver circuit and in the path of outgoing voice-currents occasioned by operation of the transmitter, a shunt at a transmitting station about effective resistance included in the circuit of said secondary for conveying outgoing voice currents impressed upon the secondary, and switching mechanism controlling the continuity of said shunt and the transmitter circuit.

4. In a telephone system, the combination with a telephone receiver, of a telephone transmitter, circuits for said receiver and transmitter, an induction coil whose primary is in the transmitter circuit and whose secondary is in the receiver circuit, a shunt at a transmitting station about the receiver for conveying outgoing voice currents impressed upon the secondary, and switching mechanism controlling the continuity of said shunt and the transmitter circuit.

5. A telephone system including a telephone line, a transmitting station at which voice currents are impressed upon the line, a plurality of telephone stations having telephone receivers included in conductors in bridge of the telephone line, and which conductors offer differing degrees of effective resistance to the voice currents impressed thereupon by the transmitting station, each bridge conductor that is nearer the transmitting station having more effective resistance than each more distant bridge conductor, transmitters also at the latter stations, circuits for the transmitters, induction coils having primaries in the transmitter circuits and secondaries in the bridge conductors containing the receivers, and means for reducing effective resistance of said bridge conductors.

6. A telephone system including a telephone line, a transmitting station at which

voice currents are impressed upon the line, a plurality of telephone stations having telephone receivers included in conductors in bridge of the telephone line, and which conductors offer differing degrees of impedance to the voice currents impressed thereupon by the transmitting station, each bridge conductor that is nearer the transmitting station having more impedance than each more distant bridge conductor, transmitters also at the latter stations, circuits for the transmitters, induction coils having primaries in the transmitter circuits and secondaries in the bridge conductors containing the receivers, and means for reducing impedance of said bridge conductors.

7. In a telephone system, the combination with a telephone receiver, of a telephone transmitter, circuits for said receiver and transmitter, an induction coil whose primary is in the transmitter circuit and whose secondary is in the receiver circuit, and means at the telephone station where the above apparatus is located for reducing effective resistance in the path of voice currents impressed upon the secondary.

8. In a telephone system, the combination with a telephone receiver, of a telephone transmitter, circuits for said receiver and transmitter, an induction coil whose primary is in the transmitter circuit and whose secondary is in the receiver circuit and in the path of outgoing voice-currents occasioned by operation of the transmitter, and means for excluding the receiver from the direct path of voice currents impressed upon the secondary.

9. A telephone system including a telephone line, a transmitting station at which voice currents are impressed upon the line, a plurality of telephone stations having telephone receivers included in conductors in bridge of the telephone line, and which conductors offer differing degrees of effective resistance to the voice currents impressed thereupon by the transmitting station, each bridge conductor that is nearer the transmitting station having more effective resistance than each more distant bridge conductor, transmitters also at the latter stations, circuits for the transmitters, induction coils having primaries in the transmitter circuits and secondaries in the bridge conductors containing the receivers, shunts about effective resistance in said bridge conductors for conveying outgoing voice currents impressed upon the secondaries, and switching devices for opening and closing said shunts and the associate transmitter circuits.

10. A telephone system including a telephone line, a transmitting station at which voice currents are impressed upon the line, a plurality of telephone stations having telephone receivers included in conductors in bridge of the telephone line, and which con-

ductors offer differing degrees of impedance to the voice currents impressed thereupon by the transmitting station, each bridge conductor that is nearer the transmitting station having more impedance than each more distant bridge conductor, transmitters also at the latter stations, circuits for the transmitters, induction coils having primaries in the transmitter circuits and secondaries in the bridge conductors containing the receivers, shunts about impedance in said bridge conductors for conveying outgoing voice currents impressed upon the secondaries, and switching devices for opening and closing said shunts and the associate transmitter circuits.

11. In a telephone system, the combination with a telephone receiver, of a telephone transmitter, circuits for said receiver and transmitter, an induction coil whose primary is in the transmitter circuit and whose secondary is in the receiver circuit and in the path of outgoing voice-currents occasioned by operation of the transmitter, a shunt at a transmitting station for reducing effective resistance in the path of voice currents impressed upon the secondary, and switching mechanism controlling the continuity of said shunt.

12. In a telephone system, the combination with a telephone receiver, of a telephone transmitter, circuits for said receiver and transmitter, an induction coil whose primary is in the transmitter circuit and whose secondary is in the receiver circuit, a shunt at a transmitting station about the receiver for conveying outgoing voice currents impressed upon the secondary, and switching mechanism controlling the continuity of said shunt.

13. In a telephone system, the combination with a telephone receiver, of a telephone transmitter, circuits for said receiver and transmitter, an induction coil whose primary is in the transmitter circuit and whose secondary is in the receiver circuit and in the path of outgoing voice-currents occasioned by operation of the transmitter, a shunt at a transmitting station about impedance for conveying outgoing voice currents impressed upon the secondary, and switching mechanism controlling the continuity of said shunt and the transmitter circuit.

14. A telephone system including a telephone line, a transmitting station at which voice currents are impressed upon the line, a plurality of telephone stations having telephone receivers included in conductors in bridge of the telephone line, and which conductors offer differing degrees of effective resistance to the voice currents impressed thereupon by the transmitting station, each bridge conductor that is nearer the transmitting station having more effective resistance than each more distant bridge conductor, transmitters also at the latter stations, circuits for the transmitters, induction coils

having primaries in the transmitter circuits and secondaries in the bridge conductors containing the receivers, shunts about effective resistance in said bridge conductors for conveying outgoing voice currents impressed upon the secondaries, and switching devices for opening and closing said shunts and the associate transmitter circuits, said shunts containing differing degrees of effective resistance, each shunt that is nearer the transmitter station having more effective resistance than each more distant shunt.

15. A telephone system including a telephone line, a transmitting station at which voice currents are impressed upon the line, a plurality of telephone stations having telephone receivers included in conductors in bridge of the telephone line, and which conductors offer differing degrees of impedance to the voice current impressed thereupon by the transmitting station, each bridge conductor that is nearer the transmitting station having more impedance than each more distant bridge conductor, transmitters also at the latter stations, circuits for the transmitters, induction coils having primaries in the transmitter circuits and secondaries in the bridge conductors containing the receivers, shunts about impedance in said bridge conductors for conveying outgoing voice currents impressed upon the secondaries, and switching devices for opening and closing said shunts and the associate transmitter circuits, said shunts containing differing degrees of impedance, each shunt that is nearer the transmitter station having more effective resistance than each more distant shunt.

16. A telephone system including a telephone line, a transmitting station at which voice currents are impressed upon the line, a plurality of telephone stations having telephone receivers included in conductors in bridge of the telephone line, and which conductors offer differing degrees of effective resistance to the voice currents impressed thereupon by the transmitting station, each bridge conductor that is nearer the transmitting station having more effective resistance than each more distant bridge conductor, transmitters also at the latter stations, circuits for the transmitters, induction coils having primaries in the transmitter circuits and secondaries in the bridge conductors containing the receivers, shunts containing differing degrees of effective resistance, each shunt that is nearer the transmitter station having more effective resistance than each more distant shunt.

17. In a telephone system including a telephone line, a transmitting station at which voice currents are impressed upon the line, a plurality of telephone stations having telephone receivers included in conductors in bridge of the telephone line, and which conductors offer differing degrees of impedance

to the voice currents impressed thereupon by the transmitting station, each bridge conductor that is nearer the transmitting station having more impedance than each more distant bridge conductor, transmitters also at the latter stations, circuits for the transmitters, induction coils having primaries in the transmitter circuits and secondaries in the bridge conductors containing the receivers, shunts containing differing degrees of impedance, each shunt that is nearer the transmitter station having more effective resistance than each more distant shunt.

18. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, means for equalizing the voice currents received at one station as a result of equivalent transmitter operations at other stations, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, and means for reducing effective resistance of said bridge conductors when outgoing voice currents are impressed thereupon.

19. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, means for equalizing the wattage of voice currents received at one station as a result of equivalent transmitter operations at the other stations, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, and means for reducing effective resistance of said bridge conductors when outgoing voice currents are impressed thereupon.

20. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, means at each of the latter stations for equalizing the voice currents received at the first station as a result of equivalent transmitter operations at other stations, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, and means for reducing effective resistance of said bridge conductors when outgoing voice currents are impressed thereupon.

21. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, means at each of the latter stations for equalizing the wattage of voice currents received at the first station as a result of equivalent transmitter operations at the other stations, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, and means for reducing effective resistance of said bridge

conductors when outgoing voice currents are impressed thereupon.

22. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations at differing distances from the former station, means for supplying the transmitter at each of the latter stations with differing voltages of transmitter current, the voltage at each of the latter stations that is nearer the first station being less than that at each of the latter stations more distant from the first station, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, and means for reducing effective resistance of said bridge conductors when outgoing voice currents are impressed thereupon.

23. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations at differing distances from the former station, local transmitter circuits at the latter stations, sources of current in said local circuits having differing voltages, the voltage of the source of current at each of the latter stations that is nearer the first station being less than that at each of the latter stations more distant from the first station, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, and means for reducing effective resistance of said bridge conductors when outgoing voice currents are impressed thereupon.

24. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, means at each of the latter stations for equalizing the voice currents received at the first station as a result of equivalent transmitter operations at other stations, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including different degrees of effective resistance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more effective resistance than each more distant bridge conductor, and means at the latter stations for excluding said effective resistances from said bridge conductors when outgoing voice currents are impressed upon said conductors.

25. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, means at each of the latter stations for equalizing the voice currents received at the first station as a result of equivalent transmitter operations at other stations, bridge con-

ductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of impedance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more impedance than each more distant bridge conductor, and means at the latter stations for excluding said impedance from said bridge conductors when outgoing voice currents are impressed upon said conductors.

26. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, means at each of the latter stations for equalizing the voice currents received at the first station as a result of equivalent transmitter operations at other stations, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of effective resistance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more effective resistance than each more distant bridge conductor, shunts about said effective resistances, and switching mechanism for controlling the continuity of said shunts.

27. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, means at each of the latter stations for equalizing the voice currents received at the first station as a result of equivalent transmitter operations at other stations, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of impedance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more impedance than each more distant bridge conductor, shunts about said impedance, and switching mechanism for controlling the continuity of said shunts.

28. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, means at each of the latter stations for equalizing the voice currents received at the first station as a result of equivalent transmitter operations at other stations, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of effective resistance to the voice currents impressed thereupon by the first station, each bridge

conductor that is nearer said first station having more effective resistances than each more distant bridge conductor, shunts about said effective resistances, said shunts including differing degrees of effective resistance, each shunt that is nearer the said first station having more effective resistance than each more distant shunt, and switching mechanism for controlling the continuity of said shunts.

29. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, means at each of the latter stations for equalizing the voice currents received at the first station as a result of equivalent transmitter operations at other stations, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of impedance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more impedance than each more distant bridge conductor, shunts about said impedance, said shunts including differing degrees of impedance, each shunt that is nearer the said first station having more impedance than each more distant shunt, and switching mechanism for controlling the continuity of said shunts.

30. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, means for supplying the transmitter at each of the latter stations with differing voltages of transmitter current, the voltage at each of the latter stations that is nearer the first station being less than that at each of the latter stations more distant from the first station, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of effective resistance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more effective resistance than each more distant bridge conductor, shunts about said effective resistance, and switching mechanism for controlling the continuity of said shunts.

31. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, means for supplying the transmitter at each of the latter stations with differing voltages of transmitter current, the voltage at each of the latter stations that is nearer the first station being less than that at each of the latter stations more distant from the first station, bridge conductors at each of the

latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of impedance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more impedance than each more distant bridge conductor, shunts about said impedance, and switching mechanism for controlling the continuity of said shunts.

32. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, means for supplying the transmitter at each of the latter stations with differing voltages of transmitter current, the voltage at each of the latter stations that is nearer the first station being less than that at each of the latter stations more distant from the first station, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of effective resistance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more effective resistances than each more distant bridge conductor, shunts about said effective resistances, said shunts including differing degrees of effective resistance, each shunt that is nearer the said first station having more effective resistance than each more distant shunt, and switching mechanism for controlling the continuity of said shunts.

33. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, means for supplying the transmitter at each of the latter stations with differing voltages of transmitter current, the voltage at each of the latter stations that is nearer the first station being less than that at each of the latter stations more distant from the first station, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of impedance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more impedance than each more distant bridge conductor, shunts about said impedance, said shunts including differing degrees of impedance, each shunt that is nearer the said first station having more impedance than each more distant shunt, and switching mechanism for controlling the continuity of said shunts.

34. A telephone system including a telephone line, a telephone station thereon, a

plurality of other telephone stations thereon, local transmitter circuits at the latter stations, sources of current in said local circuits having different voltages, the voltage of each source of current at each of the latter stations that is nearer the first station being less than that at each of the latter stations more distant from the first station, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of effective resistance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more effective resistance than each more distant bridge conductor, shunts about said effective resistances, and switching mechanism for controlling the continuity of said shunts.

35. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, local transmitter circuits at the latter stations, sources of current in said local circuits having different voltages, the voltage of each source of current at each of the latter stations that is nearer the first station being less than that at each of the latter stations more distant from the first station, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of impedance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more impedance than each more distant bridge conductor, shunts about said impedance, and switching mechanism for controlling the continuity of said shunts.

36. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, local transmitter circuits at the latter stations, sources of current in said local circuits having different voltages, the voltage of each source of current at each of the latter stations that is nearer the first station being less than that at each of the latter stations more distant from the first station, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of effective resistance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more effective resistance than each more distant bridge conductor, shunts about said effective resistances, said shunts including differing degrees of effective resistance, each shunt that

is nearer the said first station having more effective resistance than each more distant shunt, and switching mechanism for controlling the continuity of said shunts.

37. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, local transmitter circuits at the latter stations, sources of current in said local circuits having different voltages, the voltage of each source of current at each of the latter stations that is nearer the first station being less than that at each of the latter stations more distant from the first station, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of impedance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more impedance than each more distant bridge conductor, shunts about said impedance, said shunts including differing degrees of impedance, each shunt that is nearer the said first station having more impedance than each more distant shunt, and switching mechanism for controlling the continuity of said shunts.

38. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, local transmitter circuits at the latter stations, sources of current in said local circuits having different voltages, the voltage of each source of current at each of the latter stations that is nearer the first station being less than that at each of the latter stations more distant from the first station, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of effective resistance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more effective resistance than each more distant bridge conductor, shunts about said effective resistances, and switching mechanism controlling the continuity of said transmitter circuits and said shunts.

39. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, local transmitter circuits at the latter stations, sources of current in said local circuits having different voltages, the voltage of each source of current at each of the latter stations that is nearer the first station being less than that at each of the latter stations more distant from the first station, bridge conductors at each of the latter stations containing telephone receivers and upon which

outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of impedance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more impedance than each more distant bridge conductor, shunts about said impedance, and switching mechanism controlling the continuity of said transmitter circuits and said shunts.

40. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, local transmitter circuits at the latter stations, sources of current in said local circuits having different voltages, the voltage of each source of current at each of the latter stations that is nearer the first station being less than that at each of the latter stations more distant from the first station, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of effective resistance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more effective resistances than each more distant bridge conductor, shunts about said effective resistances, said shunts including differing degrees of effective resistance, each shunt that is nearer the said first station having more effective resistance than each more distant shunt, and switching mechanism con-

trolling the continuity of said transmitter circuits and said shunts.

41. A telephone system including a telephone line, a telephone station thereon, a plurality of other telephone stations thereon, local transmitter circuits at the latter stations, sources of current in said local circuits having different voltages, the voltage of each source of current at each of the latter stations that is nearer the first station being less than that at each of the latter stations more distant from the first station, bridge conductors at each of the latter stations containing telephone receivers and upon which outgoing voice currents at the latter stations are impressed, said bridge conductors including differing degrees of impedance to the voice currents impressed thereupon by the first station, each bridge conductor that is nearer said first station having more impedance than each more distant bridge conductor, shunts about said impedance, said shunts including differing degrees of impedance, each shunt that is nearer the said first station having more impedance than each more distant shunt, and switching mechanism for controlling the continuity of said transmitter circuits and said shunts.

In witness whereof, I hereunto subscribe my name this 18th day of July A. D., 1908.

GEORGE C. CUMMINGS.

Witnesses:

L. G. STROH,
G. L. CROGG.