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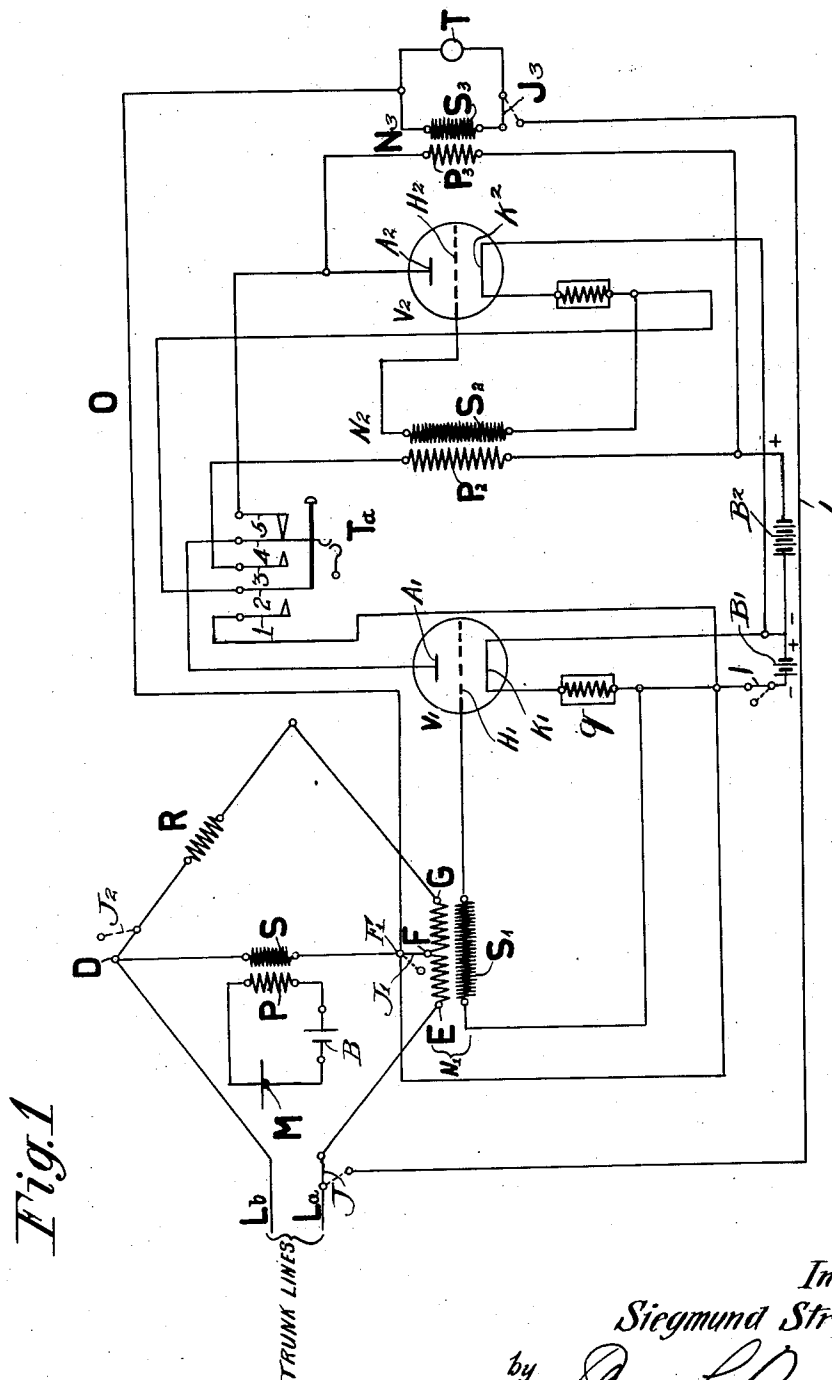
S. STRAUSS

1,541,668

AMPLIFIER FOR SUBSCRIBERS' STATIONS

Filed June 1, 1922

2 Sheets-Sheet 1



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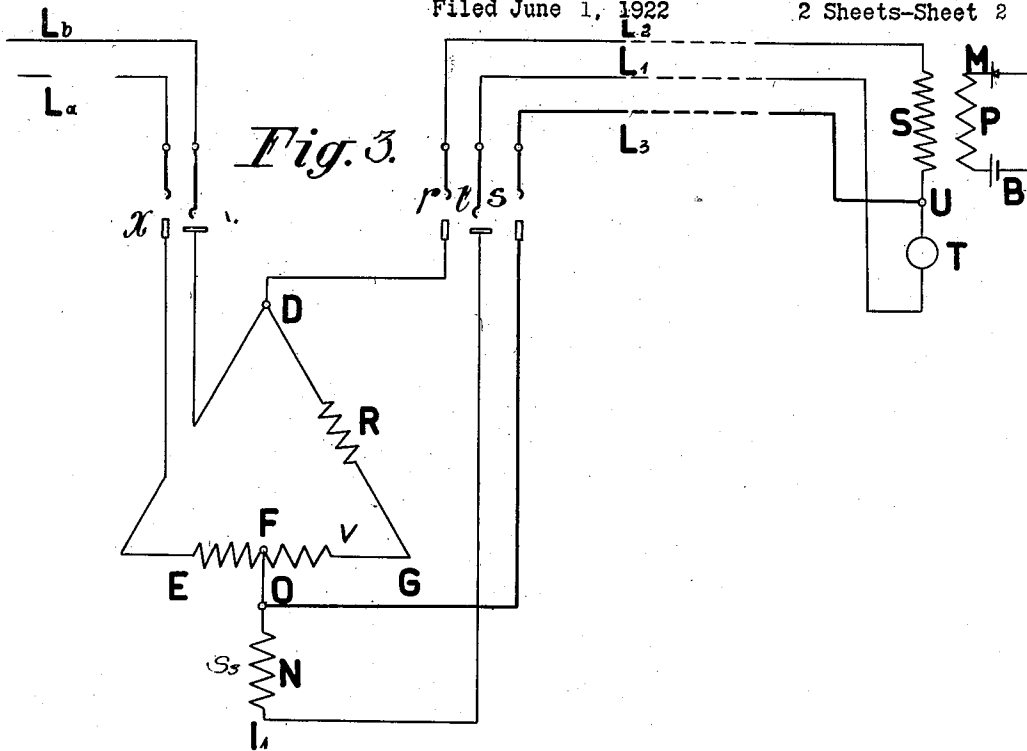
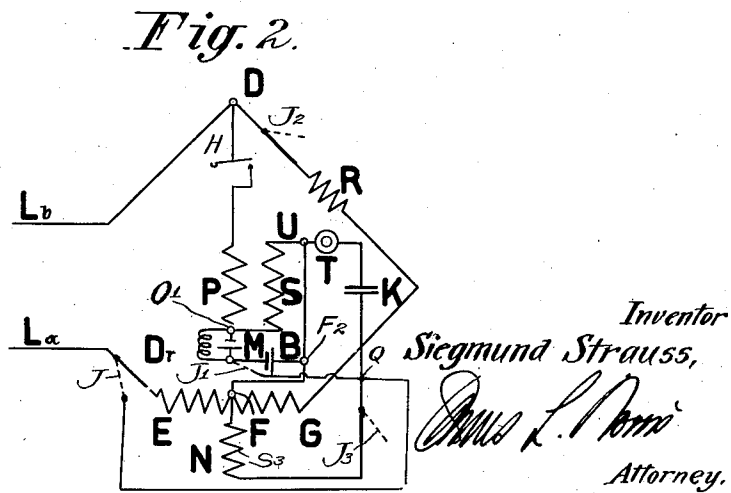
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AMPLIFIER FOR SUBSCRIBERS' STATIONS

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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE.

SIEGMUND STRAUSS, OF VIENNA, AUSTRIA.

AMPLIFIER FOR SUBSCRIBERS' STATIONS.

Application filed June 1, 1922. Serial No. 565,121.

To all whom it may concern:

Be it known that I, SIEGMUND STRAUSS, citizen of the Republic of Austria, residing at Vienna, Austria, have invented certain
 5 new and useful Improvements in Amplifiers for Subscribers' Stations (for which I have filed applications in Austria December 25, 1920; Germany, April 25, 1922; Czechoslovakia, Dec. 23, 1921; Austria, June 1, 1912; Germany, June 11, 1921; Austria, Jan. 12, 1922; Austria, Feb. 11, 1922), of which the following is a specification.

This invention relates to amplifiers for telephonic currents and especially to those
 15 which are to be provided in the subscribers' stations to amplify trunk line or local communications, and it has for its object to provide a simplified and improved arrangement which enables the subscriber as well as
 20 the operator of a branch or house exchange to connect the amplifier, at will, with an existing subscriber's station of either the local or the central battery type, according to requirements, the present invention enabling
 25 these results to be obtained without requiring special adaptation, re-construction or other alteration of the existing type of station.

A further object of this invention is to
 30 provide an arrangement by means of which one or more amplifiers of the vacuum tube type can be inserted by a simple manipulation, whereby it is possible for the operator of a manual or other house exchange as well
 35 as the person speaking from a substation connected to said house exchange to use the amplifier, according to requirements, when receiving telephonic messages.

A further object of this invention is to
 40 remove all whistling or extraneous noises in the receiver due to the connections, as well as to prevent any disturbing influence due to the voice of the individual speaking at the exchange or sub-station, due to the
 45 fact that the voice of such person is also amplified.

In the accompanying drawings—

Fig. 1 shows the connections of the amplifier when working in a local battery system and employing two vacuum tubes that
 50 may be connected in series.

Fig. 2 shows the connections for sub-

scribers' stations of the central battery type, having a single amplifier of the vacuum tube type.

Fig. 3 shows the connections for a house exchange of the local battery type, which permits not only the operator, but also the different subscribers' stations to receive amplified trunk communications by simply
 60 using an additional single conductor.

Fig. 1 illustrates the application of the present invention to a subscriber's station when such station is of the local battery type, it being well known that in subscribers' stations of the local battery type the microphone M, the local battery B and the primary P of the induction coil are in one circuit. The primary P acts on the secondary S which is connected with the trunk
 70 lines L_a and L_b . According to this invention, one of the trunk lines, line L_a , for example, is connected through the switch J with the primary E—G of the first repeater N_1 . The middle of the primary E—G of the first repeater N_1 is connected with the secondary S of the induction coil through the switch J_1 . The other end of the secondary S is connected with the point D of the trunk line L_b . The end G of the
 80 primary E—G of the first repeater N_1 is also connected with the point D through the resistance R and the switch J_2 . The resistance R is so chosen that it equals, so far as is possible, the resistance of the trunk
 85 lines L_a and L_b . The connection point F in the middle of the primary E—G of the first repeater N_1 is connected with the receiver T by means of the conductor O. A conductor L leads back from the receiver T to the
 90 switch J through the switch J_3 and is capable of establishing a direct communication between the subscriber's telephone and the trunk lines independently of the amplifier V_1 , so that the speaking current can
 95 be received without amplification.

The amplifier V_1 is a thermionic relay, it comprising an incandescent cathode K_1 , anode or plate A_1 and a grid H_1 . The grid is connected with the secondary S_1 of the first repeater N_1 . The negative side of the battery B_1 , B_2 is connected with the conductor O at the point F_1 .

The plate circuit of the amplifier V_1 com-

prises the contact springs 4 and 5 of the key T_a , the primary P_3 of the last repeater N_3 , and the battery B_2 . The secondary S_3 of the last repeater is in parallel with the

5 receiver T.
The key T_a allows a second amplifier V_2 to be connected in series with the first amplifier V_1 . For this purpose, it comprises a number of contacts 1, 2, 3, 4 and 5 which
10 control the circuits of the second amplifier. The heating current for the cathode or filament K_2 of the second amplifier is controlled by the contacts 1 and 2 of this key, and the contacts 3 and 4 of the key control the
15 primary P_2 of an intermediate repeater N_2 , the secondary S_2 of this intermediate repeater being connected with the grid H_2 of the amplifier V_2 . If the switches I, J, J_1 , J_2 and J_3 are in the position shown in
20 dotted lines, the amplifier is switched off and the current coming from the trunk line L_a flows over the switch J, conductor L, switch J_3 , receiver T, conductor O, to the secondary S of the induction coil thence
25 through connection point D and back to the line L_b . The microphone current flows through the primary P of the induction coil, the battery B and back to the microphone M.

30 When the microphone M is actuated while the amplifier is switched off the speaking currents, induced in the secondary S of the induction coil will pass into the trunk lines L_b and L_a , the current flowing to trunk line
35 L_b directly over the connection point D, while it flows to trunk line L_a , and also through the conductor O, receiver T, switch J_3 , conductor L, switch J and thence to the trunk line L_a . On the other hand, if
40 the amplifier is working, in which case all switches are thrown into the full line positions shown, the incoming speech currents from the trunk line L_a flows over the switch
45 J to connection point E of the first repeater N_1 through the same over connection G, resistance R, switch J_2 , connection D back to the trunk line L_b and thus acts fully on the first repeater. A feeble shunt to this
50 microphone current exists through the trunk line L_a , connection E of the first repeater, connection F, and secondary S of the induction coil to connection D; but as the current in such shunt flows in the same direction as
55 the current flowing through the connection G and resistance R, no interference between the said currents will occur.

The incoming speech currents therefore fully act on the first repeater N_1 and are amplified by the thermionic relay V_1 in a
60 known manner. The amplified current flows from battery B_2 through the filament K_1 , the plate A_1 , the springs 4 and 5 of the key T_a and through the primary P_3 of the last repeater N_3 back to the battery. This current therefore acts on the secondary S_3 of the

last repeater N_3 , the secondary S_3 being in parallel with the receiver T and switch J_3 . At the same time the connection point F is connected with the negative pole of the heating current battery B_1 , through point F.
70 The connection O, which establishes a permanent connection between the secondary S_3 and the connection point F of the first repeater N_1 causes no disturbances of the amplified current; on the contrary it was observed that whistling or other noises in the receiver is prevented thereby.

In the position of rest of the key T_a , as shown in Fig. 1, the heating current of the first relay flows from the negative pole of the battery B_1 through the iron resistance q through the incandescent cathode K_1 back to the positive side of this battery, but while the key is in this position, the circuit of the incandescent cathode K_2 of the second valve
85 relay is disconnected from the negative battery pole of the battery B_1 by the open contacts 1 and 2 of the key T_a ; consequently the second relay is not working. The microphone current stepped up in the winding S_1 of the first repeater N_1 acts on the incandescent cathode K_1 and the grid H_1 of the first amplifier. The amplified current flows from the negative pole of the battery B_1 through the incandescent cathode K_1 to the anode
95 A_1 , thence through contacts 4, 5 of the key T_a and over the primary P_3 of the last repeater N_3 and then back to the positive pole of the battery B_2 supplying current. At this time the primary P_2 of the intermediate
100 repeater N_2 is switched off by the open contact 3 of the key T_a , and the second thermionic relay V_2 the cathode of which is not heated forms an infinitely high resistance between its anode A_2 and its cathode K_2 . The amplified current will therefore act directly in the last repeater N_3 and receiver T as set forth above. A single stage of amplification of the incoming microphone current
110 is thus obtained.

If the second relay is to be connected in series with the first one to obtain a higher amplification, the key T_a is operated. When the key T_a is actuated the heating circuit of the incandescent cathode K_2 of the second
115 amplifier is closed with the battery B_1 by the engagement of the contact 1, 2. The current then flows from the negative side of the heating current battery B_1 , through contacts 1, 2 of the key T_a , through incandescent cathode
120 K_2 and back to the positive side of this battery. The primary P_2 of the intermediate repeater N_2 is then connected as follows: negative side of battery B_1 , cathode K_1 ,
125 anode A_1 , engaged contacts 4, 3 of the key T_a , primary P_2 , of the second repeater, and then back to the positive side of the battery B_2 , the current flowing through this circuit therefore acting on the second relay
130 V_2 through the secondary S_2 , of the interme-

diating repeater N_2 . The anode circuit of the second thermionic relay V_2 extends from the negative side of the heating battery B_1 , through engaged contacts 1, 2 of the key T_1 , thence through cathode K_2 , and to the anode A_2 . This circuit is interrupted at open contact 5 of the key, and hence this current will flow back to the positive pole of the anode current battery B_2 through the primary P_3 , of the last repeater N_3 . This current therefore acts on the secondary S_3 of the last repeater N_3 of the receiver. Thus, the single amplifier may be changed to a double one by simply actuating the key T_1 .

Fig. 2 shows the connections for a subscriber's station of the central battery type.

In this figure, the arrangement is similar to that shown in Fig. 1. However, the secondary of the repeater and the connections leading to the amplifier are omitted for the sake of simplification, and only the secondary S_3 of the last repeater is shown, which is connected with the point F of the primary E, G of the first repeater coil. With respect to the amplifier arrangement, Fig. 2 is, therefore, identical with Fig. 1, or may include only one amplifier, omitting the switch T_1 and the second amplifier controlled thereby.

The modification with respect to Fig. 1 resides mainly in the arrangement of the circuits in the subscriber's station herein-after described.

In this arrangement M designates the microphone, and P the primary of the induction coil of the subscriber's station, which is connected with connection point D of the trunk line L_b over the closing contact of the hook switch H. Other reference letters are identical with those appearing in Fig. 1. The microphone is arranged in series with primary P while its other end is connected to the trunk line L_a when the amplifier is not in action, or over the battery B with connection point F of the first repeater E, G when the amplifier is switched in. A choke coil D, may be connected in parallel with the microphone as shown.

The circuit containing the receiver T, the condenser K, and the secondary coil S is not closed in this case, as usual, but is connected with the connection point O, between the microphone and the primary coil.

The amplifier is connected with the secondary of the first repeater E, G in the same way as shown in Fig. 1.

The switches J, J_1, J_2, J_3 , according to the position they occupy, allow the telephonic message to be received with or without amplification. When the amplifier is cut out, the switches J, J_1, J_2, J_3 are in the position shown in the dotted lines.

The incoming current flows in this case from the trunk line L_a over switch J and switch J_1 (both in the position shown in

dotted lines) through the microphone M, the primary P, the hook switch H in its closed position, and over connection point D back to the conductor L_b . The receiver current is stepped up in the coil S and flows from S over the receiver T, the condenser K, connection point Q, microphone M and point O back to the induction coil S.

When the amplifier is switched in, the switches J, J_1, J_2, J_3 must be brought into the full line positions shown. The incoming current flows from the trunk line L_a through the primary E, G of the first repeater and then through the artificial resistance R and connection point D back to the line L_b . There also exists a second path over F, F_2 , U and the secondary S, but owing to the high alternating current resistance of this coil, this does not impair the operation. In any case, the whole current will flow back to the trunk line L_b . The current passing through repeater E, G is amplified by means of the amplifier not shown connected to the secondary of the repeater E, G, and is then in its amplified condition, it acting upon the coil N of the last repeater. The amplified current passes over switch J_3 to the receiver and returns to coil N over U and F_2 .

The microphone currents produced in the sub-station flow from battery B and microphone M through the primary P of the subscriber's induction coil P and over the hook switch H to point D and trunk line L_b , and, on the other hand, they pass the points U, F_2 and F and flow over switch J to the second trunk line L_a .

In this case the microphone has its own battery B which may be identical with the battery used for heating the incandescent cathode of the amplifier tube or tubes because such a battery is used only when the amplifier is used; otherwise the microphone can derive its current from a central battery. This special microphone current is stepped up by the induction coil before passing out to the trunk lines. By inserting the battery in the microphone circuit at a point between the connection points F and D of the bridge, the microphone current of the station will be divided at connection point F and will flow through the two parts of the primary winding of the first repeater N_1 in opposite directions; therefore it does not act on the amplifying device if the resistance of the trunk line is equal or nearly equal to that of the artificial resistance R.

The principal object of the invention is to allow the connection of the amplifier arrangement with any subscriber's station regardless of the system, and to amplify the incoming speech currents. The outgoing currents are not amplified and therefore noises in the receiver are suppressed, undesired feed backs are eliminated and, furthermore, the voice of the person speaking

at the station does not sound disagreeably loud in the receiver.

Fig. 3 shows the connections of an amplifying device for a house exchange, it permitting not only the operator, but also, if required, the sub-station connected with the house exchange, to receive the incoming trunk communications in amplified condition.

In this figure, a sub-station of the local battery type is shown, but it is obvious that a sub-station of the central battery type may also be employed without changing the conditions.

The arrangement of the connections of a house exchange is known, and, therefore, is not shown in this figure. Two plugs are provided, one with two contacts X , Y , and one with three contacts, r , s , t . The line through contact s leads to the middle of the primary E , G of the first repeater at connection point F and to the secondary S_2 of the last repeater N_2 . All other reference characters in this figure correspond with those used in Figs. 1 and 2.

The operation of this arrangement is as follows:

In this figure, the incoming speech current flows from the trunk line L_a through the tip X of plug to connection point E of the primary of the first repeater N_1 and from the end thereof at G through the resistance R , point D and the contact Y of the plug back into the trunk L_b and this current is therefore amplified in the amplifying device by means of the secondary connected to the grid of the amplifying device V_1 .

The amplified current flows from the secondary S_2 of the last repeater, through the additional conductor L_3 and plug contact s to point U , thence through the receiver T of the sub-station, then through conductor L_1 , and plug contact t , and back to the secondary S_2 of the last repeater N_2 , so that the microphone current may be received in amplified condition in the receiver T of each sub-station connected in this manner.

The outgoing microphone current produced in the secondary S flows from connection point U through the additional conductor L_3 , and contact s of the plug, to connection point F of the first repeater N_1 , thence to point E , contact X of plug, through trunk line L_a back over trunk line L_b , through contact Y of plug, to connection point D , thence through contact r of the plug, and conductor L_2 to the other end of the induction coil S . Over the resistance R a shunt exists, which is of no consequence.

In this way, it is possible, with a single amplifier in the house exchange, and a special conductor for each sub-station, for the operator or any person in one of the sub-stations to receive amplified trunk current.

Of course, as already described, with ref-

erence to Figs. 1 and 2, the operator in the house exchange, as well as the subscriber, may choose to receive the current unamplified. To allow alternate use of amplified or unamplified currents, switches identical with those shown in Fig. 2 may be provided and arranged in the same manner as those shown in Fig. 2. These switches are not shown in Fig. 3, as their arrangement and operation will be easily understood from the preceding figures.

I claim:—

1. In a telephone system comprising telephone lines, and a subscriber's station at the ends of the lines having a microphone, a telephone and an induction coil, an amplifier for amplifying the incoming speech currents, a telephone repeater having a primary and a secondary, a connection including an artificial resistance substantially equal to the line resistance connecting said primary with the telephone lines, means for connecting said microphone to the primary of said repeater whereby the currents from said microphone remain unamplified, a second telephone repeater operatively connected with the amplifier and having a secondary operatively connected with the subscriber's telephone, and a connection between the secondary of said repeater and the middle of the primary of the first telephone repeater.

2. In a telephone system comprising telephone lines, and a subscriber's station at the ends of the lines having a microphone, a telephone and an induction coil, an amplifier for amplifying the incoming speech currents, a telephone repeater having a primary and a secondary, a connection including an artificial resistance substantially equal to the line resistance connecting said primary with the telephone lines, a bridge between one of said lines and the middle of the primary of said repeater, said bridge and connection being operable to cause amplification of the incoming speech currents but to cause the currents from said microphone to remain unamplified, a second telephone repeater operatively connected with the amplifier and having a secondary operatively connected with the subscriber's telephone, and a connection between the secondary of said repeater and the middle of the primary of the first telephone repeater.

3. In a telephone system comprising telephone lines, and a subscriber's station at the ends of the lines having a microphone, a telephone and an induction coil, an amplifier for amplifying the incoming speech currents, a telephone repeater having a primary and a secondary, a connection including an artificial resistance substantially equal to the line resistance connecting said primary with the telephone lines, a bridge between one of said lines and the middle of the primary of said repeater, said bridge including a wind-

ing of the subscriber's induction coil, said bridge and connection being operable to cause amplification of the incoming speech currents but to cause the currents from said microphone to remain unamplified, a second telephone repeater operatively connected with the amplifier and having a secondary operatively connected with the subscriber's telephone, and a connection between the secondary of said repeater and the middle of the primary of the first telephone repeater.

4. In a telephone system comprising telephone lines and a subscriber's station at the ends of the lines having a microphone, a telephone and an induction coil, an amplifier consisting of a vacuum tube with a heated cathode, a grid and an anode therein, a source of current for heating said cathode, a telephone repeater having a primary and a secondary, a connection including an artificial resistance substantially equal to the line resistance connecting said primary with the telephone lines, means for connecting said microphone to the primary of said repeater whereby the currents from said microphone will remain unamplified, the secondary of said repeater being connected with the grid circuit of the amplifier and the heated cathode and with the middle of the primary of said repeater.

5. In a telephone system comprising telephone lines and a subscriber's station at the ends of the lines having a microphone, a telephone and an induction coil, an amplifier consisting of a vacuum tube with a heated cathode, a grid and an anode therein, a source of current for heating said cathode, a telephone repeater having a primary and a secondary, a connection including an artificial resistance substantially equal to the line resistance connecting said primary with the telephone lines, a bridge between one of said lines and the middle of the primary of said repeater, said bridge including one winding of the subscriber's induction coil, said bridge and connection being operable to cause amplification of the incoming speech currents but to cause the currents from said microphone to remain unamplified, a second telephone repeater operatively connected with the subscriber's telephone, a connection between the secondary of said repeater and the middle of the primary of the first telephone repeater, a controlling circuit for the amplifier connected with the secondary of the first repeater, and a connection between the supply circuit of the cathode and the middle of the primary of the first repeater.

6. In a telephone system comprising telephone lines and a subscriber's station at the ends of the lines, having a microphone, a telephone and an induction coil, an amplifier for amplifying the incoming speech currents, a telephone repeater having a pri-

mary and a secondary, a connection including an artificial resistance substantially equal to the line resistance connecting said primary to the telephone lines, a bridge between one of said lines and the middle of the primary of said repeater, said bridge including one winding of the subscriber's induction coil, the other winding being directly connected with the terminal of the winding included in said bridge, said connection and bridge being operable to cause amplification of the incoming speech currents but to cause the currents from said microphone to remain unamplified.

7. In a telephone system comprising telephone lines and a subscriber's station at the ends of the lines, having a microphone, a telephone and an induction coil, an amplifier for amplifying the incoming speech currents, a telephone repeater having a primary and a secondary, a connection including an artificial resistance substantially equal to the line resistance connecting said primary to the telephone lines, a bridge between one of said lines and the middle of the primary of said repeater, said bridge including one winding of the subscriber's induction coil, the other winding of said induction coil being branched off from the terminal of the winding included in said bridge, said bridge and connection being operable to cause amplification of the incoming speech currents but to cause the currents from said microphone to remain unamplified, a second telephone repeater operatively connected with the amplifier and having a secondary operatively connected with the subscriber's telephone, and a connection between the secondary of said repeater and the middle of the primary of the first telephone repeater.

8. In a telephone system comprising telephone lines and a subscriber's station at the ends of the lines having a microphone, a telephone and an induction coil, an amplifier for amplifying the incoming speech currents including means whereby the currents from said microphone remain unamplified, a second amplifier capable of further amplifying the output currents of the first amplifier, a telephone repeater having a primary and a secondary, the primary being connected with the telephone line and the secondary with the first amplifier, a second telephone repeater having a primary and a secondary, the primary branching off from the output circuit of the second amplifier, and the secondary being connected with the subscriber's telephone, and a multiple switch controlling the working circuit of the second amplifier, comprising means capable of connecting the primary of the second repeater alternately with the output circuit of either of said repeaters.

9. In a telephone system comprising telephone lines and a subscriber's station at the

ends of the lines having a microphone, a telephone and an induction coil, an amplifier for amplifying the incoming speech currents including means whereby the currents from said microphone remain unamplified, a second amplifier capable of further amplifying the output currents of the first amplifier, a telephone repeater having a primary and a secondary, the primary being connected with the telephone line and the secondary with the first amplifier, a second telephone repeater having a primary and a secondary, the primary branching off from the output circuit of the second amplifier, and the secondary being connected with the subscriber's telephone, a multiple switch controlling the energizing circuit of said second amplifier, a third repeater having a primary capable of being connected with the output circuit of the first repeater by the said multiple switch, and a secondary in operative connection with the second amplifier, said multiple switch including contacts capable of connecting alternately the primary windings of the second or third repeater with the output circuit of said amplifier.

10. In a telephone system comprising telephone lines and a subscriber's station at the ends of the lines having a microphone, a telephone and an induction coil, an amplifier for amplifying the incoming telephone currents including means whereby the currents from said microphone remain unamplified, a second amplifier for increasing the amplification obtained by the first amplifier, a multiple switch controlling simultaneously the output circuit of the first amplifier and the working circuit of the second amplifier, said switch being provided with means for connecting alternately the output circuits of the first and second amplifiers with the subscriber's station telephone.

11. In a telephone system comprising telephone lines and a subscriber's station at the ends of the lines having a microphone, a telephone and an induction coil, an amplifier for amplifying the telephone currents transmitted to the subscriber's telephone, a repeater having a primary connected with the telephone line and a secondary connected with the input circuit of said amplifier, means for connecting said microphone to the primary of said repeater whereby the currents from said microphone will remain unamplified, a second repeater having a primary connected with the output circuit of said amplifier, and a secondary connected with the subscriber's telephone, a second amplifier having an output circuit equally connected with the primary of the second repeater, an intermediate repeater with a primary capable of being connected with the output circuit of the first amplifier and

a secondary connected with the input circuit of the second amplifier, and a multiple switch controlling simultaneously the output circuit of the first amplifier and connecting it alternately with the second or the intermediate repeater and the working circuit of the second amplifier.

12. In a telephone system comprising telephone trunk lines and a subscriber's station at the ends of the lines having a microphone, a telephone and an induction coil, an amplifier for amplifying the incoming telephone currents, a telephone repeater having a primary capable of being connected with the line and a secondary connected with the input circuit of the amplifier, means for connecting said microphone to the primary of said repeater whereby the currents from said microphone will remain unamplified, a second repeater having a primary capable of being connected with the output circuit of the repeater and a secondary connected with the subscriber's telephone, a connection between said secondary and the middle of the primary of the first repeater and a further connection between said secondary and the telephone line, and switch arms for alternately opening and closing said connection and the connection between the primary of the first repeater and the line, as well as the connection between the secondary of the second repeater and the subscriber's telephone.

13. In a telephone system comprising telephone trunk lines and a subscriber's station at the ends of the lines having a microphone, a telephone and an induction coil, an amplifier for amplifying the incoming telephone currents, a telephone repeater having a primary capable of being connected with both lines, said connection including an artificial resistance substantially equal to the line resistance, and a secondary connected with the input circuit of the amplifier, a bridge between one of said lines and the middle of the primary of the repeater, said connection and bridge being operable to cause amplification of the incoming speech currents but to cause the currents from said microphone to remain unamplified, said bridge including a switch arm capable of disconnecting the bridge connection from the said primary, a second repeater, having a primary capable of being connected with the output circuit of the repeater and a secondary connected with the subscriber's telephone, a connection between said secondary and the middle of the primary of the first repeater, a further connection between said secondary and the telephone line, and switch arms adapted to be operated simultaneously with the switch arm in the bridge for alternately opening and closing said connection and the connection between the primary of the first repeater and the line as well as the con-

nection between the secondary of this second repeater with the subscriber's telephone.

14. In a telephone system comprising telephone trunk lines and a subscriber's station at the ends of the lines having a microphone, a telephone and an induction coil, an amplifier for amplifying the incoming telephone currents, a telephone repeater having a primary connected with both trunk lines, said connection including an artificial resistance substantially equal to the line resistance, and a secondary connected with the input circuit of the amplifier, a bridge between one of said trunk lines and the middle of the primary of the repeater, said bridge including the secondary winding of the induction coil of the subscriber's station, said connection and bridge being operable to cause amplification of the incoming speech currents but to cause currents from said microphone to remain unamplified, the primary winding of said induction coil being connected immediately in series with the secondary, the connection between the middle of the primary of the repeater and the induction coil branching off at an intermediate point between the primary and the secondary of the induction coil and including the microphone whereby the energizing current of said microphone is prevented from acting upon the amplifier.

15. In a telephone system comprising telephone trunk lines and a subscriber's station at the ends of the lines having a microphone, a telephone and an induction coil, an amplifier for amplifying the incoming telephone currents, a telephone repeater hav-

ing a primary connected with both trunk lines, said connection including an artificial resistance substantially equal to the line resistance, and a secondary connected with the input circuit of the amplifier, a bridge between one of said trunk lines and the middle of the primary of the repeater, said bridge including the microphone of the subscriber's station, said connection and bridge being operable to cause amplification of the incoming speech currents but to cause currents from said microphone to remain unamplified, a feeding battery for said microphone, and a switch arm between the microphone and the battery capable of disconnecting the bridge connection from the primary of said repeater, a second telephone repeater having a primary connected with the output circuit of the amplifier, and a secondary operatively connected with the subscriber's telephone, switch arms capable of alternately opening and closing this connection and the connection between the trunk line and the primary of the first telephone repeater simultaneously with the switch arm in the bridge, the battery providing a connection of the telephone directly with the trunk lines or over the amplifier, the switch arm in the bridge when open disconnecting the microphone and the feeding battery, thereby establishing direct connection between the telephone and the trunk line.

In testimony whereof I affix my signature in presence of two witnesses.

ING. SIEGMUND STRAUSS.

Witnesses:

CARL CONDENBURY,
JOSEF GURMANN.