

April 24, 1956

P. JEANLIN

2,743,314

TWO-WAY LOUDSPEAKER TELEPHONE INSTALLATIONS

Filed Aug. 28, 1951

3 Sheets-Sheet 1

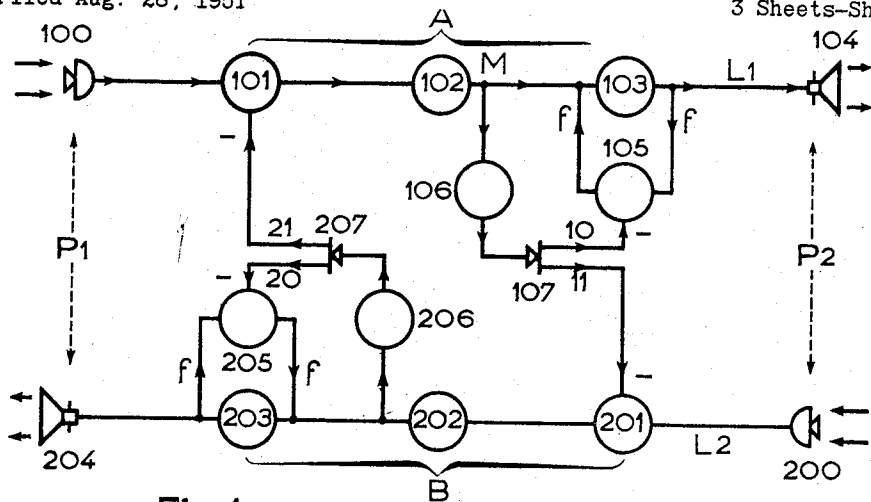


Fig. 1

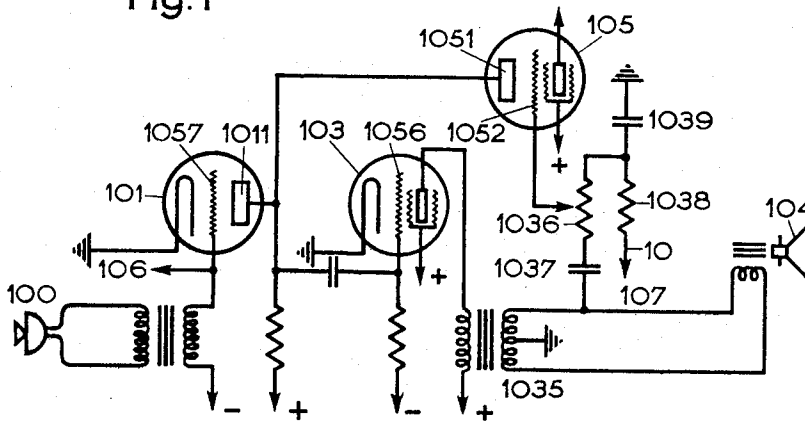


Fig. 2

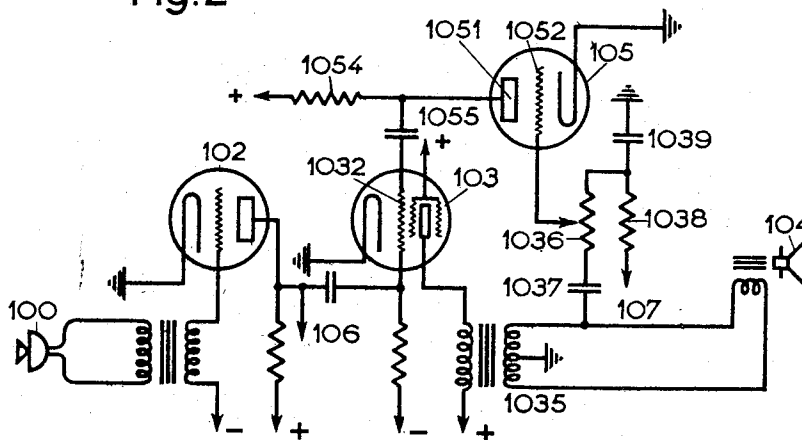


Fig. 3

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3 Sheets-Sheet 2

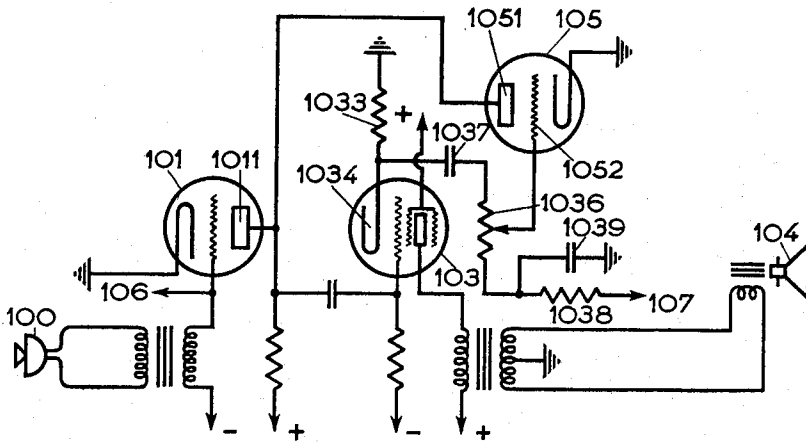


Fig. 4

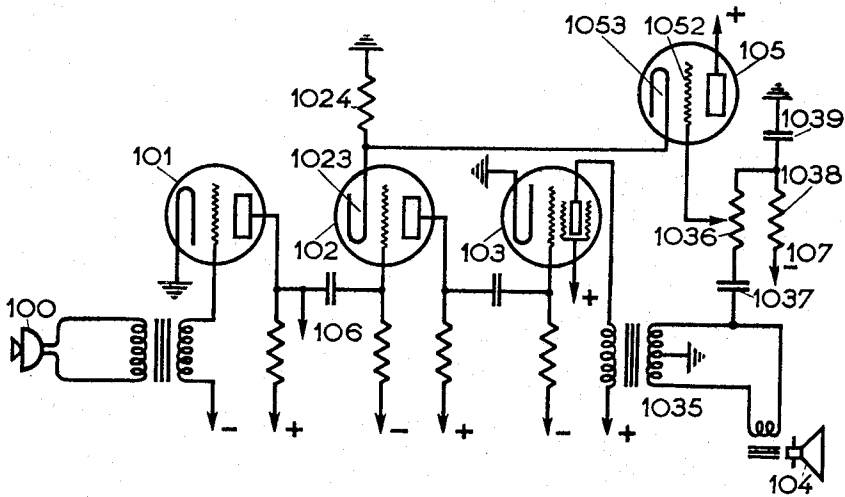


Fig. 5

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3 Sheets-Sheet 3

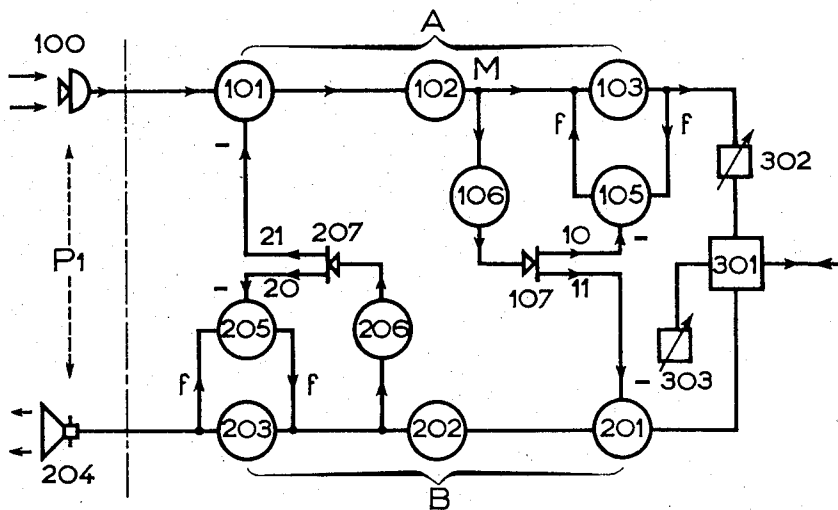


Fig. 6

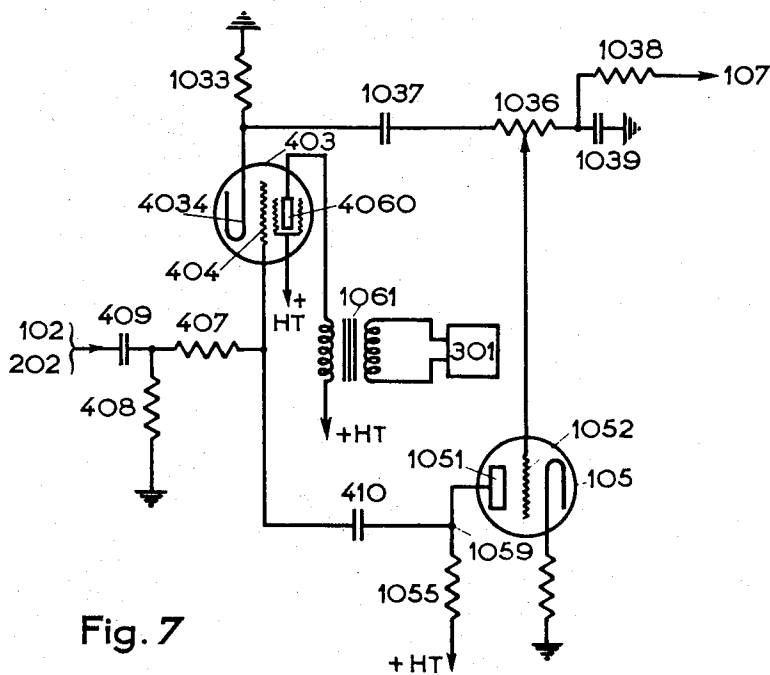


Fig. 7

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1

2,743,314

TWO-WAY LOUDSPEAKER TELEPHONE INSTALLATIONS

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Application August 28, 1951, Serial No. 244,056

Claims priority, application France September 6, 1950

4 Claims. (Cl. 179-1)

The principal defect in two-way loudspeaker telephone installations, as is known, is the risk of the so-called Larsen effect which consists in the initiation of undesirable audible oscillations.

In order to ensure maximum stability, at least one amplifier, for example one of the amplifiers of the microphone at the receiving station, was, in the prior art, initially blocked by a polarising voltage fed from a source independent of the modulated current issued from the microphone of the way in use. Consequently the gain of both ways was restrained when no speech current was flowing in one of the ways or channels. As soon as a modulation due to speech current appeared in one of the ways, the gain of the way in use was restored to its full value, whereas the gain of the other way was completely nullified. But, due to this time constant (and there is always a time constant even if small), the beginning of the speech took place before the gain of the way in use was fully restored, so that the first syllables of the speech were often almost inaudible, thus introducing a feature of great practical nuisance. It is of course very difficult to understand a sentence the first syllables of which are not clearly heard. And this defect is still greater when the while speech consists of only one or two syllables such as "yes," "no," "of course," etc.

Of course the restraining or blocking action is held as low as possible when no sound is being transmitted, but it must be nevertheless sufficient to stop the loudest sound able of reaching the loud speaker before the blocking of the other way. Should such a sound pass through the blocked amplifier the Larsen effect will start.

But the restraining voltage being the same when currents corresponding to loud sounds or weak sounds flow through the way in use, a current corresponding to a weak sound will not energize the loud speaker before having tripped a sufficient voltage for restoring the full gain of the restrained amplifier of the way in use and nullifying the gain of the amplifier of the other way. It will be seen that the weaker sounds increase the time lag for restoring said full gain and the clear hearing of said sound.

On the contrary, and according to the present invention, the blocking action is not due to a source of voltage independent of the modulated speech current, but this speech current is by itself the source both of the restraining or blocking voltage and of the restoring voltage. Consequently the same means give rise to two effects: First, it restrains the amplifier of the way in use according to the intensity of the sound to be transmitted. For a very weak sound the restraining voltage is very low, so that said weak sound can flow through without being completely restrained (a condition which is not troublesome since such a weak sound is unable to give rise to the Larsen effect). On the other hand, loud sounds are greatly restrained, but are nevertheless audible. Consequently there is never total silence for the hearer. Second, it promotes the restoration of the gain of the amplifier of the way in use and the blocking of the other way at the same time it promotes the restraint of the gain of

2

the way in use. This circumstance renders the time constant practically nil and said blocking or restraining action on the amplifier of the way in use is reduced to so short a time that it is hardly noticeable. Accordingly, the present invention has for its object the provision, in a two way loudspeaker installation each way of which includes a microphone, a loudspeaker, and an amplifier having an amplifying tube with an input circuit and an output circuit, of a restraining tube having input and output circuits respectively connected with the output and input circuits of the amplifying tube in such manner that the amplifying tube and restraining tube are not energized when no sound modulated current is flowing in either way and with the amplifying tube capable of exercising full gain, the restraining tube being energized by the output circuit of the amplifying tube in response to the appearance therein of an amplified modulated current for supplying a gain restricting potential to the input circuit of the amplifying tube. In addition, each of the ways is provided with a control circuit which is energized in response to sound modulated current appearing therein for supplying a cut-off potential to its restraining tube so that the gain restricting potential supplied by its restraining tube is only temporary and is applied only during the initiation of a conversation after which its amplifying tube is restored to full gain, and for supplying a blocking potential to the way not in use.

According to the invention the auxiliary tube is mounted in negative feed-back relation with the amplifier tube with which it is combined.

This system makes use of no element having an appreciable time constant, so that the above-mentioned drawback can no longer exist.

In a preferred mode of carrying the invention into practice, the means used for blocking at the same time the negative feed-back tube combined with one of the amplifier tubes of the way or line in use and one of the amplifier tubes of the way or line not in use, is constituted, in a manner in itself known, by an electronic tube the output of which leads to a rectifier which gives a continuous negative potential output utilized for the two blockages above referred to.

The accompanying drawings illustrate diagrammatically, and by way of example, different modes of carrying the invention into practice. In the drawings:

Figure 1 is a diagram showing in a general manner an arrangement according to the invention in the case of an auxiliary tube mounted in a negative feed-back arrangement.

Figures 2 to 7 show different modes of connecting up the negative feed-back auxiliary tube with the corresponding way or line.

In Figure 1, there are two loudspeaker telephone stations P1 and P2. The station P1 comprises a microphone 100 and a loudspeaker 204, whilst the station P2 comprises a microphone 200 and a loudspeaker 104. L1 and L2 are the lines connecting the loudspeaker of each station with the microphone of the other station.

In the line L1 there is an amplifier A formed by three electronic tubes 101, 102, 103. In the line L2 there is an amplifier B formed by three tubes 201, 202, and 203.

With the tubes 103 and 203 are combined respectively auxiliary tubes 105, 205, the input and output of these tubes 105, 205, being coupled with the line L1 or L2 relatively to the tubes 103, 203, in such manner that the voltage supplied by 105 or 205 is in phase-opposition to the voltage arriving at 103 or 203. There results when the tubes 104 and 205 are energised, i. e., when speech current flows in the way A or B, a negative feed-back represented by the arrows f (Figure 1) which reduces the gain of the tube 103 or 203. If the tube 105 or 205 gives no output, the gain of the tube 103, on the contrary

is very high. At a point M in the line L1 there is connected a tube 106. The output of 106 is led to a rectifier 107 which then furnishes a continuous negative voltage. This voltage is fed to the grids of the tubes 105 and 201 which are thus blocked as soon as modulated current is emitted by the tube 102.

A symmetrical arrangement is constituted by the tube 206 and rectifier 207, which, when they are fed by the output from 202, block the tubes 205 and 101.

It will be seen at once that when current is established in the installation without any modulation being furnished by one of the microphones, the tubes 105 or 205 are not energized in feed back relation with the tubes 103, 203 so that the gain of said last-named tubes remains full but as soon as a speech current flows in one of the lines the tubes 105 or 205 act in negative feed-back relation with the tubes 103 or 203 in such manner that only a weakened current nevertheless in proportion to the loudness of the sound emitted in front of the microphone in use passes in the lines L1, L2. At the same time, with speech in front of one of the microphones, however, 100 for example, the modulated current traverses the tube 106 and passes to the rectifier 107 which, by the wires 10 and 11, sends a negative voltage to the tubes 105 and 201.

This voltage is effectual for blocking the tube 105 in such manner that the negative feed-back to 103 ceases and the latter recovers its normal high gain. At the same time, however, the tube 201 is blocked through the wire 11. Consequently, the result is to restore full power to the line L1 and to block the line L2.

The inverse effect is produced if there is speech in front of 200. The current of the tube 206, rectified at 207, blocks 205 and 101, thus restoring full power to 203 and blocking the line L1.

It will be seen that the amplifier of the line used is only restrained, at the commencement of each conversation, in proportion with the intensity of the sound to be transmitted and during precisely the time necessary for the blocking of the amplifier of the other line. This action is practically instantaneous, the time constants of the system being practically nil as explained hereinbefore. The restraint, not being done by the direct action upon the amplifier tube of a continuous voltage from a rectified modulation, introduces no risk of distortion. On the contrary, it affords to the transmission the advantages derived from negative feed-back.

Figures 2, 3 and 4 illustrate examples of means for carrying the invention into practice and they differ from one another mainly only in the points of connection of the grids of the tubes 105 and 205. It should be noted that the negative feed-back voltage should be 180° out of phase relative to the voltage of the corresponding tube 103 or 203. However, as the tubes 105, 205 themselves give an inversion of 180° it is necessary, in the event, to develop the grid voltage of the tubes 105 and 205 in such manner that, when developed, it will be of the same phase as the voltage of the tubes 103 and 203.

In Figure 2, the grid voltage of the tube 105 is developed at the secondary of a transformer 1035 which serves for the coupling of the loudspeaker 104. It will be seen that the development is effected upon a potentiometer 1036 by way of a condenser 1037. The resistance of the potentiometer 1036 is in parallel with a resistance 1038 to which is connected the wire 10 coming from the rectifier 107 (Figure 1).

The feed-back of the voltage emitted from 105 at 1051 is effected upon the grid 1056 of 103 and upon the anode 1011 of 101, and the grid 1057 of 101 is connected to the input of the tube 106 (Figure 1).

In Figure 3, the development of the grid voltage of 105 is as described with reference to Figure 2. The feed-back is effected upon the grid 1032 of the tube 103 by decoupling the anode 1051 of the tube 105 by a resistance 1054 and a condenser 1055.

In Figure 4, the grid voltage of 105 is developed through the medium of a potentiometer 1036 and a condenser 1037 in front of a resistance 1033 inserted in the circuit of the cathode 1034 of the tube 103, and the feed-back is effected through the anodes 1011 and 1051 as in Figure 2.

In Figure 5, the grid voltage of 105 is developed as in Figure 2 and fed back to the cathode 1023 of the tube 102 by connecting the cathode 1053 of the tube 105 with the cathode 1023 of the tube 102.

In all these examples, the negative feed-back voltage is adjusted by the potentiometer 1036, the cursor of which is connected to the grid 1052, under control of the condenser 1037. The resistance 1038 decoupled by the condenser 1039 completes the return from the grid of 105 to the rectifier 107 which furnishes the blocking voltage.

The auxiliary amplifier 106 and the rectifier 107, which are of standard type, are not shown in Figures 2 to 5.

Figure 6 illustrates a mode of carrying out the invention as applied to a two-wire-line loudspeaker telephone. This Figure is similar to Figure 1 and the operation is the same. However, the elements at the station P2 (microphone 200 and loudspeaker 104) are replaced by a differential transformer 301 of any known type as used for example in telephonic repeaters. The function of this differential transformer is to ensure the passage of the circuit from the four-wire circuit diagrammatically represented in Figure 1 to the two-wire circuit generally used in current telephony. An attenuator 302 can be provided for adjusting the level of emission and an equilibrator 303 can be added according to the type of differential circuit adopted.

It is to be noted that by reason of the qualities belonging to the circuits hereinbefore described, the equilibrium of the differential may be imperfect without altering the functioning of the system.

Figure 7 shows a detail of an arrangement of the auxiliary tube 105 adapted to the system in Figure 6. In Figure 7, the tube 403 replaces one of the tubes 103 or 203 in Figure 6.

The negative feed-back voltage of 105 is developed upon the cathode 4034 of 403 at the terminal of the biasing resistance 1033 and is applied to the grid 1052 of the tube 105 by way of the condenser 1037 and the dosing potentiometer 1036.

Blocking of the tube 105 by the current from the rectifier 107 is ensured by the return from the grid 1052 through the resistance 1036 decoupled by the condenser 1039.

The negative feed-back voltage, dephased by the tube 105, is picked up at 1059 (at the exit from the anode 1051 of 105) connected with the resistance 1055, through which the anode 1051 is fed by the high tension supply, marked +HT. The high tension voltage is applied to the grid 404 of the tube 403 by way of the condenser 410.

A resistance 407 combined with a shunt resistance 408 and a condenser 409 partially avoids the transmission of the negative feed-back voltage back towards the tube 102 or 202. The anode 4060 of 403 is coupled by the transformer 1061 with the differential transformer 301. The transformer 1061 may itself function as the differential transformer.

Although this arrangement has been described more particularly in regard to the system in Figure 6 in which the receiver is a differential transformer, it is equally adapted for being utilized with the system in Figure 1 in which the receiver is a loudspeaker.

In Figures 2, 3, 4, 5, and 7 there is represented in the line L1 only one of the amplifier tubes 101 or 102, the arrangement of the second of these tubes in relation to the tube illustrated being apparent to all those acquainted with the art. Moreover, it is evident that the arrangements illustrated for the line L1 are equally suitable without change for the line L2.

5

I claim:

1. A two-way loudspeaker installation having a pair of transmission lines each of which comprises a microphone, a receiver, and an amplifier for transmitting signals from said microphone to said receiver, each of said amplifiers comprising amplifying means including an amplifying tube having input and output circuits, gain restraining means including a first control tube connected with said output circuit and temporarily responsive to the transmission of signals through said output circuit for supplying a gain reducing potential to said amplifying tube, and means including a second control tube connected with said input circuit and responsive to the transmission of signals from said microphone for supplying a cut-off potential to said first control tube and to the amplifying tube of the amplifying means in the other of said lines.

2. An installation as claimed in claim 1 characterized by said last-named means including a rectifier energized by the output of said second control tube, and having an output circuit connected with said first control tube and with said amplifying tube in the other of said lines.

3. A two-way loudspeaker installation having a pair of transmission lines each of which comprises a microphone, a receiver, and an amplifier for transmitting signals from said microphone to said receiver, each of said amplifiers comprising amplifying means including an amplifying tube having input and output circuits, gain restraining means including a first control tube connected with said output circuit and temporarily responsive to the transmission of signals through said output circuit for supplying a gain reducing potential to said amplifying tube, means including a second control tube connected with said input circuit and responsive to the transmission of signals

6

from said microphone for supplying a cut-off potential to said first control tube, and means connecting each of said last named means in one of said lines with the amplifying means in the other of said lines whereby to render the amplifying means in either line inoperative in response to transmission of signals by the amplifying means of the other line.

4. A two-way loudspeaker installation having a pair of transmission lines each of which comprises a microphone, a receiver, and an amplifier for transmitting signals from said microphone to said receiver, each of said amplifiers comprising amplifying means including an amplifying tube having input and output circuits, gain restraining means including a first control tube connected with said input circuit and control means connected with said output circuit responsive to the transmission of modulated current through said output circuit for rendering said control tube operative to supply a gain reducing potential to said input circuit, and means including a second control tube connected with said input circuit and responsive to the transmission of signals from said microphone for supplying a cut-off potential to said first control tube and to the amplifying tube of the amplifying means in the other of said lines.

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