

Dec. 10, 1940.

P. N. ROSEBY

2,224,698

TELEPHONE SYSTEM

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2 Sheets-Sheet 1

Fig. 1.

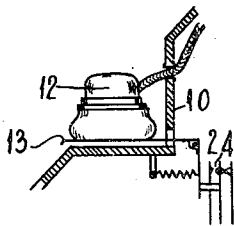
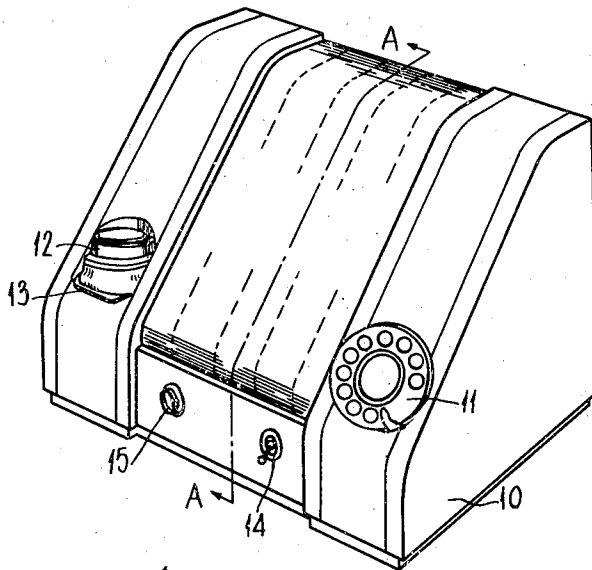


Fig. 2.

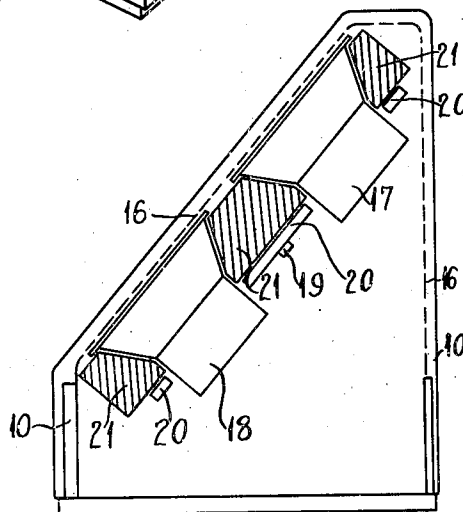


Fig. 3.

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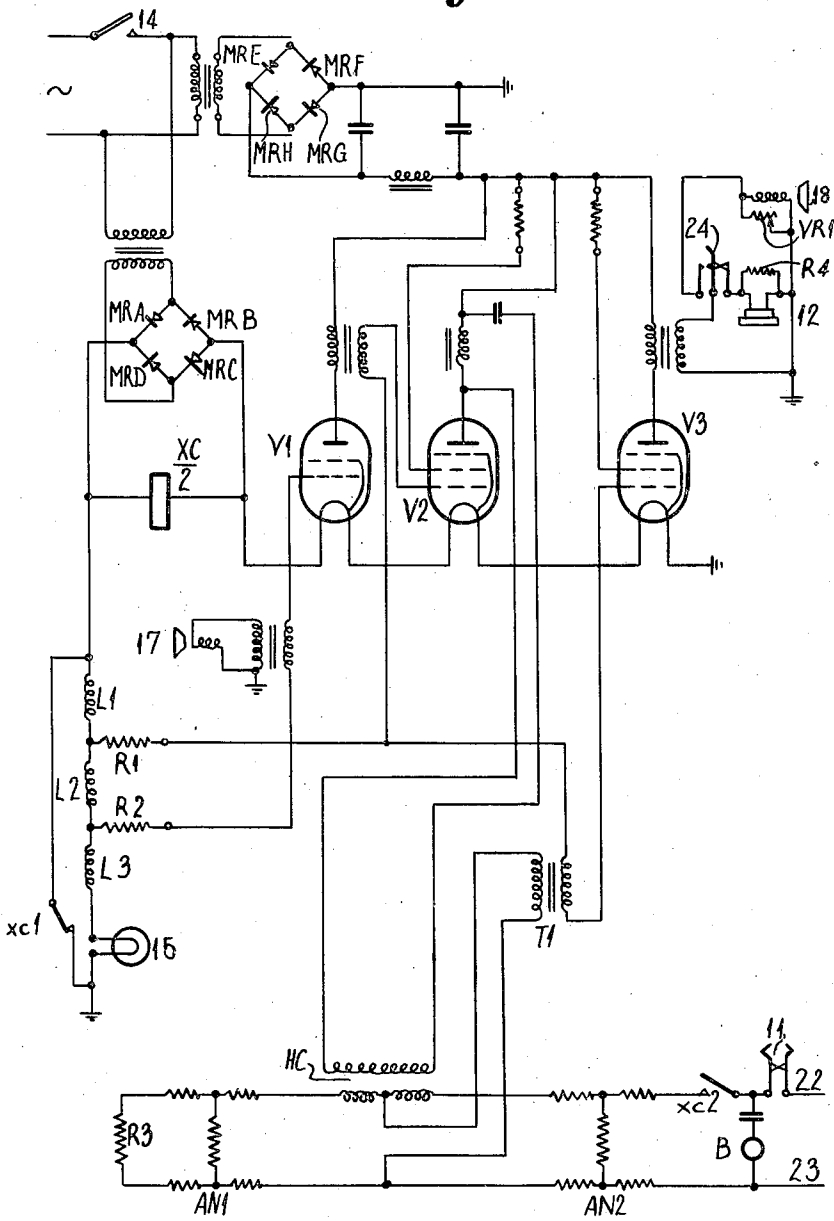
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2 Sheets-Sheet 2

Fig. A.



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TELEPHONE SYSTEM

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6 Claims. (Cl. 179—1)

The present invention relates to telephone systems and is more particularly concerned with so-called loudspeaking systems in which one at least of the subscribers is provided with a loudspeaker in conjunction with equipment which enables him to conduct a satisfactory conversation without being in close proximity to the microphone, the opposite substation being either similarly equipped or having an ordinary telephone instrument.

In loudspeaking telephone systems hitherto proposed, where both loudspeaker and microphone have been located in the same cabinet the coupling existing between them has produced a tendency to self-oscillation or howling and it has therefore been found necessary to employ voice-operated switching devices which serve to prevent the simultaneous completion of circuits to the loudspeaker and microphone. The chief object of the invention is to provide a loudspeaking telephone unit in which coupling is reduced to such an extent that voice-operated switches or the like with their attendant disadvantages and expense may be dispensed with.

According to one feature of the invention in a loudspeaking telephone unit incorporating a loudspeaker and a microphone, the microphone and loudspeaker comprise identical units which are mounted in close proximity with their axes substantially parallel and their mouths in substantially the same plane so as to reduce acoustic coupling.

According to another feature of the invention in a loudspeaking telephone unit incorporating a loudspeaker and a microphone, coupling between the microphone and the loudspeaker is reduced to tolerable dimensions by mounting the two components on a wad of some absorbent material with their axes parallel and their mouths in the same plane, covering them with a grille woven from strips of soft metal and connecting them electrically to the line by means of a hybrid coil or the like in association with a balance network.

The invention will be better understood from the following description of one method of carrying it into effect, reference being had to the accompanying drawings comprising Figs. 1 to 4. Fig. 1 is a perspective view of a suitable design of loudspeaking telephone unit of the desk type according to the invention which is assumed to connect with an automatic telephone exchange over an ordinary two-wire line. Fig. 2 is a view showing the operation of the lever platform which supports an auxiliary watch receiver and Fig. 3

is a sectional view along the line AA of Fig. 1 showing the mounting arrangements of the microphone and loudspeaker. Fig. 4 shows the main principles of the circuit connections used for the equipment.

Referring now to Fig. 1, the cabinet 10 is of a pleasing balanced design with a sloping front and has mounted on its exterior the dial impulse sender 11, watch receiver 12 resting on the pivoted lever platform 13, on-off switch 14 and pilot lamp 15 which glows when the equipment is in operation. The opening for the microphone and loudspeaker is protected by the metal grille 16 which is not shown in detail but comprises what may be termed a woven structure employing thin strips of relatively soft metal. A suitable number of equally spaced longitudinal strips are provided extending also over the back of the instrument and these are threaded through at intervals by a smaller number of transverse strips. This arrangement gives adequate protection to the loudspeaker and microphone without introducing an appreciable amount of coupling between them. This grille is preferably backed by a sheet of silk or similar material to screen the parts and protect them from dust.

Referring now to the sectional view of Fig. 3, it will be seen that the microphone and loudspeaker 17 and 18 which may comprise identical permanent magnet moving coil units are mounted one above the other in a wad of sound-absorbent material 21 such as felt, and are arranged so that their axes are parallel and their mouths lie in the same plane. The whole assembly of the wad of felt carrying the two units is secured against the metal grille 16 by means of the clamping bar 19. A wood back-plate 20, preferably provided with ample clearance holes for the permanent magnets of the moving coil units, is interposed between the clamping bar and the felt and enables an even clamping pressure over the whole area of the felt to be effected.

It will be understood that in addition to the apparatus shown the transmit and receive amplifiers and their associated equipment are also contained in the cabinet, but the power supply unit will preferably have a separate housing in order to keep down the dimensions of the cabinet.

Considering now the circuit of Fig. 4, when it is desired to bring the equipment into operation for either an outgoing or an incoming call the switch 14 situated on the front of the cabinet is operated to connect up the supply mains, which are in this case assumed to be alternating current, and suitable plate, grid and filament

potentials are thereupon applied to the valves V1 to V3.

In order that the valve filaments may be heated up very quickly so that the equipment shall be ready for conversation almost as soon as it is switched on, the valves utilised are of the directly-heated battery type and have their filaments connected in series so that in this instance if 2-volt valves are assumed they will together require an applied voltage of 6 volts. The output from the full wave rectifier arrangement MRA—MRD is however 25 volts and the voltage-dropping chokes L1—L3 are initially short-circuited by an armature of relay XC so that the valve filaments will receive an initial excess voltage for the duration of the operating time of relay XC. On the operation of this relay after a very short period, the short-circuit is removed from the chokes L1—L3 and the normal voltage is then applied to the filaments and the pilot lamp then lights to indicate that the equipment is ready for conversation. It is not found that any damage is done to the filaments by these arrangements since the over-voltage is applied for such a short duration.

Relay XC also connects the transmit and receive amplifier equipment to the telephone exchange line 22 and 23 so that an outgoing call may be set up in the normal manner by dialling, while in the case of an incoming call when the bell B is being rung from the exchange the looping of the line trips the ringing and enables conversation to proceed.

Considering now the operation of the equipment during conversation, speech from the microphone 17 is passed through the two-stage transmit amplifier comprising the valves V1 and V2 and then into the upper winding of the hybrid transformer HC. The centre-tapped line winding of this transformer connects on one side via an attenuation network AN1 to a line balance resistance R3 and on the other side via an attenuation network AN2 to the exchange line, the arrangements which follow known principles being such that when a balance condition prevails no speech energy will feed back into the input circuit of the receive amplifier valve V3. In case an out-of-balance condition exists to any slight extent, that part of the speech energy which feeds back to the valve V3 will give rise to side tone in the loudspeaker 18 which is connected in circuit over contacts 24 of the normally operated lever platform when the receiver 12 is resting thereon, as shown in Fig. 2. A variable resistance VR1 is connected across the loudspeaker to permit adjustment to be made readily: this resistance is not accessible to the subscriber.

Received speech incoming from the line passes to the hybrid coil HC where it divides up between the line balancing network and the primary winding of the input transformer T1 connecting with the valve V3, any energy which finds its way into the plate circuit of the valve V2 being without effect.

Considering now the possibilities of feed-back, it will be appreciated that a balance of the two sides of the hybrid coil line winding is aimed at always and the use of the attenuation network serves to reduce the effect of variations in the line impedance. In practice however some small degree of out-of-balance always obtains so that some speech energy is fed back from the transmit to the receive amplifier circuits. There will be some degree of acoustic coupling existing between the loudspeaker and microphone and if

this provides insufficient damping self-oscillation can be brought about. With the arrangement according to the invention however in which the loudspeaker and microphone are mounted side by side in a wad of sound-absorbent material with protection by a grille of special form, the coupling between them is so reduced as to prevent self-oscillation provided the stage gain of the amplifiers and the state of out-of-balance at the hybrid coil are kept within reasonable limits. As previously pointed out the loudspeaker and microphone need to be mounted with their axes parallel and to have diaphragms of such a shape that sound waves if emitted by both would be in parallel beams.

The watch receiver shown for use when it is not desired to receive incoming speech on the loudspeaker is preferably provided with an elastic or self-coiling cord which returns inside the case when the receiver is not being used. It will be understood that this could if desired be replaced by an ordinary handset working independently of the loudspeaking equipment and preferably normally resting on a cradle at the back of the instrument. The same dial would be arranged to be available for use in either condition when originating a call, and during dialling the loudspeaker or receiver as the case may be would be short-circuited by the dial off-normal springs so as to prevent the dialled impulses from being reproduced.

The dial might conveniently be replaced by a mechanical key-operated impulse sender, the keys being possibly mounted on the front panel of the cabinet. Alternatively where for example a number of subscribers are served by a small private exchange, the loudspeaking telephone equipment might be for one privileged subscriber only and might be provided with keys which would enable him to connect directly with any other subscriber without having either to set up the exchange switches or to call the manual board as the case may be.

It will be understood also that the hybrid coil might be replaced by any other conjugate connecting arrangement giving in effect an anti-side-tone circuit.

It will be appreciated that a loudspeaking telephone unit of the type described offers considerable advantages as it enables conversation to be carried on in a perfectly natural manner and either subscriber can if he desired interrupt the other as is the case with ordinary telephone instruments.

I claim:

1. In a loudspeaking telephone unit comprising a loudspeaker, a microphone, means including a wad of sound absorbent material for mechanically mounting said loudspeaker and said microphone with their axes parallel and their mouths in the same plane to reduce acoustic coupling between said loudspeaker and microphone to tolerable dimensions, a cover for said microphone and loudspeaker comprising a grille woven from strips of soft metal, a line, a hybrid coil, a balance network for said line, and electrical connections for operatively connecting said loudspeaker and microphone to said line and balance network by means of said hybrid coil.

2. In a loudspeaking telephone unit comprising a loudspeaker unit, a microphone unit identical in construction with said loudspeaker unit, mechanical means for mounting said loudspeaker unit and said microphone unit in close proximity, said units being mounted with their axes sub-

stantially parallel and their mouths in substantially the same plane in order to reduce acoustic coupling between said units, and a front inclined surface in which the microphone unit is mounted by said mounting means above said loudspeaker unit.

3. In a loudspeaking telephone unit comprising a loudspeaker unit, a microphone unit identical in construction with said loudspeaker unit, mechanical means for mounting said loudspeaker unit and said microphone unit in close proximity, said units being mounted with their axes substantially parallel and their mouths in substantially the same plane in order to reduce acoustic coupling between said units, a back-plate and a wad of felt or similar material mounted on said back-plate as a part of said mechanical mounting means for mounting said loudspeaker and microphone units.

4. In a loudspeaking telephone unit comprising a loudspeaker unit, a microphone unit, mechanical means for mounting said loudspeaker unit and said microphone unit in close proximity, said units being mounted with their axes substantially parallel and their mouths in substantially the same plane in order to reduce acoustic coupling between said units, amplifying valves of the directly heated type and circuits for heating the filaments of said valves, a relay and a circuit for operating the same, means for simultaneously closing said filament circuits and said relay circuit to supply an excess voltage to said filament circuits for rapidly heating the filaments of said valves and to operate said relay, and means including contacts operated by said relay for reducing the voltage applied to said filament circuits.

5. In a loudspeaking telephone unit comprising

a loudspeaker unit, a microphone unit, mechanical means for mounting said loudspeaker unit and said microphone unit in close proximity, said units being mounted with their axes substantially parallel and their mouths in substantially the same plane in order to reduce acoustic coupling between said units, amplifying valves and circuits for heating the filaments of said valves, a relay and a circuit for operating said relay, a lamp operative to indicate that the apparatus is ready for service, means for simultaneously closing said filament circuits and said relay circuit to supply an excess voltage to said filament circuits for rapidly heating the filaments of said valves and to operate said relay, and means including contacts operated by said relay for reducing the voltage applied to said filament circuits and for operating said lamp in series with said filaments.

6. In a loudspeaking telephone unit comprising a loudspeaker unit, a microphone unit, mechanical means for mounting said loudspeaker unit and said microphone unit in close proximity, said units being mounted with their axes substantially parallel and their mouths in substantially the same plane in order to reduce acoustic coupling between said units, amplifying valves and circuits for heating the filaments of said valves, a relay and a circuit for operating the same, means for simultaneously closing said filament circuits and said relay circuit to supply an excess voltage to said filament circuits for rapidly heating the filaments of said valves and to operate said relay, a line, and means including contacts operated by said relay for reducing the voltage applied to said filament circuits and for operatively connecting said unit to said line.

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