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2,277,907

TELEPHONE SET

Filed Aug. 15, 1940

2 Sheets-Sheet 1

FIG. 1

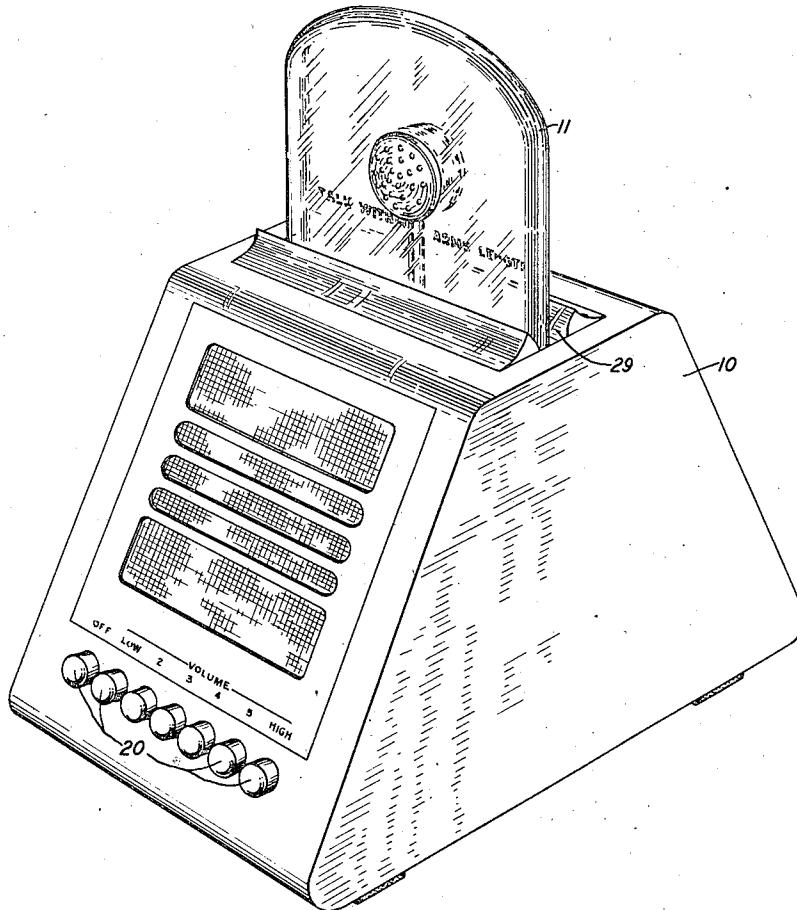
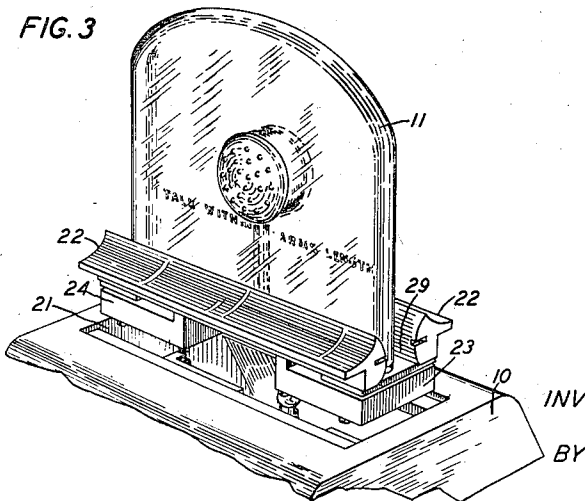


FIG. 3



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FIG. 4

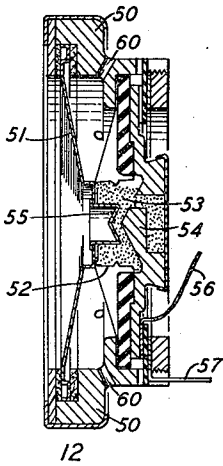


FIG. 5

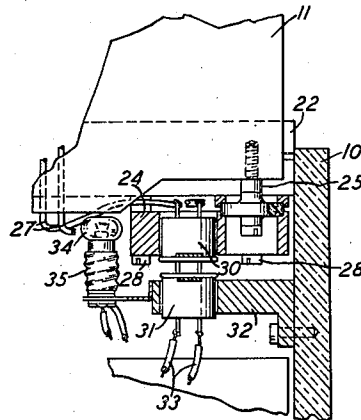
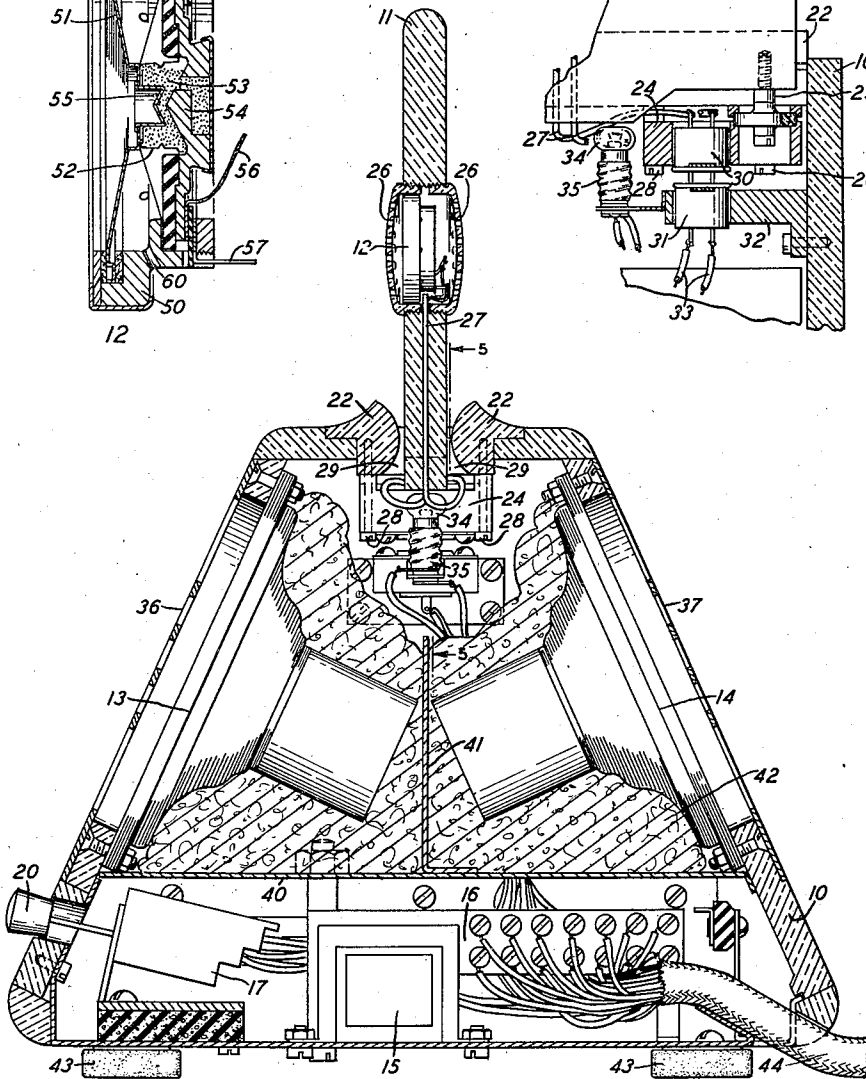


FIG. 2



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TELEPHONE SET

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13 Claims. (Cl. 179—1)

This invention relates to telephone sets and more particularly telephone sets, equipped with a receiving means and a microphone or transmitter device, suitable for use at some distance from the talker.

This type of telephone set is suitable for use on universal telephone line service, announcing, intercommunicating or other direct wire service, or radio telephone service.

The peculiar advantage of this type of set lies in its ability to transmit and receive sound satisfactorily over air paths of relatively large attenuation. This property removes the restrictions of holding or wearing any instrument, thereby permitting sound transmission and reception with freedom of movement and unrestricted use of the hands for individuals or groups. In effect it provides for the transmission and reception of speech in a manner closely simulating direct face-to-face conversation.

One inherent difficulty in the design and operation of a loud-speaking, distant talking set, results from the acoustic coupling between the loud-speaking device and the transmitting device. Sound energy which has been converted from electrical energy by the loud-speaking device agitates the transmitting device and is converted to electrical energy. If the loud-speaking and transmitting circuits are connected together, either electrically or electroacoustically (through another loud-speaking device), a sustained tone or "singing" condition is likely to occur at one or more frequencies depending on the existing phase relations; if there is a net amplification in the resulting closed path. Where there is not net amplification, the returned current from the transmitting device produces the effect known as "sidetone," which also may be objectionable.

It has been found that by special design of the telephone set, the efficiency of the coupling between the loud-speaking means and the transmitting means can be substantially reduced without degrading the transmitting or receiving performance, so that greatly improved operation can be had, whether or not voice-operated amplification control is used to prevent singing or to reduce sidetone. This application deals in one aspect with the method of achieving this reduction in the efficiency of the acoustic coupling path between the loud-speaking device and the transmitting device.

One object therefore of this invention is to so design a loud-speaking, distant talking telephone set that it will operate satisfactorily when used in conjunction with voice-operated amplification

controls and when connected to an ordinary subscriber's telephone line for universal service.

A further object of this invention is the production of a loud-speaking distant talking telephone set in which the effect of acoustic feedback is substantially reduced so that improved operation may be had for universal telephone line service; announcing, intercommunicating or other direct wire service; radio telephone service; or any other form of communication involving the combined use of loud-speaking and distant talking means.

One feature of this invention resides in a loud-speaker transmitter combination in which direct sound from the loud-speaker means may impinge on the transmitter without causing said transmitter to operate.

In accordance with a further feature of this invention a pair of loud-speakers are so arranged with respect to a transmitter that direct sounds from each loud-speaker arrive simultaneously and in equal volume at the transmitter and produce no net effect thereon.

Another feature of this invention involves the use of a bidirectional transmitter associated with a loud-speaker means, arranged symmetrically therewith, whereby the acoustic paths from the speaker means to each diaphragm face of the transmitter are equal.

Other and further objects and features of this invention will be more fully and clearly understood from the following detailed description with reference to the accompanying drawings in which:

Fig. 1 is a perspective view of a telephone set comprising an illustrative embodiment of this invention;

Fig. 2 is a sectional view of the set illustrated in Fig. 1;

Fig. 3 is a perspective view of the upper portion of the device shown in Fig. 1 with parts separated to more clearly illustrate details of construction;

Fig. 4 is a sectional view of one form of transmitter suitable for the telephone set of this invention; and

Fig. 5 is a partial section taken on line 5—5 of Fig. 2.

The telephone set illustrated comprises a casing or housing 10, which may be made of a plastic material, having a baffle 11 supported thereon. A bidirectional transmitter 12 is mounted in the baffle and a pair of loud-speakers 13 and 14 are secured in the casing 10. Also housed in the casing 10 are loud-speaker transformer means 15,

a connecting or junction block 16 and volume control means 17 having operating buttons 20.

The baffle 11 which may be of any suitable material is preferably made of a transparent plastic material, whereby it offers no serious obstruction to sight on the desk or table where the set is used. The baffle and its immediate support means may conveniently be made up as a unit to be inserted in a slot or opening 21 in the top of the housing 10 as shown in Fig. 3. This baffle unit or assembly may comprise a pair of rails or supporting members 22 secured in spaced parallel relation by means of blocks 23 and 24. The members 22 may be made of plastic or like material. The blocks 23 and 24 may be fastened to members 22 at each end thereof by means of screws 28 or other suitable fastening means. The baffle 11 is mounted between and spaced slightly from members 22 by means of resilient mountings secured to said baffle and to blocks 23 and 24, respectively. One form of a suitable resilient mounting is shown at 25 on Fig. 5. This mounting may comprise a disc of rubber or some other suitable material, having a bolt or screw secured through its center. The periphery of the disc is secured to the block 24 and the screw to the baffle 11. A similar mounting may be secured between the baffle and the block 23. Thus the baffle 11 is resiliently supported or "floated" between members 22, protecting the transmitter 12 from shock and vibration. The spaces or slots 29 between baffle 11 and rails 22 provide a pair of outlets from casing 10 that are symmetrical with respect to said baffle and transmitter 12.

The transmitter 12 may be concealed and protected by cloth, screens and perforated covers 26. A pair of conductors 27 extend through the baffle 11 to the transmitter 12. These conductors 27 may be brought out of the bottom of the baffle to an attachment plug or connector 30 secured in the block 24. A mating connector 31 may be secured in a bracket 32 fastened to the housing 10. Conductors 33 may be run from connector 31 to a suitable point for connection to the associated circuit. A signal lamp 34, to show when the set is properly operating, may be mounted in a bracket 35 secured to the bracket 32. The lamp 34 may be located, for example, adjacent the edge of baffle 11 so that it will illuminate the baffle.

The loud-speakers 13 and 14 are secured in back-to-back relation to opposite walls of the housing 10. The axis of each speaker lies in the same plane as the axis perpendicular to the transmitter diaphragm, which is also its axis of maximum efficiency. The loud-speakers are arranged symmetrically with respect to the transmitter, the plane of the baffle 11 being the median plane between the speakers. The axes of the loud-speakers may be inclined somewhat, to direct the sound upwardly toward the user of the set. The housing 10 is preferably provided with protective grills and cloth screens 36 and 37 in front of each loud-speaker.

A horizontal partition 40 separates the speakers from the auxiliary apparatus in the base of the housing. A vertical fin or partition 41 may be secured to the horizontal partition 40. The fin 41 may be of steel or other material which will serve as a magnetic shield between the magnets of the loud-speakers. The space in the housing 10 above the partition 40 may be filled with sound-absorbing material 42, such as wool, felt or the like.

The housing 10 may be provided with resilient

feet 43. A suitable foot may comprise a pad of sponge rubber covered with suede leather or the like. The base of the housing may be detachable to provide access to the apparatus.

A cable 44 contains sufficient conductors for making connections from the desk set to a suitable amplifier.

The transmitter 12 may be any one of suitable bidirectional type. It has been found that a satisfactory transmitter of this characteristic is a simple telephone type granular carbon transmitter unit provided with a diaphragm accessible to sounds from both front and rear as shown in Fig. 4.

Referring to Fig. 4, the transmitter 12 here illustrated comprises a casing 50 in which is supported a diaphragm 51. A container 52 supports carbon granules 53 between a fixed electrode 54 and a movable electrode 55. The electrodes are connected to external circuits by way of terminals 56 and 57. A plurality of orifices 60 in the casing 50 allow access of sound waves to the back as well as to the front of the diaphragm 51, thereby providing bidirectional or pressure gradient characteristics.

As has been previously indicated, one of the difficulties involved in the use of a distant talking, loud-speaking telephone set is "singing" due to acoustic feedback from the receiver means to the transmitter means. It will be readily observed that with the telephone set of this invention the effect of acoustic feedback is substantially eliminated. Considering the set particularly disclosed, the loud-speakers 13 and 14 are arranged so that the sound paths from speaker 13 to the front side of the diaphragm 51 of transmitter 12 are of the same lengths as the corresponding paths from speaker 14 to the back of said diaphragm. Vibrations which might pass from the speakers to the transmitter via the casing 10 and baffle 11 are attenuated by the flexible mountings 25 and sound absorbing material 42 and residual vibrations which may emerge from symmetrical slots 29 are balanced on either side of the transmitter so that they produce no appreciable effect. The speakers 13 and 14 have their operating means so connected to the circuit that their respective diaphragms are "in phase" with respect to movement toward and away from the median plane between said speakers. The loud-speakers are thus enantiomorphically related both as to position and operation. In other words each speaker may be considered the mirror image of the other with respect to the diaphragm plane of the transmitter. Any differential in acoustic efficiency between speakers may be eliminated by means of resistance connected in series with the more efficient loud-speaker or by other balancing means. Thus at any instant the sound pressures on opposite sides of the diaphragm, due to the loud-speaker means, are substantially equal. Since the sound pressures are equal and opposing the diaphragm remains stationary. On the other hand, sound waves due to a user's voice approach the transmitter from one side only and the unbalanced forces cause the diaphragm to vibrate.

The set illustrated has control buttons 20 on one face only. In ordinary use by one person this face would be the front. For some purposes it might be desirable to have the set controllable from either front or back. Provision for such use could be made by means of duplicate, interlocked controls, on each face. Because of the symmetrical arrangement of the transmitter and

receiver means, allowing talking and listening from either face, this set may be conveniently employed by small groups for telephone conferences.

The telephone set is designed for "arms length" operation in order to allow freedom of movement of the user, plus convenient control. The volume control allows the user to receive sound at a level suitable to his needs. The operation of the controls of the illustrated device, from the user's viewpoint, is believed to be obvious from an inspection of Fig. 1. The user turns the set on by operating the proper volume control button to obtain suitable reception thus automatically releasing the left-hand button from the off position. For a given speech level at the other end of the line the volume control will ordinarily need no further attention after being set at the beginning of the conversation.

Although a specific embodiment of this invention has been shown and described, it will be understood that modifications may be made therein without departing from the scope and spirit of this invention as defined by the appended claims.

What is claimed is:

1. A distant talking and listening telephone set comprising a support having a base portion for placement on a desk or table, a bidirectional transmitter mounted on the support, loud-speaking receiver means also mounted on said support between said transmitter and said base and oriented to deliver substantially equal sound energy to both sides of said transmitter, whereby the net acoustic effect of the receiver means on the transmitter is zero.
2. A set for a telephone system with voice operated amplification control, comprising a housing, a pair of loud-speakers secured in said housing and oriented to radiate in substantially opposite directions and a bidirectional transmitter mounted on said housing and surrounded by a plane baffle, said baffle and the transmitter diaphragm lying in the median plane between said speakers.
3. A telephone set comprising a housing, a pair of receivers mounted in back-to-back relation within said housing, a baffle secured to the housing and lying in the median plane between said receivers, and a bidirectional transmitter mounted in said baffle, the major axes of the receivers and the transmitter lying in a plane perpendicular to said median plane.
4. An acoustic transducer comprising a bidirectional transmitter and loud-speaking receiver means secured to a support, said receiver means arranged to radiate in substantially opposite directions and said transmitter having its axis of maximum sensitivity correspondingly directed.
5. An acoustic transducer comprising a bidirectional transmitter and a pair of receivers secured to a support, said receivers oriented to radiate in substantially opposite directions and said transmitter having its axis of maximum sensitivity correspondingly directed.
6. A telephone set comprising a support, a pair of loud-speakers and a bidirectional transmitter mounted on the support, the loud-speakers being in back-to-back relation with their axes in the same vertical plane, the transmitter having its axis of maximum sensitivity in said plane and its diaphragm in a plane between the speakers and equidistant therefrom.

7. A telephone set comprising a bidirectional transmitter and a pair of receivers associated with said transmitter and arranged to radiate equally in substantially opposite directions corresponding to the axis of maximum response of the transmitter, the paths from each receiver to the transmitter being substantially equal.

8. A telephone set comprising a pressure gradient transmitter having a diaphragm, a plane baffle around said transmitter, two loud-speaking receivers one on each side of the plane of said baffle and oriented to radiate in substantially opposite directions, the output of each receiver being adjusted with respect to the paths from said receiver to the transmitter to supply equal sound pressure simultaneously to opposite faces of said diaphragm.

9. A telephone set comprising a housing, a pair of receivers mounted in the housing to radiate in the same phase in substantially opposite directions, electrical means for equalizing the efficiency of the loud-speaking receivers, a plane baffle mounted on the housing above the level of the receivers and in the median plane therebetween, a bidirectional transmitter in said baffle with its diaphragm in said median plane, insulating means associated with the housing and baffle to inhibit the transmission of sound from the receivers to the transmitter by way of said housing and baffle, and symmetric apertures to deliver any residual internal sound radiation from the housing equally to opposite sides of the transmitter.

10. A telephone set comprising two enantiomorphically related receivers, a bidirectional transmitter having its sound responsive element in the plane of symmetry between said receivers and its axis in a plane including the axes of said receivers and perpendicular to said plane of symmetry.

11. A telephone set comprising a bidirectional transmitter, loud-speaker means, support means common to both, and sound baffling means associated with said transmitter for enhancing its bidirectional effect, said speaker means arranged to deliver equal sound energy to opposite faces of said transmitter whereby the net acoustic effect of the speaker means upon the transmitter is substantially zero at any instant.

12. A telephone set comprising sound pick-up means and emitter means, said means being arranged respectively for bilateral pick-up and emission, the relative orientation of each means being such that their planes of symmetry coincide, whereby the sound from the emitter means which acts upon the pick-up means is divided into components the effective sum of which is zero.

13. A telephone set comprising a housing, a baffle, vibration damping means, between said baffle and said housing, a bidirectional transmitter secured in said baffle, receivers in said housing arranged to transmit equal instantaneous sound pressures to opposite sides of said baffle and transmitter, and sound-absorbing material in said housing, the damping means and sound-absorbing material inhibiting transmission of mechanical vibration from the receivers to the transmitter.

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