

Sept. 8, 1936.

B. A. ENGHOLM

2,053,364

LOUDSPEAKER

Filed Aug. 17, 1934

2 Sheets-Sheet 1

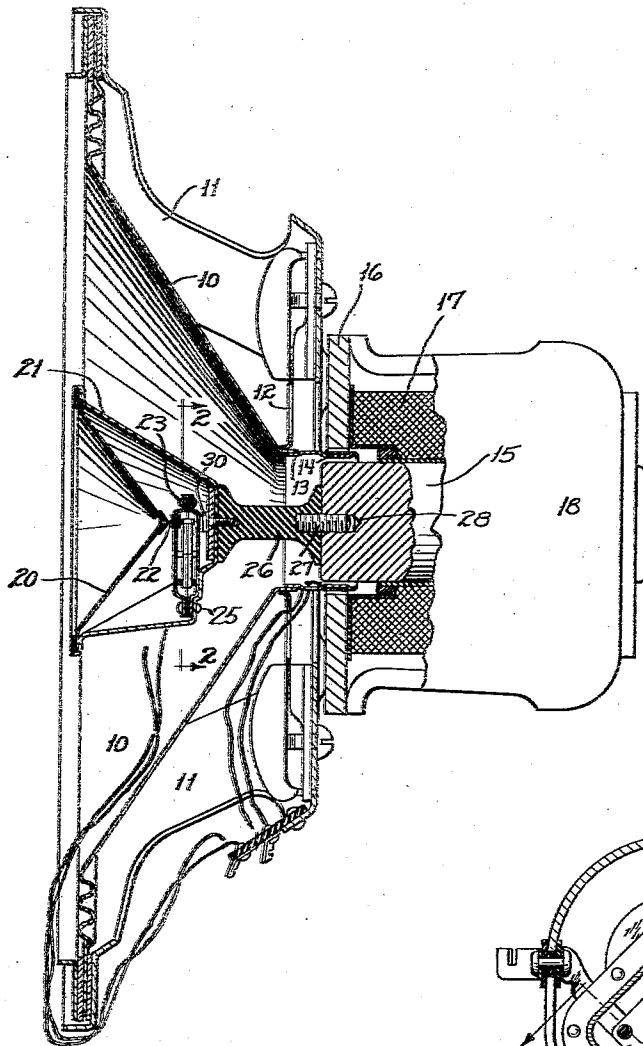


FIG. 1

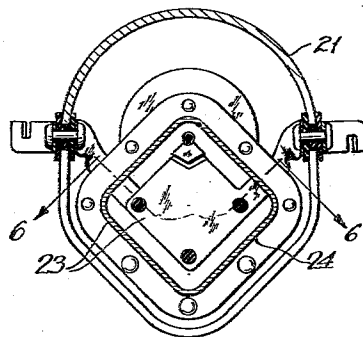


FIG. 2

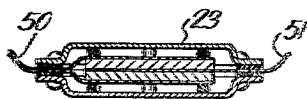


FIG. 6

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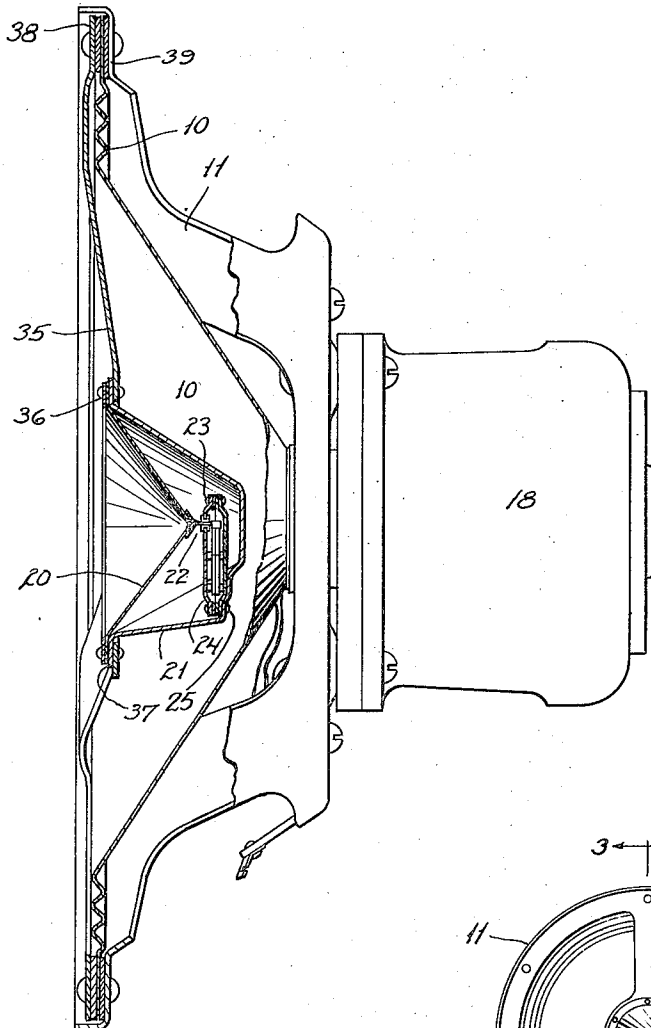


Fig. 3

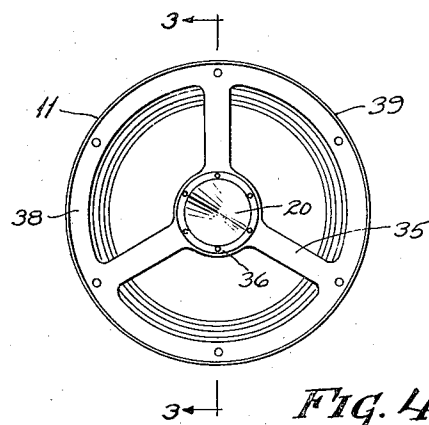


Fig. 4

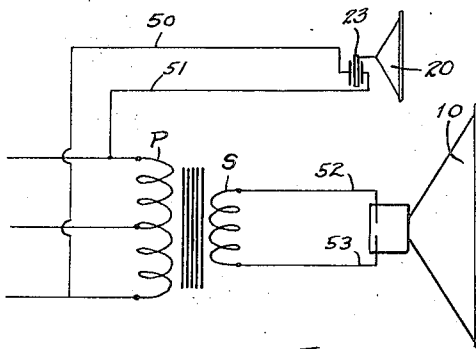


Fig. 5

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UNITED STATES PATENT OFFICE

2,053,364

LOUDSPEAKER

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Application August 17, 1934, Serial No. 740,214

8 Claims. (Cl. 179—110)

This invention relates to loud speakers and particularly to an arrangement wherein a plurality of speakers are used in a single receiver for increasing the frequency range. Where multiple speakers have been used in a single receiver, it has been customary to mount the low and high frequency speakers behind different openings in the panel. This practice is not entirely satisfactory however, for it suggests to an auditor that the sound originates at spaced points.

An object of my invention is to make a mounting by means of which a high-frequency speaker can be supported in nested relationship within a low-frequency speaker so as to create in the mind of an auditor the suggestion that sound originates at a single point. In this connection, my invention is directed toward a construction, which will permit a manufacturer to use a low-frequency speaker either with or without the high frequency one, and yet, will permit the manufacturer to install the high frequency speaker at the purchaser's option, without changing the construction of the low frequency speaker.

One form of high frequency speaker in use at the present time utilizes a Rochelle salt crystal, but one of the characteristics of it, is that its efficiency is greatly diminished if it is operated in a region where the temperature exceeds a predetermined degree. Heat generated at the core of the low frequency field structure, is sufficient to diminish the efficiency of the crystal, and so it is a further object of my invention to provide a mounting, which will insulate the crystal against the conduction of heat, and yet allow it to be mounted within the diaphragm of the low frequency speaker.

Referring now to the drawings, Fig. 1 is a side elevation, partly in section, of a plurality of speakers which are mounted in operating relationship in accordance with my invention; Fig. 2 is a section taken on the line 2—2 in Fig. 1; Fig. 3 is a side elevation partly in section, of a loud speaker, having a modified form of my invention; Fig. 4 is a front view of the arrangement shown in Fig. 3; Fig. 5 is a wiring diagram of one form of circuit, and Fig. 6 is a sectional view, as indicated by the line 6—6 on Fig. 2.

To accomplish the effect of a single source of reproduction, I arrange two speakers in nested relationship preferably with the axis of one disposed substantially in alignment with the axis of the other. In Fig. 1, for example, the outer speaker has a conical diaphragm 10, a housing 11 therefor, which supports it at the outer end thereof, and a centering member or spider 12,

which supports it at the inner end thereof. The diaphragm and centering member are attached to a voice coil form 13, which in turn carries a coil 14 that is disposed in an annular air gap between an inner pole piece 15 and an outer pole piece 16. A field structure is indicated at 17 within a shell 18.

The high-frequency speaker is disposed in nested relationship within the aforementioned speaker, and is so positioned that it lies substantially within the confines of the conical diaphragm 10. It is illustrated as having a conical diaphragm 20, which is supported at its outer end by a housing 21 and which has a stylus 22 attached to the apex thereof. The stylus is connected to a crystal unit 23, which is carried within a casing 24, and the casing in turn, is rigidly attached to the housing 21, as by securing members 25. In the preferred arrangement the peripheries of the outer and inner diaphragm lie in a common plane.

To support the inner speaker within the outer speaker, in the illustration shown in Fig. 1, I utilize a post 26 which has a threaded shank 27 that engages a correspondingly threaded socket 28 in the core 15. The post is preferably made of material that has a low value of heat conductivity, such as that which is known in the trade as "bakelite," wherefore heat developed at the core of the outer speaker cannot be directly transmitted in objectionable amounts to the inner speaker. This is important for the operating efficiency of the crystal of the high frequency speaker is diminished whenever it is subjected to undue temperature rise.

The modification illustrated in Fig. 3 eliminates the direct connection between the core of the outer speaker and the housing of the inner speaker and instead, provides a connection between the housings or peripheries of the two speakers. This is preferably accomplished by a spider 35, which has an inner rim 36 that is rigidly fastened to a flange 37 on the inner housing, and which has an outer rim 38 that is rigidly fastened to a flange 39 on the outer housing. In all other respects the parts shown in Fig. 3, which correspond to those in Fig. 1 bear corresponding reference characters.

The two speakers, which I have illustrated in the various figures are electrically interconnected. A wiring diagram, for example, in Fig. 5, illustrates an arrangement that is customary for such purpose. In such diagram "P" represents the primary of a transformer, across which the conductors 50 and 51 for the inner, or high frequency speaker, are connected.

quency speaker are connected, while "S" represents the secondary, the leads 52 and 53 of which are connected to the outer speaker.

The speaker mountings, which I have illustrated enables a high frequency speaker to be mounted within a low frequency speaker and yet insulates the crystal from an objectionable rise in temperature. Moreover, the mountings permit a manufacturer to make a low frequency speaker that can be equipped at the time of sale with a high frequency speaker in accordance with the desire of the purchaser without making any changes in the construction of the low frequency speaker.

I claim:—

1. In combination, a loud speaker having a conical diaphragm and a field structure including a central core, a second speaker positioned within said diaphragm, and having a diaphragm and a housing extending across the core beyond its inner end, and means having low heat conductive properties for connecting said housing to said core for supporting the inner speaker within the outer speaker.

2. In combination, two interconnected nested loud speakers, one being of high frequency and having an element deleteriously affected by heat, one speaker having a field structure, which includes a central core and the other having a support, which is positioned forwardly of the core, and a member connecting said core to said support for holding the inner speaker within the outer one, said member having a sufficiently low value of heat conductivity to insulate the inner speaker against the conduction of heat in sufficient quantities to interfere with the normal operation of the high frequency speaker.

3. In combination, a loud speaker having a conical diaphragm and a housing therefor, a second speaker positioned within said diaphragm and having an element deleteriously affected by heat, and means for attaching the second speaker to the housing, so as to position the speakers in substantially axial alignment, said means insulating the inner speaker against the conduction of heat from the outer speaker in sufficient quantities to interfere with the normal operation of the high-frequency speaker.

4. In combination, a low frequency speaker, having a diaphragm and a housing therefor, a high frequency speaker nested within said diaphragm, said high frequency speaker having a diaphragm, a housing and an operating element

between the diaphragm and housing, which element is deleteriously affected by heat, and means interconnecting the housings for holding the speakers in spaced relationship to each other sufficiently far apart so that the said element of the high frequency speaker will not be affected by heat that is generated by the outer speaker.

5. A loud speaker unit having a conical diaphragm, a voice coil attached thereto, a field structure including a core and an apertured plate which cooperates to provide an annular air gap in which the field coil is positioned, a second speaker unit including a diaphragm and housing therefor, and means having low heat conductivity projecting from the core and detachably connected to the core for mounting the housing of the second speaker unit within said conical diaphragm.

6. In a loud speaker of the dynamic type, including a hollow mechanical sound amplifier having a voice coil and a magnet operatively associated therewith, a piezo-electric speaker unit and means supporting the same within said amplifier, said unit including a housing containing the electric actuating element of the unit, said housing being spaced a sufficient distance from the magnet to substantially insulate the said element from heat generated thereby.

7. In combination, a loud speaker of the dynamic type, including a hollow mechanical sound amplifier, a voice coil and a magnet, the latter having an air gap receiving the coil, a high frequency speaker including a diaphragm substantially coaxial with the amplifier, and lying within the same, a crystal actuator element operatively associated with the diaphragm, and means to insulate the said element from heat generated by magnet.

8. In combination, a low frequency speaker having a diaphragm, a housing and operating means normally acting to generate heat, a high frequency speaker having a diaphragm and a housing, said high frequency speaker operating independently of said operating means of the low frequency speaker, and means for supporting the two speakers in nested relationship with the axes of the diaphragms in substantial alignment, said high frequency speaker being spaced from the low frequency speaker a sufficient distance to insulate it against heat generated by said operating means.

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