1,080,829

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,080,829

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Int. Cl.:—**H 04 r 11/02**

COMPLETE SPECIFICATION

Loudspeaker

We, ROLEN DIVERSIFIED INVESTORS INC., a Corporation organised and existing under the laws of the State of Nevada, of 1759 Mariposa Road, Stockton, California, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to loudspeakers, that is to say electroacoustic transducers for reproducing sound from a sound modulated electrical signal such as that produced by a radio or gramophone amplifier. Such transducers incorporate an electromechanical transducer which converts the signal into corresponding vibrations and a sound radiator which vibrates in sympathy and thereby creates the sound waves.

According to the present invention an electromechanical transducer unit for attachment to the surface of a sound radiator comprises a casing containing a permanent magnet having pole plates spaced apart from one another in a direction which, when the unit is attached to the surface, is substantially parallel to the latter, a coil supported between the pole plates and having a central bore opening at one end of the coil towards the surface, an elongated soft iron armature extending through the bore and so supported that in response to a sound modulated electrical signal applied to the coil, the armature vibrates with respect to the coil in the said direction, and a member connected to the armature and extending towards the surface and terminating in a pointed end. When the unit is attached to the sound radiator, the pointed end contacts the surface thereby transmitting the vibrations to the radiator.

The armature and thus the pointed member vibrates in a direction which is substantially parallel to the surface. In other words the armature and the pointed member move in a plane which is perpendicular to the plane of the surface. As a result of this, the sound which is radiated is of high quality. Moreover it is substantial in volume, evenly modulated and non-directional. The unit may be of simple design thus resulting in economical manufacture and can easily be attached to the sound radiator. This may be for instance a suitable rigid member such as a door panel. Accordingly the desirable results mentioned above can be obtained without using a conventional loudspeaker, which as it would probably require baffles or other arrangements to match the mechanical impedance of the loudspeaker speech coil to the acoustical impedance of the driven air, would probably be more expensive.

Units in accordance with the invention can take a number of different forms but preferably the armature carries a coaxially mounted pin to which a relatively heavy disc is attached. The pointed member is then secured to the disc adjacent to the edge thereof and is orientated so that the point is substantially aligned with the pin axis. This improves the reproduction characteristics of the unit.

It is also preferable that the unit should include two permanent magnets, coils and armatures connected to respective pointed members. In other words the parts of the unit which serve to convert the electrical signal into the vibrations are duplicated.

By way of example a unit in accordance with the invention will now be described by way of example with reference to the accompanying drawings in which:—

Figure 1 is a perspective view of the unit attached to a sound radiator;

[*Price 4s. 6d.*]

Figure 2 is an enlarged sectional elevation on the line 2—2 of Figure 1;

Figure 3 is a sectional plan view on the line 3—3 of Figure 2; and

Figure 4 is a sectional elevation on the line 4—4 of Figure 3.

Referring first to Figure 1, the transducer unit includes an elongated, rectangular casing 1 which has a top 2, sides 3, a bottom 4, and a rear end 5. The top 2 is formed at its front end with an upstanding attachment flange 6, while the bottom 4 is formed at its front end with a depending attachment flange 7. Both flanges have holes for screws 8 which secure the flanges and hence the casing 1 to the surface 9 of a substantially rigid panel 10 which forms the sound radiator. The panel 10 may be part of a door, wall, or the like. As can be seen the casing projects outwardly at right angles to the panel. The sides 3 of the casing 1 are shorter than the top 2 and bottom 4 so that the flanges 6 and 7 are the only parts of the casing that contact the surface 9 of the panel 10.

Referring now to Figures 2, 3 and 4, a pair of electromechanical transducers 11 and 12 of balanced bipolar magnetic type are disposed in the casing 1 adjacent one another. As the transducers are identical, only one will be described.

Each transducer comprises a longitudinally extending bar type permanent magnet 13 of rectangular cross-section fitted on opposite sides with upstanding pole plates 14. The lower part of the pole plates 14 extends the full length of the magnet 13, but the upper part of the pole plates is shorter and centrally disposed, as shown in Figure 4.

A coil 15, wound on a plastic spool 16, is disposed above the centre of the magnet 13 so as to be located between the pole plates 14. The axial bore 17 of the spool 16 extends parallel to the sides of the casing 1. The spool 16 is clamped between the pole plates 14 with a felt spacer 18 disposed between the sides of the spool and each of the pole plates. The latter are each fitted with front and rear opposed, inwardly projecting pole shoes 19 and 20 respectively.

An elongated soft iron armature 21 is freely disposed in the axial bore 17. One end of the armature 21 is bedded in a resilient block 22 of soft rubber or the like. The block 22 is carried on a cross plate 23 which is connected between the rear pole shoes 20 by screws 24. Spacers 25 on the screws 24 separate the cross plate 23 from the rear pole shoes 20. Adjacent the front pole shoes, the armature 21 is clamped from opposite sides between opposed fulcrums 26 attached by screws 27 to the corresponding pole plates 14. The working edges of the fulcrums 26 are relatively sharp and engage in grooves 28 in the corresponding side faces of the armature 21 which is therefore free to rock laterally or vibrate about the fulcrums 26, the vibrations being damped by the resilient block 22.

At its front end, the armature 21 is formed with a forwardly opening socket 29 carrying the rear of a pin 30 which is held in the socket by means of a set screw 31. The pin 30 is formed with an integral relatively heavy disc 32 which is concentric with the pin axis. An elongated pointed member in the form of the needle 33 is fixed at its rear end adjacent the periphery of the disc 32 in a slanted socket 34. This socket is slanted so that the needle 33 extends forwardly so as to converge with the extended axis of the pin 30, the end of the needle 33 being substantially aligned with the axis of the pin 30. This pin is formed at its front end with a small head 35 having a flat face 36 disposed adjacent but in spaced parallel relation to the needle 33, this face limiting the vibrational movement of the needle.

A felt spacer 37 is disposed between the outermost upstanding pole plate 14 and the adjacent side 3 of the case 1. The pole plate 14 is clamped to the side by means of a holding screw 38 which extends through a longitudinal slot 39.

With the exception of the magnet 13, the pole plates 14, the pole shoes 19 and 20, and the armature 21, the parts of the unit are mainly of nonmagnetic material.

The transducers 11 and 12 are disposed in abutting side-by-side relation and are rigidly secured together by elongated cross bolts 40.

The coils 15 are connected in parallel to a pair of conductors 41 which pass out of the casing 1 through a grommet 42 in the end 5. The conductors 41 can then be connected to the output of an amplifier (not shown) which supplies a sound modulated electrical signal in the normal way.

After the casing 1 is attached to the face 9 of the panel 10 as described, the screws 38 are loosened and the transducers 11 and 12 are adjusted in the casing 1 until the needles 33 bear firmly against or slightly penetrate the surface 9 of the panel 10. The screws 38 are then retightened and the unit is ready for operation with the panel 10 providing the sound radiator of the loudspeaker.

When a sound modulated signal is fed by the conductors 41 to the transducers 11 and 12, the energised coils induce vibrations in the armatures 21. The vibrations correspond to the modulation of the signal and are effectively transmitted by the needles 33 to the panel 10. The panel 10, in response to the vibrations, sets in motion sound waves of sufficient intensity to create a substantial volume of sound in the space contiguous to the panel such as, for example, in a room wherein the panel forms part of a door or

a wall. The sound radiated by the panel 10 is not only substantial in volume and evenly modulated but is full in range, ample in resonance, and non-directional. The volume of the sound may, of course, be regulated by varying the current fed from the amplifier in the normal manner.

WHAT WE CLAIM IS:—

1. An electromechanical transducer unit for attachment to the surface of a sound radiator to form a loudspeaker, the unit comprising a casing containing a permanent magnet having pole plates spaced apart from one another in a direction which, when the unit is attached to the surface, is substantially parallel to the latter, a coil supported between the pole plates and having a central bore opening at one end of the coil towards the surface, an elongated soft iron armature extending through the bore and so supported that in response to a sound modulated electrical signal applied to the coil, the armature vibrates with respect to the coil in the said direction, and a member connected to the armature and extending towards the surface and terminating in a pointed end, this end contacting the surface and thereby transmitting the vibrations to the sound radiator.

2. A unit according to claim 1 in which the armature is supported between a pair of opposed fulcrums which project inwardly from the pole plates and engage the armature between the coil and the radiator surface.

3. A unit according to claim 2 in which the end of the armature remote from the radiator surface is bedded in a resilient block secured within the casing.

4. A unit according to any one of the preceding claims including opposed pole shoes projecting inwardly from the pole plates between one end or the ends of the coil and one end or the ends respectively of the armature, the pole shoes terminating adjacent but clear of the armature.

5. A unit according to any one of the preceding claims in which the armature carries a coaxially mounted pin to which a relatively heavy disc is attached, and the pointed member is secured to the disc adjacent to the edge thereof and is orientated so that the point is substantially aligned with the pin axis.

6. A unit according to claim 5 in which the pin has a flat face at the end adjacent the radiator surface for limiting the vibratory movement of the pointed member.

7. A unit according to any one of the preceding claims in which the armature is mounted within the casing so as to be axially movable to adjust the contact pressure between the pointed end of the pointed member and the radiator surface.

8. A unit according to any one of the preceding claims including two permanent magnets, coils and armatures connected to respective pointed members.

9. A unit according to claim 1 substantially as described and illustrated with reference to the accompanying drawings.

10. A loudspeaker comprising an electromechanical transducer unit according to any one of the preceding claims attached to the surface of a substantially rigid member which acts as the sound radiator.

11. A loudspeaker according to claim 10 in which the substantially rigid member is a panel.

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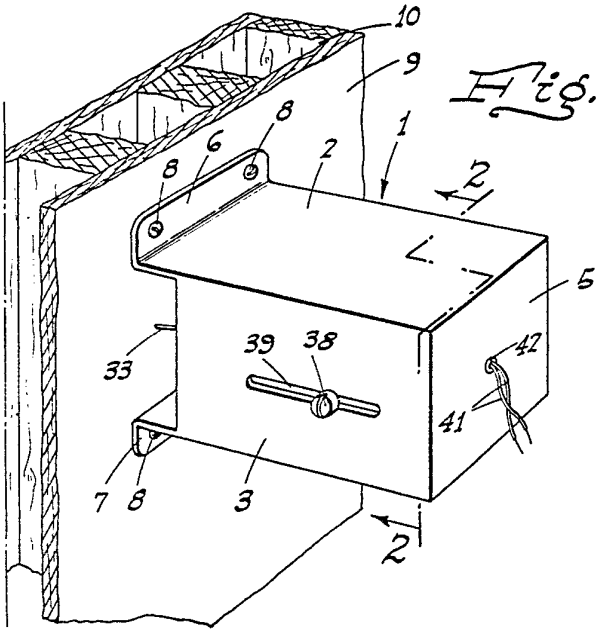
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Fig. 1

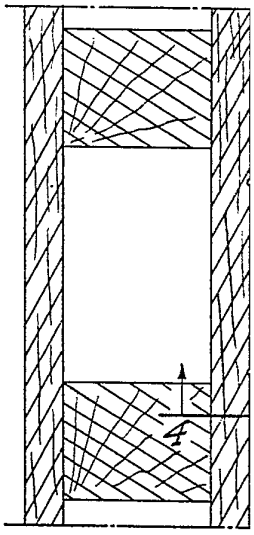
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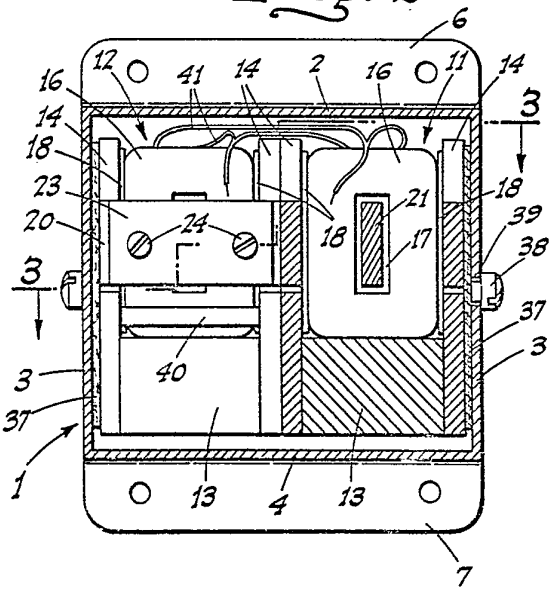
Fig. 2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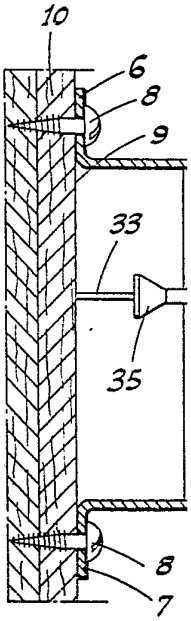
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Fig. 3

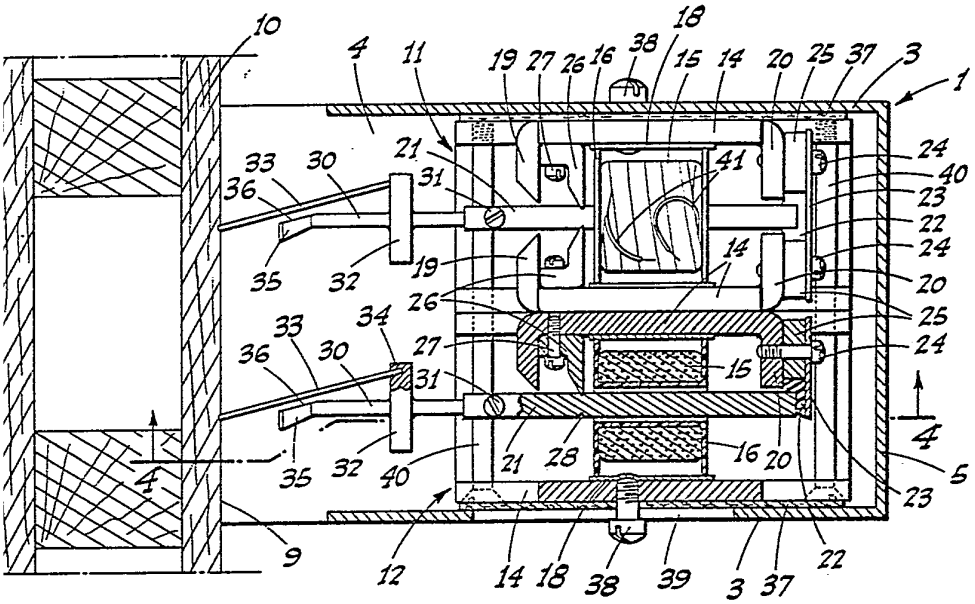

Fig. 4

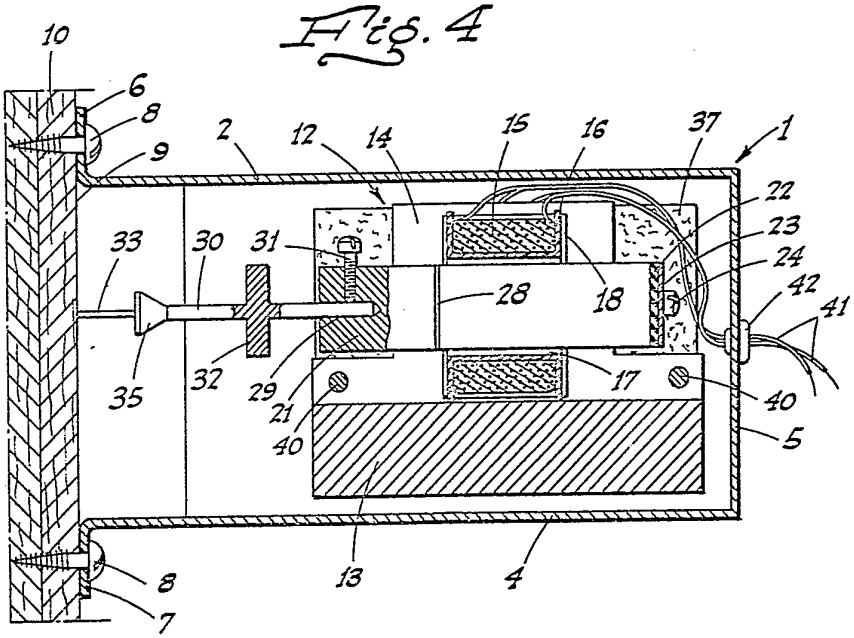

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Fig. 1

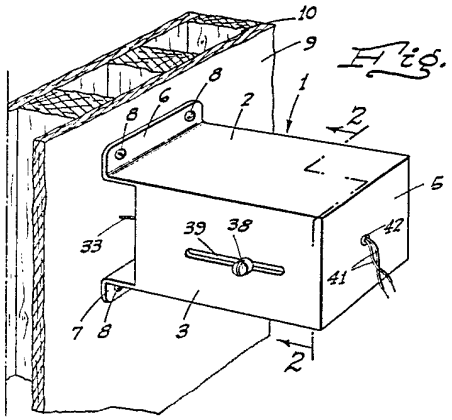

Fig. 3

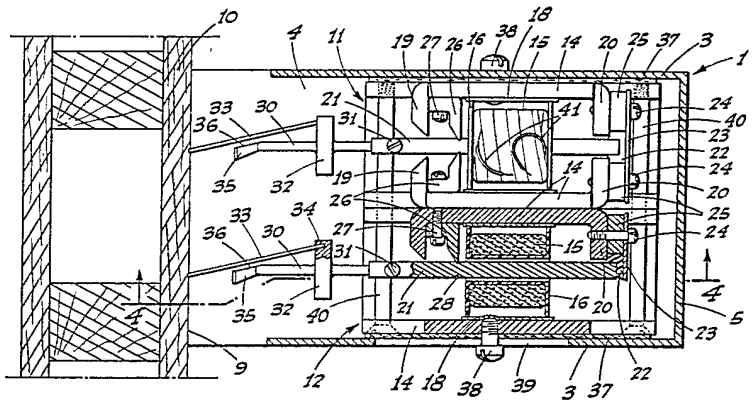

Fig. 2

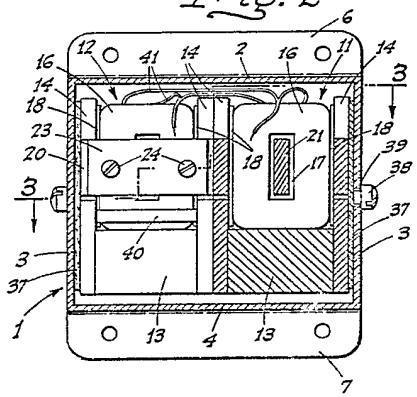

Fig. 4