United States Patent

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[54] **LOUDSPEAKER WITH IMPROVED VOICE COIL SUSPENSION**
4 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** ..... **179/115.5 R**
[51] **Int. Cl.** **H04r 9/04**
[50] **Field of Search** ..... 179/115.5 PS, 115.5 VC, 115.5; 310/27, 30

[56] **References Cited**
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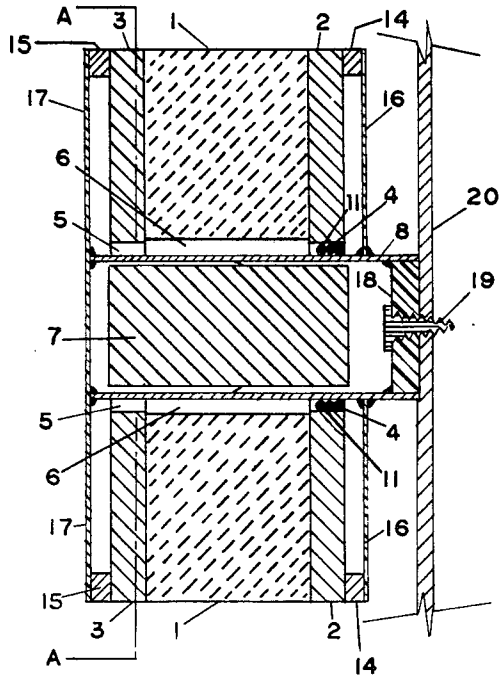
ABSTRACT: A loudspeaker driver having its voice coil wound on a movable bobbin that is flexibly supported at both of its ends, with the bobbin resiliently suspended in such a manner where only an in-and-out movement is permitted.



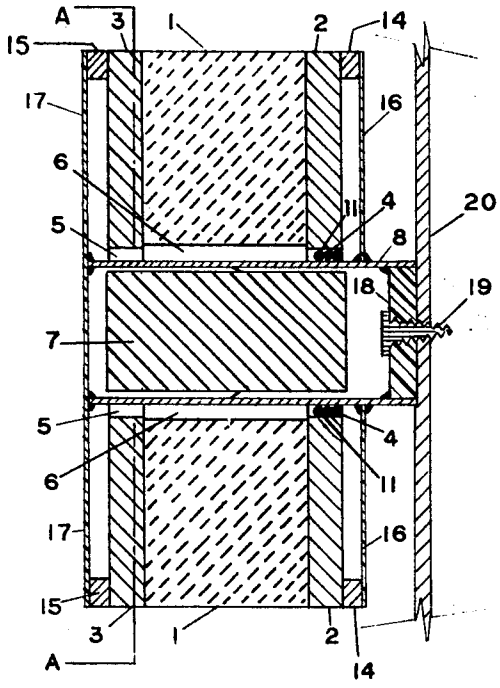


FIG. 1

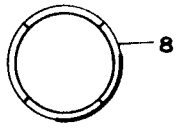


FIG. 2

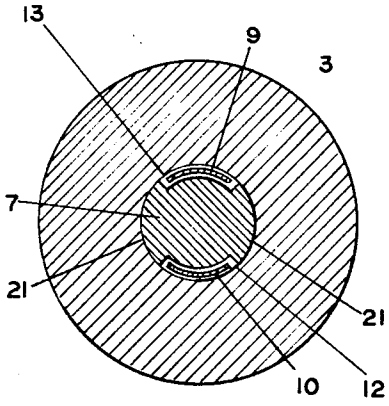


FIG. 4

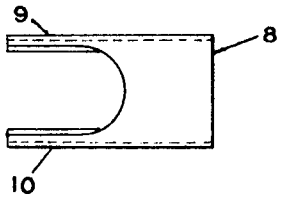


FIG. 3

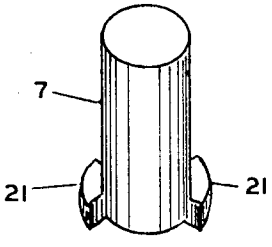


FIG. 5

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LOUDSPEAKER WITH IMPROVED VOICE COIL SUSPENSION

BACKGROUND OF INVENTION

The present invention relates to loudspeaker drivers and specifically relates to inertia drivers employed in driving large sounding boards such as a door, wall, ceiling, etc.

In the past it has been possible to actuate a sounding board with a conventional loudspeaker dynamic driver. This could be done by attaching the voice coil bobbin to the magnet portion of the driver with a very rigid spider or connector and then coupling the end of the voice coil bobbin that would normally connect to a paper cone to the sounding board. When the driver is activated with a signal, inertia would tend to hold the driver mass in a fixed position, permitting the voice coil to move, causing the sounding board to vibrate and emit audible sound.

The rigidity required in the connecting means connecting the voice coil to the magnet allows very little movement of the voice coil. The extreme rigidity required is necessary because the entire weight of the driver is supported by the voice coil bobbin and connector. If the connector were less rigid, the driver mass would become misaligned with the voice coil and the voice coil would drag. The higher rigidity required fixes the natural resonance of the driver at a frequency too high to permit it to develop sufficient driving power to reproduce low frequencies.

SUMMARY OF INVENTION

The general object of the present invention is to provide a driver having a movable voice coil wherein the voice coil bobbin may be directly connected to a sounding board but still retain a high flexibility allowing the driver to resonate at a frequency low enough so it will cause the sounding board to reproduce bass tones as well as high tones. Other objects and advantages of the invention will be apparent from the following description and from the drawing forming a part thereof.

The drawings show a preferred embodiment of the invention and such embodiment will be described but it will be understood that various changes may be made from the construction disclosed, and that the drawings and descriptions are not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

FIG. 1 is a sectional view of the driver showing it attached to a sounding board.

FIG. 2 is an end view of the voice coil bobbin.

FIG. 3 is a side view of the voice coil bobbin showing the extending legs of the voice coil form.

FIG. 4 is a section taken along line A—A.

FIG. 5 is the center pole piece of the driver.

FIG. 1 shows a cross section view of the present invention where a circular permanent magnet 1 with a hole 6 through its center is sandwiched between two circular flat iron discs 2 and 3, with each having a round hole centered in each of them. Discs 2 and 3 are positioned and attached to the permanent magnet 1 so the centrally located holes 4 and 5 will be in alignment and also will be in alignment with the centrally located hole 6 in the permanent magnet.

The ears 21—21 of the central pole piece 7 are pressed into the hole 5 in disc 3 which solidly fixes the center pole piece 7 centrally in hole 6 of the permanent magnet 1 and hole 4 in disc 2.

Voice coil bobbin 8 having the correct number of turns of wire wound on it for the desired operating impedance, positions through holes 4, 5, and 6 and over the central pole piece 7.

As shown in FIG. 4, the iron central pole piece 7 is rigidly fixed in disc 3, being held in position by ears 21—21. The tubular voice coil bobbin 8 has a portion of each side cut away as shown in FIG. 3, leaving legs 9 and 10 extending.

The voice coil is wound on the tubular portion of the coil bobbin 8 as shown in FIG. 1.

Voice coil form 8 is positioned over the central pole piece 7 and through holes 4, 5, and 6.

Legs 9 and 10 of the voice coil form extend through the slots 12 and 13. Slots 12 and 13 result because of portion cut away from the head of pole piece 7 which leaves ears 21—21.

Spacer rings 14 and 15 are cemented to discs 2 and 3 and flexible diaphragms 16 and 17 are cemented to spacer rings 14 and 15. The voice coil bobbin 8 is then cemented to diaphragms 16 and 17 which suspends the voice coil bobbin 8 over pole piece 7 and through holes 4, 5, and 6. A centrally located hole is in diaphragm 16 for the end of voice coil bobbin 8 to extend through. The diaphragm 16 is cemented to voice coil bobbin 8 at the point where the voice coil bobbin is adjacent to the diaphragm 16.

The extended legs 9 and 10 of the voice coil bobbin 8 extend through slots 12 and 13 and cements to diaphragm 17. Epoxy cement was found to be suitable for all operations requiring cement for bonding.

Diaphragms 16 and 17 are made of a material that will allow in and out movement but will not permit significant up and down movement.

Diaphragms 16 and 17 of the present invention were constructed of plastic film 0.015 inch thick and 3 inches in diameter.

One inch tubular Bakelite with a wall thickness of 0.040 inch was found to be suitable for the voice coil bobbin 8.

The operation and construction of a dynamic loudspeaker driver will not be described in this application because this type driver is well known to the art and the present invention utilizes this type of driver.

The voice coil bobbin 8 has a plug 18 containing a screw 19 cemented in its tubular end.

By the use of screw 19 the driver may be rigidly attached to a sound board 20 or other flexible diaphragm.

When an actuating signal is fed to the voice coil 11, because of the weight of the driver mass, inertia will tend to hold the mass in a fixed position. The voice coil 11 and voice coil bobbin 8 will move in relation to magnet 1, discs 2 and 3 and pole piece 7. This movement will be transferred to the sounding board 20.

As can be seen, if both ends of the voice coil form were not supported in suspension, diaphragm 16 would be required to be extremely rigid to hold the voice coil 11 and the mass portion of the driver in proper alignment, otherwise, the resulting misalignment would cause the voice coil to drag, rendering the device inoperative.

The present invention allows considerable in-and-out movement of the voice coil even though the device is entirely supported by the voice coil bobbin 8 because the bobbin 8 is supported in suspension at both ends on diaphragms 16 and 17.

Both diaphragms 16 and 17 will produce sound as well as the sounding board 20. The amount of sound given off by each diaphragm can be regulated by the size of each diaphragm. For instance, diaphragm 16 would be made smaller than diaphragm 17 if it was desirable to cause diaphragm 17 to radiate more sound than diaphragm 16. If it were desirable to radiate as little sound as possible from both diaphragms 16 and 17, then these diaphragms would be made as small as practical.

I claim:

1. An electromechanical transducer, comprising a magnet and a center pole core disposed within said magnet, said center pole core being provided with means for mounting said center pole core to provide an airgap between said magnet and said center pole core, a coil of wire wound on a coil-carrying means with said coil being disposed in said airgap for rectilinear oscillatory movement; wherein, said coil-carrying means is disposed within and along the entire length of and outward from each end of said airgap and extending along the entire length and outward from each end of said center pole core with said coil-carrying means being carried by plural resilient support means whereby, said coil is disposed between two of said resilient support means and said center pole core is

disposed between two of said resilient support means and an opening being provided at the mounting end of said center pole core for the passage therethrough of said coil-carrying means.

2. An electromechanical transducer according to claim 1 wherein, at least one of said resilient support means is a diaphragm for transmitting audible vibrations into the surrounding area.

3. An electromechanical transducer according to claim 1 wherein, said coil carrying means is solidly coupled to a sounding board.

4. An electromechanical transducer according to claim 1 wherein, said sounding board is the sole support means for said transducer.