Jan. 30, 1968 H. RIES 3,366,749

AUDIO TRANSDUCER

Filed April 9, 1964

Fig. 1.

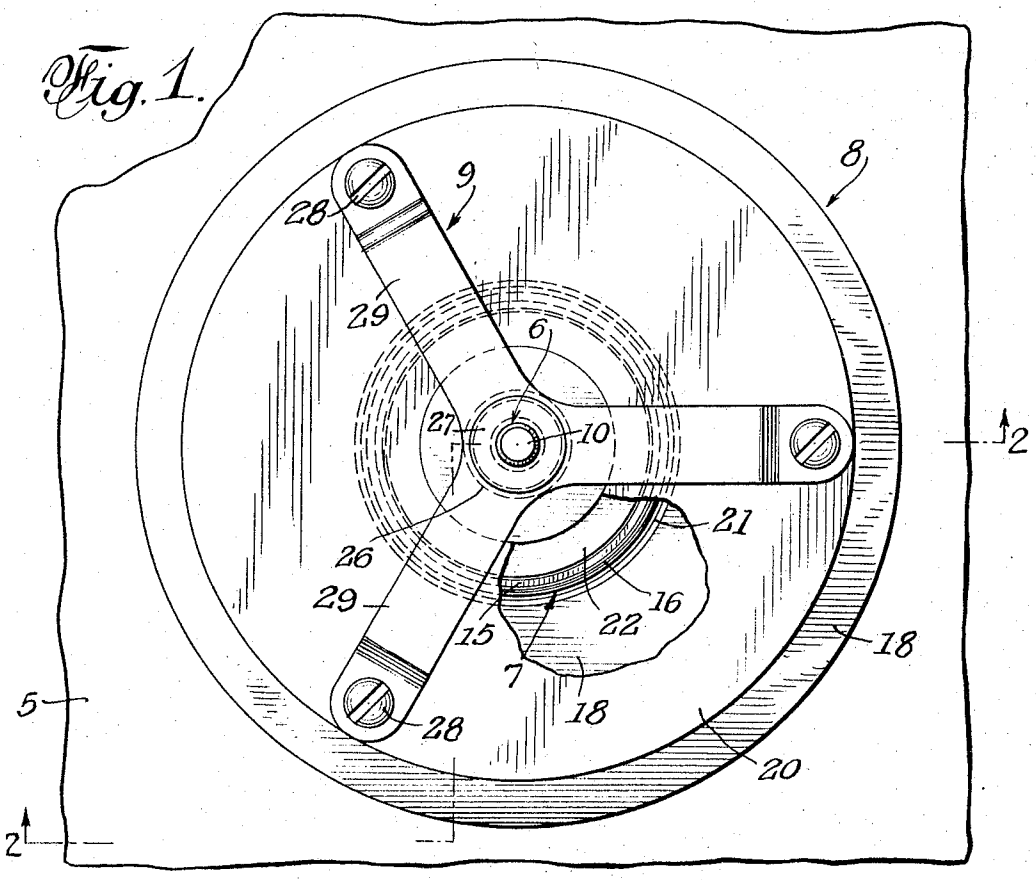
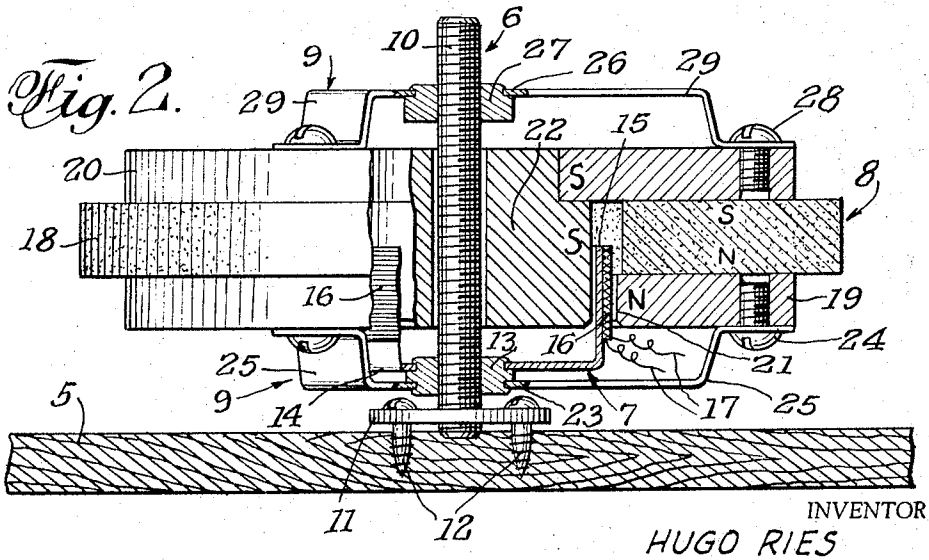


Fig. 2.



INVENTOR

HUGO RIES

BY

Hyman Jackman

ATTORNEY

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AUDIO TRANSDUCER

Hugo Ries, Los Angeles, Calif., assignor of one-half to Alan A. Allen, Los Angeles, and one-half to Harry Z. Marx, La Jolla, Calif.

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ABSTRACT OF THE DISCLOSURE

A sound-producing device having a post adapted to be rigidly affixed, by one end, to a sounding board, a voice coil mounted on said board, a permanent magnet assembly coaxial with the coil with one pole piece around and on the outside of the coil and a second pole piece within the coil, the post extending through a clearance hole in the latter pole piece, and means resiliently mounting the magnet on the post.

This invention relates to an audio transducer for producing sound in a sounding board member on which the transducer is mounted.

An object of the present invention is to provide a transducer that converts the electrical impulses received from a sound head or similar source into dynamic movement of a coil unit, the movement of the latter imparting conforming vibration to a post on which the transducer is mounted and which, in turn, is affixed to the sounding board member. The latter, thereby, produces sound translated from said electric impulses.

Another object of the invention is to provide a transducer in which the mass of the magnetic components thereof has inertia that causes a reactive vibratory movement in the post on which the same is mounted.

A further object of the invention is to provide an audio transducer, as above characterized, provided with a resilient interconnection between the post and magnetic components through which the vibratory drive of the post is effected.

This invention also has for its objects to provide such means that are positive in operation, convenient in use, easily installed in a working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description, and which is based on the accompanying drawing. However, said drawing merely shows, and the following description merely describes, one embodiment of the present invention, which is given by way of illustration or example only.

In the drawing, like reference characters designate similar parts in the several views.

FIG. 1 is a top plan view, partly broken, of an audio transducer according to the present invention.

FIG. 2 is a cross-sectional view as taken on the line 2—2 of FIG. 1.

The audio transducer of the present invention is shown as mounted on a sounding board member **5** which may be of any suitable material, as wood, plastic or metal, so long as the same is capable of sound-producing vibration.

The present transducer comprises, generally, a mounting post **6** that is affixed to the member **5**, a coil unit **7** carried by the post **6**, a permanent magnet assembly **8**, and oppositely arranged resilient means **9** mounting said assembly **8** on the post **6**.

The post **6** is shown as an externally threaded rod **10** of a diametral size to be inflexible. Said rod is preferably

made of brass or other non-magnetic material. A plate **11** is shown as threadedly connected to one end of said rod **10**, suitable screws or other fastener elements **12** connecting said plate to the sounding board **5**. This arrangement of rod, plate and sounding board provides for said end of the rod being directed toward the sounding board and enabling a tight and preferably recessed or indented engagement of the rod with the sounding board, merely by turning the rod so the threads thereof tighten in the plate **11**. The above describes an exemplary manner of rigidly affixing the post **6** to the sounding board **5**.

The coil unit **7** is mounted on the rod **10** of the post **6**, a nut **13** threadedly engaged with the rod being provided for effecting longitudinal adjustment of said unit on the rod. Said unit **7** is shown as a non-magnetic cup **14** that is staked to the nut **13** and has a cylindrical outer wall **15** concentric with the axis of said rod, and a voice coil **16** wound on said wall **15**. Said coil, in the usual manner, has conductor leads **17** that connect to a sound head or other such device. It will be understood that electro-magnetic impulses are brought to the coil by said leads **17**.

The permanent magnet assembly is shown as a ring permanent magnet **18** preferably of the ceramic-alloy type typically having opposite polarity at the outer and inner circumferential portions thereof. Such poles are indicated on magnet **18** in FIG. 2. Opposite ring-shaped, soft iron pole pieces **19** and **20** are applied to the opposite side faces of the magnet **18**, thereby producing an assembly in which the magnet and pole pieces form a three-layer arrangement, clearly shown in FIG. 2. The inner peripheral surface **21** of the pole piece **19** is larger than the outer peripheral surface of the coil **16**, providing a gap between said surfaces, as shown. The pole piece **20** is provided at its central part with a projecting pole **22** that extends into the interior of the wall **15** of the cup **14** with an annular gap between said pole **22** and said cup wall. The rod **10** extends through a clearance hole in the pole **22**.

It will be seen that the coil **16** is disposed in the magnetic field between the pole piece **19** and the pole **22** and that the non-magnetic cup **14** serves only as a carrier for the coil, having no magnetic effect on the field, as above described.

The resilient mounting means **9** is shown as a three-armed, non-magnetic, flexible spider **23** staked at its center to the nut **13** and connected to the pole piece **19** by screws **24** that fasten the ends of the spider arms **25** to the outer portion of said pole piece, and a similar three-armed, non-magnetic, flexible spider **26** staked at its center to a nut **27** on the rod **10** and connected to the pole piece **20** by screws **28** that fasten the ends of the spider arms **29** to the outer portion of said latter pole piece.

In the above manner, the magnet assembly is resiliently carried by the post **6**, the latter vibrating, due to impulses of the voice coil, relative to the mass of the magnet assembly, the latter, by reaction, moving on its resilient connection **9** with the post **6**.

The amount of the relative reaction movements of the magnet assembly **8** and post **6** may be regulated by first mounting the magnet assembly on the post **6** by means of the spider **23**, and then, when applying the spider **26** to said post and before applying the screws **28**, setting said spider on the post **6** relative to the spider **23**, so as to inwardly flex the respective arms **25** and **29**, as desired, and accordingly increasing or decreasing the resilience of the magnet mount. The greater the flexure of the spiders, the higher the pitch of the sound produced in the sounding board **5**. Such change in resilience of the spider arms may also be effected by locating the nut **27** in such spaced relation to the magnet assembly **8** that it will be necessary to flex the arms thereof toward the pole piece **20** before the

screws can be applied. The spider arms 25 and 29 will thus be flexed oppositely outwardly from their inward flexure, as above described.

Regardless how flexed, the mounting spiders may be set to control pitch of the sound produced by the vibrating member 5.

While the foregoing has illustrated and described what is now contemplated to be the best mode of carrying out the invention, the construction is, of course, subject to modification without departing from the spirit and scope of the invention. Therefore, it is not desired to restrict the invention to the particular form of construction illustrated and described, but to cover all modifications that may fall within the scope of the appended claims.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. An audio transducer comprising,
   (a) a post adapted to be fixedly engaged by one end to a sounding board,
   (b) an annular voice coil coaxially carried by said post and spaced radially therefrom,
   (c) a permanent magnet assembly having one pole piece coaxial with said voice coil and spaced radially outwardly therefrom and a second pole piece radially spaced from and within said annular voice coil, and
   (d) a first resilient flexible mounting means on said post resiliently supporting said one pole piece,
   (e) a second resilient flexible mounting means on said post spaced axially from said first mounting means, resiliently supporting said second pole piece,
   (f) the second pole piece having an axial bore therethrough and the post extending freely through said bore and out of contact with the bore wall, said post and magnet assembly having relative vibratory reaction movements in response to electrical impulses in said coil.

2. An audio transducer according to claim 1 in which an annular space is provided between the pole pieces, and a cup of non-magnetic material mounts the coil on the post in said annular space with gaps separating said coil from the pole pieces.

3. An audio transducer according to claim 1 in which each flexible mounting means comprises a non-magnetic spider member with radial flexible arms.

4. An audio transducer according to claim 1 in which means are interposed between the flexible mounting means and the post and adjustably engaged with the post to adjust the degree of flexure of the flexible mounting means.

5. An audio transducer comprising:
   (a) an axial member adapted to be fixedly engaged at one end to a sounding board,
   (b) a voice coil concentrically carried by said member and radially spaced therefrom,
   (c) a permanent magnet with one pole around and on the outside of the voice coil and the other pole thereof within said coil, said magnet between its poles being disposed along the axis of said axial member and along said axis at a position beyond the coil with respect to the point of engagement of the axial member with the sounding board, and
   (d) resilient means extending from said axial member and having peripheral portions engaged with and mounting said magnet,
   (e) the axial member and the magnet having relative reaction movements in response to electrical impulses in the coil,
   (f) said axial member serving as the sole support for said magnet and voice coil.

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KATHLEEN H. CLAFFY, *Primary Examiner.*

A. A. McGILL, *Assistant Examiner.*