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S. B. COLLINS

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TRANSDUCER

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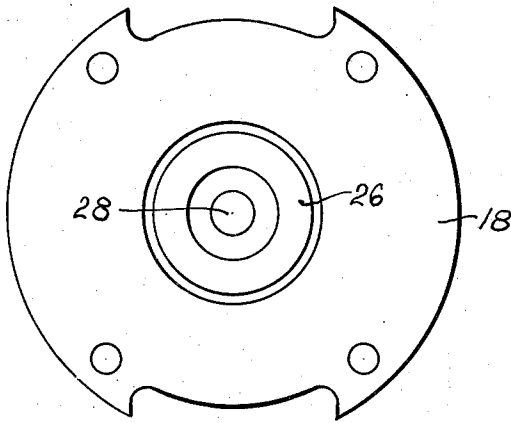


FIG. 2

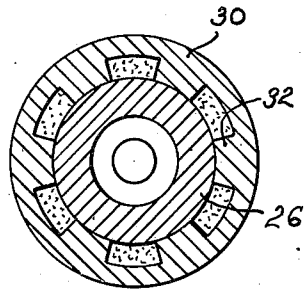


FIG. 3

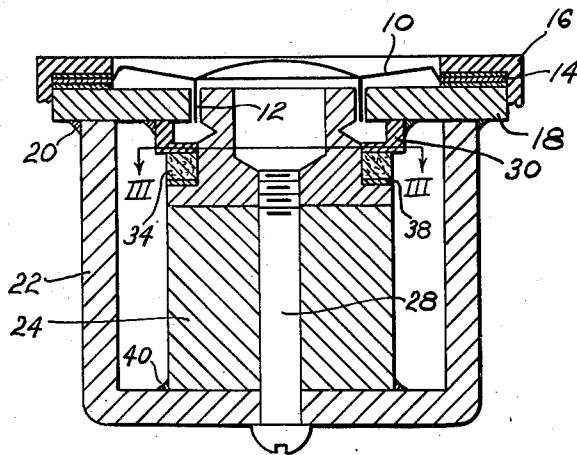


FIG. 1

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This invention relates to transducers, and, more particularly, is concerned with improvements in dynamic-type microphones and loud speakers.

Dynamic-type transducers, including microphones and loud speakers, are old and well known, and have been employed in many capacities. However, it has always been a problem to construct apparatus of this type so that the parts could be readily assembled, or disassembled for repair. Furthermore, so far as I am aware, no one has ever provided means for positively holding the pole pieces of a dynamic type transducer in accurate alignment with each other in a structure which can be readily assembled and disassembled. As a result, operation failures of dynamic transducers have occurred when the transducer is subjected to shocks or jars usually because the pole pieces move out of alignment and prevent free movement of the voice coil therebetween.

It is the general object of my invention to avoid and overcome the foregoing and other difficulties of and objections to known transducers by the provision of an improved, readily assembled and disassembled dynamic transducer in which the pole pieces are held in accurate alignment even under the most severe jars and impacts.

Another object of my invention is the provision of an improved transducer of the type described which is relatively inexpensive to manufacture, and in which maintenance and repair are substantially eliminated.

The foregoing objects of my invention, and other objects which will become apparent as the description proceeds, are achieved by the provision of a transducer assembly including a diaphragm, a helical coil carried by the diaphragm, a magnet, a pole piece carried by one end of the magnet and extending inside of the coil, a pole piece carried by the other end of the magnet and extending to a position to surround the outside of the coil, and non-magnetic means extending between the pole pieces and holding them in fixed alignment with each other.

For a better understanding of my invention reference should be had to the accompanying drawing in which Fig. 1 is a vertical cross sectional view of one embodiment of an improved transducer incorporating the principles of my invention; Fig. 2 is a plan view of the transducer illustrated in Fig. 1 with the diaphragm and clamp ring removed; and Fig. 3 is a horizontal cross sectional view taken substantially on line III—III of Fig. 2.

Although the principles of my invention are broadly applicable to the production of transducers of various types and characters, they are

particularly applicable to the construction of a dynamic-type microphone which may be subject to particularly severe jars as occasioned, for example, by dropping the microphone. Accordingly, I have elected to illustrate my invention, and I will so describe it, in conjunction with a dynamic-type microphone.

More particularly, and having reference to the drawing, the numeral 10 indicates a flexible diaphragm supporting a helical coil of wire 12, usually called the voice coil. The edge of the diaphragm 10 is normally supported by a plurality of insulating washers 14 clamped together by a ring 16 which is ordinarily secured by suitable means to the casing (not shown) of the microphone.

The ring 16 also serves to hold the diaphragm 10 in fixed relation to a disc 18 of magnetic material which serves as a pole piece and which is provided with a central opening closely receiving and surrounding the coil 12 but not interfering with the free movement of the coil and diaphragm 10. Thus, the disc 18 comprises the outside pole piece. Secured to the pole piece disc 18, as by brazing or welding 20 is a U-shaped pole frame 22.

The pole frame 22 receives a magnet, ordinarily of the permanent slug type, as indicated by the numeral 24. The other end of the magnet 24 supports a pole piece 26 which is adapted to extend freely inside of, but in closely adjacent relation to the coil 12. The inside pole piece 26 is preferably circular in shape so that together with the outside pole piece disc 18 a small ring shaped space is provided for the movement of the coil 12 between oppositely charged pole pieces. Non-magnetic means, such as a brass screw 28, are provided to secure the magnet 24 to the bottom of the base of the pole frame 22 and to simultaneously fasten the inside pole piece 26 in position on the end of the magnet adjacent the diaphragm 10.

In accordance with the principles of my invention, I provide means between the outside pole piece 18 and the inside pole piece 26 to accurately hold the pole pieces in proper alignment at all times even though the microphone is subjected to very severe shock or impact. In the form of my invention illustrated these means comprise a ring 30 of non-magnetic material, for example brass, which is brazed or otherwise fastened to the inside or the bottom of the pole piece disc 18. The ring 30, as best seen in Fig. 3, is provided at its bottom with a plurality of inwardly directed lugs 32 which have a sliding or pressfit with that portion of the inside pole piece 26 just below the end received within the coil 12. To facilitate assembly

the diameter of the end of the inside pole piece 26 received within the coil 12 may be made slightly smaller than the diameter of the portion of the pole piece engaging with the lugs 32.

The non-magnetic ring 30 with associated lugs 32 thereof provides a very rigid support between the inside pole piece 26 and the outside pole piece disc 18 so that even very severe jars do not impair the alignment of the pole pieces or the operation of the microphone. The spaces between the lugs 32 and the ring 30 provides openings for venting out any air tending to be trapped and compressed by the diaphragm 10 during vibrations thereof in the use of the microphone. I provide means for slightly damping the flow of air through the vent openings and also serving to seal off the entire space on the inside of the diaphragm 10 and around the coil 12 so that no dust or other foreign matter will work into this space. This is achieved by the provision of a ring or gasket 34 of felt positioned around the pole piece 26 and immediately beneath and closing the vent openings between the lugs 32. The gasket ring 34 of felt is received upon a shoulder formed on the pole piece 26, and the assembly may include a paper or other insulating washer 38.

From the foregoing it will be recognized that the various objects of my invention have been achieved by the provision of relatively simple and inexpensive apparatus of the dynamic transducer type. My improved apparatus can take without operation failure very severe knocking around and the inside and outside pole pieces are at all times accurately and positively aligned with each other. This is achieved without any sacrifice in the ease of assembly or disassembly of parts. For example, in the assembly of the parts the U-shaped pole frame 22 is first welded, brazed or otherwise fastened to the pole piece 18, and, thereafter, the ring 30 is brazed or fastened in properly aligned relation on the bottom of the pole piece disc 18. Sometimes, it is more convenient to secure the ring 30 to the pole piece disc 18 prior to fastening the U-shaped pole frame 22 thereto. In any event, it is thereafter a simple matter to position the felt gasket 34 and insulating washer 38 over the inside pole piece 26 and to drop or move the inside pole piece into the ring 30 until the lugs 32 engage with the portion of the pole piece 26 immediately below that actually extending inside of the coil 12. Now the magnet 24 is slipped laterally into the U-shaped pole frame 22 between the flat base of the frame and the inside pole piece 26 and the screw 28 is passed through suitable holes in the bottom of the pole frame 22 and in the magnet 24 and is screwed into a tapped opening in the inside pole piece 26 so as to secure the entire pole piece assembly and magnet together. The diaphragm 10, coil 12, washers 14, and ring 16 are incorporated in the assembly when the assembly is mounted in the microphone case. The disassembling operation is just as simple as the assembling operation

and is merely the reverse of the procedure just described. Preferably, I provide an additional locking of the base of the magnet 24 with respect to the U-shaped pole frame 22 by the use of cellulose cement or other suitable means, such as indicated by the numeral 40, and I may even dip the screw 28 in a suitable cement before the assembly operation so that after the screw 28 has been fastened in place and the cement has set the entire assembly is of particularly rigid and rugged character.

While in accordance with the patent statutes, I have in detail illustrated and described one embodiment of my invention, it is to be particularly understood that I am not to be limited thereto or thereby, but that the scope of my invention is defined in the appended claims.

I claim:

1. In a dynamic type transducer, a diaphragm, a voice coil carried by the diaphragm, a permanent magnet, an inside pole piece carried by one end of the magnet, said pole piece having a portion of reduced diameter extending inside of the voice coil, and a portion adjacent the magnet of substantially the diameter of the magnet and providing a shoulder, an outside pole piece carried by the other end of the magnet and extending to a position surrounding the outside of the voice coil, non-magnetic means braced to the outside pole piece and extending into engagement with the reduced diameter of the inside piece and spaced from the shoulder thereof, said means holding the pole pieces in fixed alignment with each other, said non-magnetic means having air vent openings associated therewith, and a felt washer positioned between the non-magnetic means and the shoulder of the inside pole piece for damping the flow of air through the air vent openings.

2. In a dynamic type transducer, a diaphragm, a voice coil carried by the diaphragm, a permanent magnet, an inside pole piece carried by one end of the magnet, said pole piece having a portion of reduced diameter extending inside of the voice coil, and a portion adjacent the magnet of substantially the diameter of the magnet and providing a shoulder, an outside pole piece carried by the other end of the magnet and extending to a position surrounding the outside of the voice coil, non-magnetic screw means securing the inside and outside pole pieces to the magnet, cement for locking the screw means in position, non-magnetic means fastened to the outside pole piece and extending into supporting engagement with the reduced diameter of the inside pole piece and spaced from the shoulder thereof, said last-named non-magnetic means having accurately-shaped air vent openings one wall of which is defined by the inside pole piece, and a felt washer positioned between the last-named non-magnetic means and the shoulder for damping the flow of air through the air vent openings.

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