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R. K. DUNCAN
 MEANS FOR PREVENTING INFILTRATION OF MAGNETIC
 DIRT PARTICLES INTO THE AIR GAP BETWEEN
 POLES OF MICROPHONE MAGNETIC STRUCTURES
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Fig. 1.

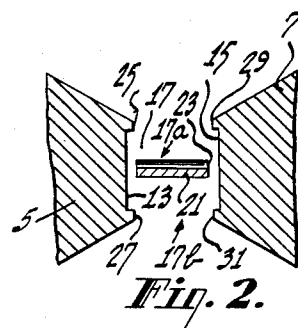
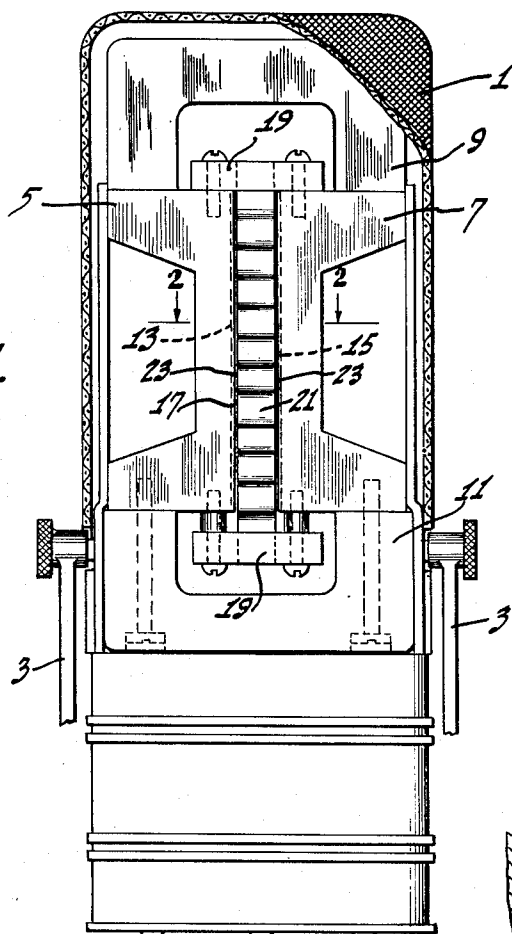


Fig. 2.

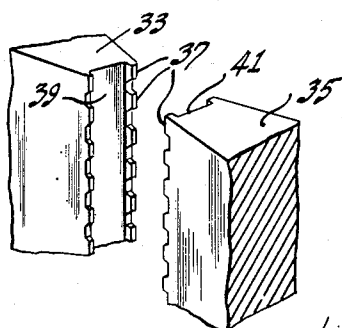


Fig. 3.

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MEANS FOR PREVENTING INFILTRATION OF
MAGNETIC DIRT PARTICLES INTO THE
AIR GAP BETWEEN POLES OF MICRO-
PHONE MAGNETIC STRUCTURESRobert K. Duncan, Mount Ephraim, N. J., as-
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1 Claim. (Cl. 179—115.5)

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This invention relates to magnetic structures for use in signal translating apparatus, and more particularly to a means for preventing magnetic dirt particles from interfering with the operation of such apparatus.

The prevention of magnetic dirt particles from accumulating on the magnetic structures of sound translating devices and thereby interfering with the normal and efficient operation thereof has always been a problem. This is particularly true in the case of sound translating instruments wherein a ribbon type diaphragm is used. In such cases, the space between the edges of the ribbon and the pole faces defining the air gap is extremely small, so that even a small particle of dirt will cause substantial interference should it become lodged between the ribbon and one of the pole faces. The methods of preventing the infiltration of magnetic dirt particles employed in present day sound translating devices are primarily directed to providing screens of various kinds around the parts to be protected. Screens, for the most part, are sufficient for protecting most devices when used under average conditions. However, they are not thoroughly dependable nor efficient, particularly in cases of exceptionally dirty atmosphere.

The interference of dirt with the ribbon diaphragm is of a mechanical nature; that is, the particles of dirt prohibit the motion of the ribbon by mechanical interference. In the conventional velocity type microphone, the pole pieces have flat pole faces disposed in spaced parallel relation to provide an air gap therebetween. Magnetic flux supplied to the pole pieces will be found to be evenly distributed along the pole faces and consequently the magnetic reluctance of the air gap is uniform throughout. Under these conditions, it is found that magnetic particles of dirt usually collect first along the edges defining the pole faces along the outside of the air gap, and then, from external agitation, vibration, or shock, these particles will slide along the pole faces until they reach the narrow spaces between the edges of the ribbon and the pole faces where they will collect and interfere with the normal movement and operation of the ribbon.

It is therefore, the primary object of my invention to provide an improved magnetic structure which will prevent the infiltration of magnetic dirt particles into the air gap between the poles of the magnetic structure.

It is also an object of my invention to provide an improved magnetic structure for dynamic sound translating devices which will prevent

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magnetic dirt particles from interfering with the normal movement and operation of the ribbon diaphragm or other similar vibratory conductor.

It is another object of my invention to provide a magnetic structure for sound translating devices which will have a stronger magnetic flux density at the edges of the pole faces than elsewhere between the pole faces.

It is also an object of my invention to provide a magnetic structure for sound translating devices which will be of simple construction and highly efficient in use for its intended purpose.

I have found that by increasing the flux density along the outer edges defining the pole faces, which may be accomplished by decreasing the magnetic reluctance in the air gap between opposed outer edges, magnetic dirt particles will have a tendency to collect along these outer edges and will not creep or slide along the pole faces and interfere with the functioning of the ribbon.

In accordance with my invention, I provide extensions or ridges substantially perpendicular to the pole faces along the outer edges thereof. Because of the increased magnetic density along the edges due to the ridges, magnetic dirt particles tending to enter the air gap will be attracted to and collected along these extensions or ridges, and thus will be prevented largely from entering further into the air gap to interfere with the normal operation and movement of the ribbon diaphragm.

The novel features characteristic of my invention, as well as additional objects and advantages thereof, will be better understood from the following detailed description of two embodiments thereof when read in connection with the accompanying drawings, in which

Figure 1 is a front elevation view of a velocity microphone in accordance with my invention, the outer protective covering thereof being shown partly broken away,

Figure 2 is an enlarged, fragmentary, cross-section view of a portion of the pole pieces shown in Figure 1, taken on the line 2—2, and

Figure 3 is a perspective view of a portion of a modified pair of pole pieces in accordance with my present invention.

Referring more particularly to the drawing, my present invention is shown applied to sound translating apparatus, preferably in the form of a velocity type microphone 1, illustrated by Figure 1 of the drawing. The microphone 1 is mounted on an appropriate support 3 and comprises a pair of pole pieces 5, 7 of magnetic material on the ends of which are secured a pair of

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U-shaped magnets 9, 11 for providing a suitable magnetic field. The pole pieces 5, 7 are provided with substantially flat pole faces 13, 15, respectively, which extend longitudinally thereof. The pole pieces are arranged in spaced, parallel relation to provide an air gap 17 between them and with their pole faces 13, 15 disposed on opposite sides of the air gap. Movably supported in the air gap 17 by terminal strips 19 is a corrugated ribbon diaphragm 21 having its longitudinal edges 23 in closely spaced relation to the pole faces 13, 15.

In the modification illustrated in Figs. 1 and 2, the pole pieces are provided with small extensions or ridges 25, 27, 29, 31 along the longitudinal edges of the pole faces. As seen in Fig. 2 of the drawing, the ridges extend substantially perpendicular to the pole faces and provide narrow air gaps 17a and 17b of lower magnetic reluctance than the main air gap 17 defined by those portions of the pole faces 13, 15 which lie between the ridges. The size of these ridges must be kept very small in order not to interfere materially with the normal functioning of the ribbon diaphragm 21. On the other hand, only a very small ridge need be provided, inasmuch as it is only necessary to have an increased flux density at the places where it is desired to collect the magnetic dirt particles. In conventional microphones, the pole face designs are sufficiently wide so that the limits of vibratory movement of the ribbon under normal operating conditions are confined within the air gap between the pole faces. The height of the ridges should be rather small in order that the microphone's sensitivity to sound will not be materially weakened because of the increased flux density along the edges of the pole faces. The width of each ridge, however, may vary according to the width of the pole face. For the purpose of illustration, the following nominal values have been found to be satisfactory: air gap width .100 of an inch; width of ribbon .090 of an inch; clearance between each side of the ribbon and the pole face .005 of an inch; height of ridge .003 of an inch; width of pole face .100 of an inch; and width of ridge .003 of an inch. Using these values, it will be recognized that sufficient clearance is provided so that the vibratory limits of movement of the ribbon diaphragm will not be interfered with. While there may be a slight loss in microphone sensitivity, due to the ribbon operating in a magnetic field of slightly lower flux density than that of conventional structures, this loss is comparatively negligible and is more than compensated for through increased life and longer use of the microphone, particularly in an atmosphere abundant in dirt particles.

In Fig. 3, there is shown a modified form of my present invention. The microphone structure is essentially the same as that shown in Figs. 1 and 2, differing only in the construction

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of the pole pieces. In place of ridges which extend throughout the length of the edges defining the pole faces, I provide a pair of pole pieces 33, 35 with a plurality of spaced apart ridges 37 along the edges defining the pole faces 39, 41. This construction will not increase the flux density along the edges of the pole faces as much as in the modification shown by Figs. 1 and 2, and consequently it will reduce the loss in microphone sensitivity.

While I have illustrated but two modifications of my present invention, it will be recognized by those persons skilled in the art that other modifications and changes will readily suggest themselves, and that the improved magnet structure may be applied to magnetic devices other than the velocity microphone described and shown herein. Therefore, I desire that the particular form of my invention described herein shall be considered as illustrative and not as limiting.

What is claimed is:

In a microphone, a vibratile member, a magnet structure comprising a pair of elongated pole pieces having pole faces disposed in spaced parallel relation to each other and providing an air gap therebetween for cooperation with said vibratile member, means to support said vibratile member for movement in said air gap in response to sound waves impinging thereon, magnet means connected to said pole pieces providing a magnetic field across said air gap, said vibratile member being disposed in closely spaced relation to said pole faces, a plurality of spaced ridges extending from each pole piece face along each side of said air gap for decreasing the reluctance of the magnetic path between the pole faces along the outer edges of said pole faces, said decrease in reluctance being substantially independent of the reluctance in said air gap cooperating with said vibratile member, said decrease in reluctance providing that magnetic particles tending to enter said air gap and obstruct vibratory movement of said member are subject to an outer zone of increased magnetic strength where they will be collected along said outer edges and prevented substantially from entering said air gap.

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