Sept. 23, 1941. J. P. QUAM 2,256,689

AIR GAP SHIELD FOR LOUD-SPEAKERS

Filed June 17, 1939

Fig. 1.

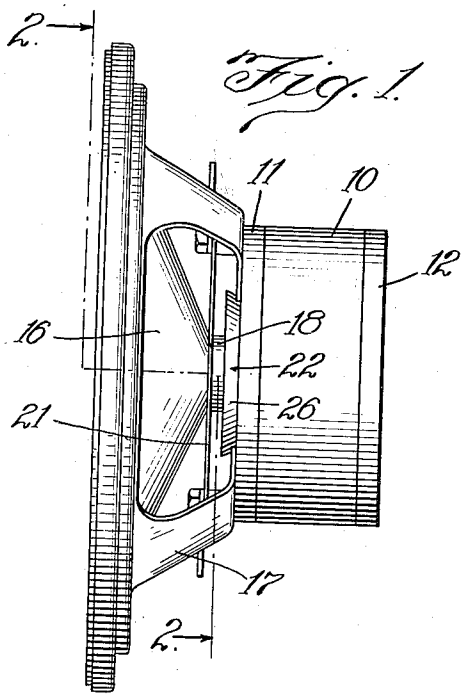


Fig. 3.

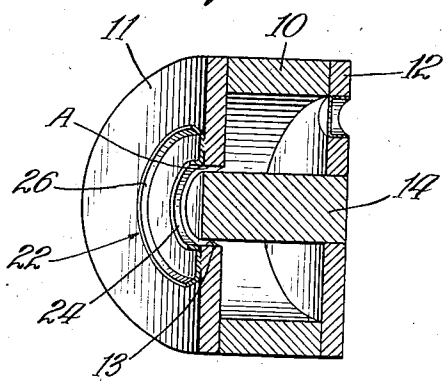
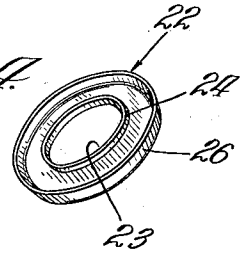


Fig. 4.



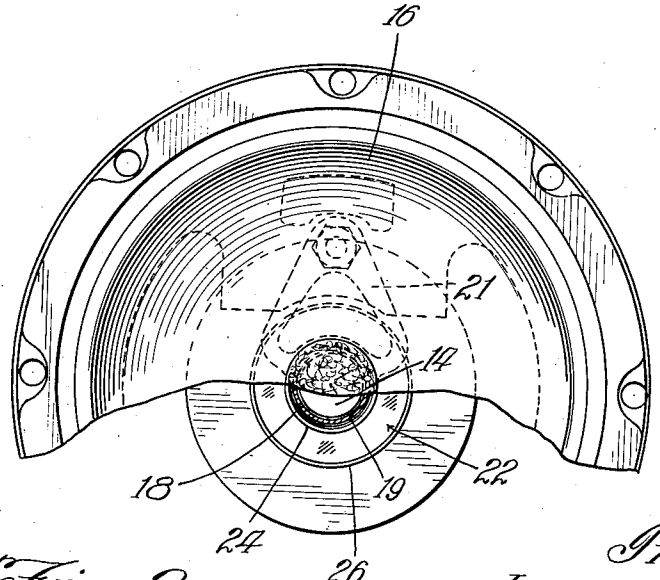


Fig. 2.

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Patented Sept. 23, 1941 2,256,689

UNITED STATES PATENT OFFICE

2,256,689

AIR GAP SHIELD FOR LOUD-SPEAKERS

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Application June 17, 1939, Serial No. 279,694

1 Claim. (Cl. 179—115.5)

My invention relates in general to loud speakers and more in particular to a shield for impeding the movement of foreign magnetic materials into the air gap of a permanent magnet dynamic loud speaker. The shield has been satisfactorily applied in a commercial embodiment of the invention to the loud speaker of my co-pending application, Serial No. 215,484.

In a loud speaker employing a movable voice coil, it is desirable to provide an air gap which is just wide enough to permit the movement of a voice coil therein without rubbing on the pole piece structure defining the inside and outside edges of the air gap. The narrow air gap is desirable because the more narrow the air gap the greater the magnetic field at the air gap to move the voice coil therein. With a narrow air gap foreign particles which move into the air gap from outside the magnet structure may impede the movement of the voice coil so as to affect the operation of the speaker. Although it is desirable to prevent the introduction of all foreign particles into the air gap, those which cause the greatest trouble in permanent magnet speakers are particles of magnetic material which move into the air gap and are retained therein by the permanent magnet pole-piece structure. The introduction of such undesirable foreign material into the air gap in the past has generally been prevented by the use of a yieldable member supplied in cloth, felt, or paper, which was secured to the moving portion of the speaker such as the spider for the voice coil, or the diaphragm and to the outer pole piece to substantially cover the air gap. This structure, however, was expensive and added to the mass of the moving portion of the speaker, so that the inertia of such moving portion was increased to cause a loss in operating efficiency. Furthermore, not only was the original cost for such foreign-material-proofing structure high in respect to material and labor, but this structure increased the cost of repairing a loud speaker in the event that it was necessary to remove the diaphragm, voice coil, and spider.

An object of the present invention is to provide an improved loud speaker.

A further object of my invention is to provide an improved dynamic loud speaker.

Another object of my invention is to provide an effective, sturdy, and simplified shield to impede the movement of foreign particles into the air gap of a loud speaker.

It is also an object of my invention, to provide a magnetic shield for the air gap of a dynamic speaker to particularly prevent the introduction therein of magnetic particles.

A still further object of my invention is to provide a shield which will impede the movement of foreign particles into the air gap of a dynamic speaker from the outside thereof, but with such shield, being entirely independent of the moving portion of the speaker and not in any way adding to the mass thereof.

A feature of my invention is the provision of magnetic means for preventing the introduction of foreign magnetic particles into the air gap of a loud speaker which does not in any way require useful magnetic flux for its energization.

Other objects and features of my invention will be apparent from the following description taken with the drawing in which:

Fig. 1 is a side elevation of a complete loud speaker embodying my invention.

Fig. 2 is an enlarged fragmentary front elevation view taken approximately on the line 2—2 of Fig. 1.

Fig. 3 is a vertical sectional view of the magnet portion of the loud speaker having the magnetic shield secured thereto.

Fig. 4 is a detail view in perspective of the magnetic shield.

In practicing my invention, I provide a member of magnetizable material for securing to the magnet portion of a loud speaker adjacent the air gap for such speaker, and being provided in such shape and of such a size that it normally surrounds the air gap in a manner to impede the movement of undesired foreign material into the air gap. Such member of magnetizable material, in one commercial embodiment of the invention is provided in a stamped-out one-piece member having raised portions thereon to act as physical barriers to the movement of foreign particles and to generally increase the effective exposed area of the shield. Although the member acts primarily to impede the movement of undesired magnetic materials into the air gap, it may be conveniently designated as a dust shield for the air gap of a loud speaker. When the dust shield is secured to the outside of the speaker magnet structure, it is magnetized by the contact and acts in turn to attract to and retain thereon foreign magnetic material so that it will not get into the air gap to interfere with the operation of the voice coil therein.

Referring now to the drawing, a complete permanent magnet dynamic loud speaker is illustrated in Fig. 1 and includes a permanent magnet structure comprising a ring 10, with plates 11

and 12 secured thereto. These three members are all of permanent magnet material, and when secured together, form the so-called "pot" for the speaker. Plate 11, as shown in Fig. 3, is provided with a central opening 13 and extending therein is a core or inner pole piece 14, which in turn is rigidly secured in a corresponding aperture in the magnet plate 12. The movable diaphragm 16 of the loud speaker is secured in the usual manner to a diaphragm frame 17 or "basket" which is welded to the face of the magnet plate 11 in a position centered with reference to the aperture 13. A voice coil is secured to the apex of the diaphragm 16 and includes a paper form 18 (Fig. 2) with a wire coil 19 wound thereon. The voice coil moves in an annular air gap A defined on the outside by the edge of the aperture 13 in the magnet plate 11 and on the inside by the cylindrical surface of the core 14 as is shown clearly in Figs. 2 and 3.

A magnetic field is permanently maintained at the air gap and the strength of such field is inversely proportional to the square of the width of the air gap, so that it is desirable to have this air gap as narrow as possible. As a result, the air gap is normally of a width such that the voice coil will conveniently move in a direction parallel to the axis of the core 14 just out of engagement with both sides of the gap. A spider 21 of yieldable insulating material is secured to the diaphragm or voice coil substantially at the juncture of the two to maintain the voice coil centered in the air gap.

Because of the danger of foreign material getting into a narrow air gap and interfering with the movement of the voice coil therein, air-gaps in dynamic loud speakers have in the past often been wider than they should be for the most efficient operation of the speaker. As a result of my invention as disclosed in the copending application previously noted, I have substantially eliminated the possibility of undesirable foreign material getting into the air gap from the inside of the "pot," and as stated above, fabric dust caps have been secured over the air-gaps in such speakers to prevent entrance from the outside. However, as mentioned, such dust caps add to the mass of the moving portion of the speaker and are expensive.

Ordinary dust having no magnetic material in it is normally blown out of the air gap simply by the propulsion of the diaphragm and voice coil in the operation of the same so that this is not serious. However, foreign particles of magnetic material which move or fall into the air gap remain therein on the permanently magnetized pole structure and may seriously impede the movement of the voice coil. Fig. 4 illustrates in detail a shield of magnetizable material for attracting to and retaining thereon foreign particles of magnetic material so that such particles will not get into the air gap A from the outside. The shield is secured to the magnet plate 11 surrounding the air gap A and becomes magnetized by virtue of its contact therewith. The illustrated shield 22 comprises a piece of magnetizable sheet metal which is blanked and formed to provide an annular opening 23 for surrounding the air gap A, with a substantially right-angled rim 24 defining the edge of the opening 23, and a similar rim 26 at the circumference of the shield. The shield is magnetized by leakage flux from the air gap. Utilizing leakage flux for magnetizing the shield causes no additional loss in the magnetic flux at the air gap and hence no loss in operating power by virtue of the use of the shield. It is to be understood also that in practicing my invention I may provide the shield in material which is permanently magnetized independently of the permanent magnetization it acquires by being mounted on the permanent magnet of the speaker. The rims 24 and 26 increase the effective magnetized area of the shield and provide not only a physical barrier to the movement of undesired magnetic material into the air gap, but also a magnetic barrier. The rims operating as a double physical barrier, so to speak, to the movement of magnetic particles across the plate 11, are important inasmuch as continuous jarring of a speaker in transit or the like may cause movement even over a magnetized surface, but it is substantially impossible to jar particles past the rims or raised portions.

In manufacturing the complete speaker the magnet pole structure is normally welded together, with the basket 17 being welded to the plate 11 either before or after welding the plate 11 to the ring 10. Either before or after welding the basket to the plate 11, the shield 22 is centered with reference to the aperture 13, or the air gap A and is welded to the plate 11. When the entire metal frame structure is complete it is immersed in a paint bath and processed as described in my copending application mentioned above. This substantially eliminates the possibility of foreign magnetic material from getting into the air gap from the inside. After this the diaphragm, voice coil, and spider are assembled onto the frame. The shield 22 becomes magnetized whenever the magnet structure of the speaker is magnetized and is immediately effective.

The shield 22 has no physical connection with the moving portion of the speaker so that it does not in any way add to the mass of the moving portion and hence reduce the operating efficiency thereof. Furthermore, the shield itself is sturdy and simple and represents a very small cost so far as material and labor is concerned. The shield 22 is not subject to atmospheric conditions such as the fabric dust-proof shield of the prior art. Because of its position on the speaker frame structure out of contact with the moving portion, and because of its imperviousness to injury, the use of the shield 22 reduces the cost of any repair of the speaker which would necessitate the removal of the diaphragm, voice coil and spider.

Although my invention has been illustrated in its preferred embodiment, it is understood that it is not limited thereby, but the invention is limited only by the scope of the appended claim.

I claim:

In a loud speaker including a pole piece having an annular aperture therein with the annular wall of said aperture forming one wall of the annular air gap in said speaker, and a member movable in said annular air gap, means for arresting the movement of foreign material into said annular air gap including a magnetizable member mounted on said pole piece adjacent the annular air gap, said magnetizable member comprising an annular body portion having an annular ring on the inside circumference and an annular ring on the outside circumference thereof, said annular rings acting magnetically and physically to arrest the movement of foreign particles over the pole piece toward the air gap.

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