Nov. 8, 1966 C. L. FENDER 3,284,581

LOUD SPEAKER CONSTRUCTION

Filed June 3, 1963 2 Sheets-Sheet 1

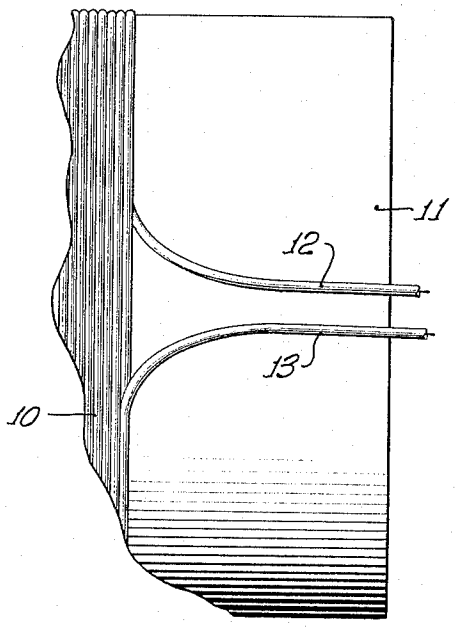


FIG. 1.

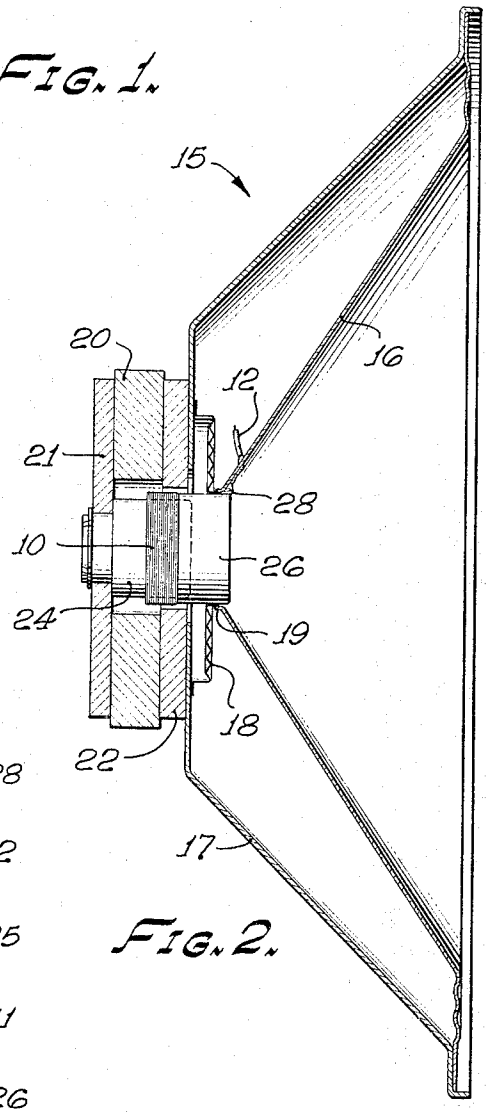


FIG. 2.

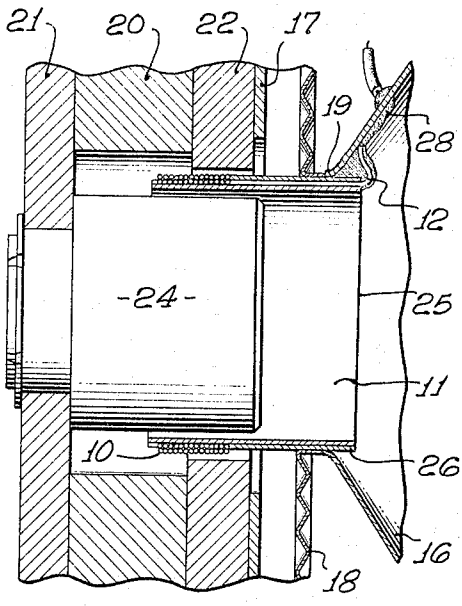


FIG. 3.

CLARENCE L. FENDER
INVENTOR.

BY Jaeckwitz & Carr

ATTORNEYS.

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LOUD SPEAKER CONSTRUCTION

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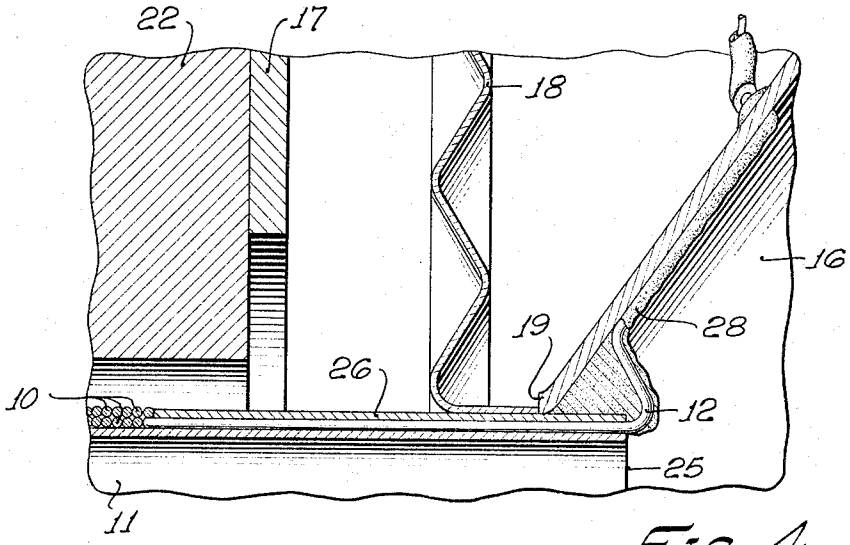


FIG. 4.

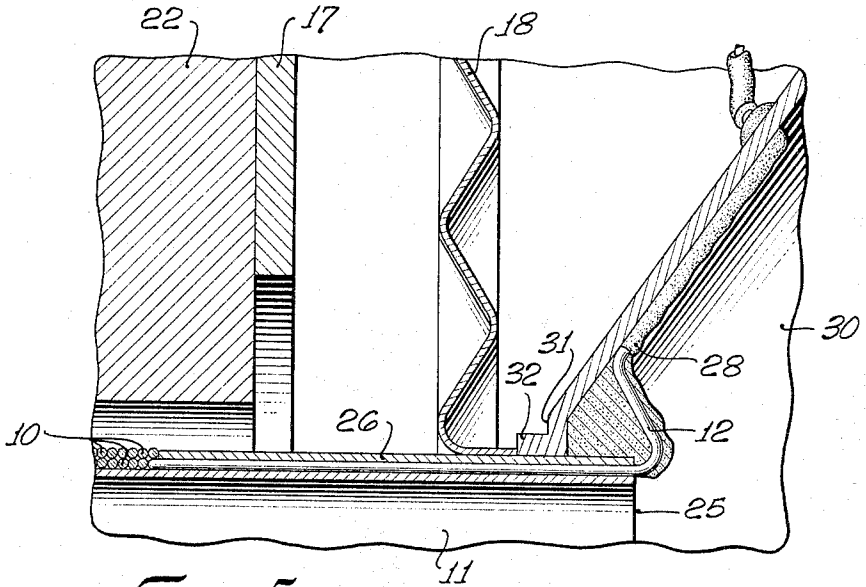


FIG. 5.

CLARENCE L. FENDER
INVENTOR.

BY Jonsewitz & Carr
ATTORNEYS.

United States Patent Office

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LOUD SPEAKER CONSTRUCTION

Clarence L. Fender, Fullerton, Calif., assignor, by mesne assignments, to Columbia Broadcasting System, Inc., New York, N.Y., a corporation of New York

Filed June 3, 1963, Ser. No. 284,905
6 Claims. (Cl. 179—115.5)

This invention pertains to loud speakers and, more particularly, to an arrangement for protecting the leads of a speaker coil.

The usual loud speaker includes a voic coil of relatively fine wire wound upon a cylinder located at the apex of the speaker cone. The leads from the coil are brought out along the inner surface of the speaker cone, where they are held with a suitable cement, and pass through the speaker wall for attachment into the amplifier circuit. This type of construction, while accepted as conventional design and nearly universally used, has led to a troublesome problem from breakage of the coil leads. The vibration of the speaker diaphragm frequently will cause a fatigue failure of the fine coil fires at the juncture between the coil and the speaker cone. Consequently, after only a short period of service many loud speakers will malfunction from the crystallization and resultant breakage of the coil leads.

The present invention provides a simple, low cost solution to this difficulty, protecting the lead wires so they will not become broken but will remain intact throughout the life of the speaker. This is accomplished by wrapping an external layer of paper over the leads at the forward edge of the coil bobbin, assuring that the leads are not connected directly to the cone surface at its inner periphery. Consequently, the lead wires are not attached at the portion of the speaker cone that is receiving the maximum vibration, and failure from diaphragm vibration is eliminated.

An object of this invention is to provide a loud speaker of durable, long-life construction.

Another object of this invention is to provide a simple, low cost arrangement for precluding breakage of lead wires of the coil of a loud speaker. A further object of this invention is to provide a means for protecting the lead wires of a speaker coil, assuring that they are not attached to the portion of the speaker cone that is vibrated the maximum amount.

These and other objects will become apparent from the following detailed description taken in connection with the accompanying drawings in which:

FIGURE 1 is a fragmentary plan view of a loud speaker coil illustrating the manner in which the lead wires extend therefrom,

FIGURE 2 is an axial sectional view of a complete loud speaker unit manufactured in accordance with this invention,

FIGURE 3 is an enlarged fragmentary sectional view of the central portion of the unit of FIGURE 2,

FIGURE 4 is a further enlarged fragmentary sectional view illustrating the coil lead wire and its attachment to the speaker cone, and

FIGURE 5 is a view similar to FIGURE 4, showing the invention as associated with a slightly modified speaker construction.

With reference to the drawings, there may be seen in FIGURE 1 a portion of a typical loud speaker voice coil construction separated from the remainder of the speaker assembly. This coil unit is defined by a length of wire **10** helically wrapped in two layers, and doubled back on itself at one end portion of a bobbin **11**. The latter member is a thin cylindrical tube, and may be made of relatively light paper having sufficient rigidity to hold its

shape. With the coil **10** being formed from a continuous length of wire, the two leads **12** and **13** may be brought away from one end of the coil across the surface of the bobbin.

The voice coil may be associated with a typical loud speaker **15**, as illustrated in FIGURE 2, being positioned at the apex of the speaker cone **16**. The latter member is mounted within a metal housing **17** that supports the speaker components. The coil is free to move axially but is precluded from appreciable radial movement by a spider **18**. This is a corrugated diaphrgam, the outer edge of which is connected to the housing **17**. The inner edge of the spider **18** meets the inner peripheral flange **19** of the speaker cone **16**, being bonded with that element to the exterior surface of the coil bobbin assembly.

On the rear side of the frame is a permanent magnet **20**, in this instance a ceramic magnet of annular construction, which is mounted between plates **21** and **22**. The plate **21** is of magnetic material and carries a pole piece **24** that extends into the bobbin **11** inwardly of the helically-wrapped coil **10**.

According to the provisions of this invention, as the voice coil unit is manufactured the leads **12** and **13** are positioned on the surface of the bobbin **11** to extend forwardly over the radial edge **25** of the bobbin. Then there is placed around the exterior of the bobbin, covering the leads **12** and **13**, an additional layer of paper **26**. This element may extend from the end of the coil **10** to the outer edge **25** of the bobbin **11**. This means that the leads **12** and **13** must be adjacent the entire length of the bobbin **11**. Consequently, the leads **12** and **13** extend into the interior of the speaker cone to the edge **25** of the bobbin, which is axially forward of the inner edge **19** of the conical speaker diaphragm. From this point, the leads are inclined outwardly to the inner surface of the speaker cone, being bonded to that element by a suitable adhesive substance **28**. After a short distance on the face of the cone, the leads pass through the wall of the element **16** to the rear side, and from there to the circuitry of the unit with which the loud speaker is associated.

The relatively simple provision of the outer layer of paper **26** protects the leads **12** and **13** so that they will not be damaged by the vibration of the speaker cone **16**. This results because the outer sleeve **26** is spaced forwardly of the inner edge **19** of the speaker cone. Consequently, the member **26** acts as a barrier membrane, and the leads necessarily are brought out to a point of attachment beyond the area immediately adjacent the edge **19**. It is the portion of the cone next to the inner peripheral edge that receives the maximum vibration as the loud speaker is used. In conventional construction, the leads are connected to the speaker cone at its inner edge, extending outwardly from that edge along the surface of the cone. Therefore, by the usual construction the leads are bonded to the surface of the cone directly adjacent the inner edge **19**. By being secured in this zone of extreme vibration, the leads of the voice coil of a conventional loud speaker quite easily can become broken from the oscillation of the speaker cone. However, by including a suitable barrier element, which necessarily results in the attachment of the leads outwardly of the inner peripheral edge of the cone, this difficulty is avoided. The reliability of the construction and the life of the lead wires are improved greatly. At the same time, this arrangement adds practically no cost to the manufacturing process, being adapted to mass production techniques and requiring very little time to accomplish. Typically, the element **26** merely is wrapped around the end of the bobbin to form a sleeve which is secured in place by adhesive. The attachment of the spider and inner edge of the cone will be made to this outer layer of the coil unit.

While it is preferred to construct the loud speaker cone as illustrated in FIGURES 2, 3 and 4, in which the inner portion of the element is of a true conical shape, such a configuration is difficult to achieve. As a practical matter, a speaker cone normally will have a shape such as shown in FIGURE 5. Here the cone **30** includes a short substantially radially extending portion **31** adjacent the flange **32** at its inner periphery. The radial portion **31** is subjected to even more pronounced movement than the inner edge of a speaker element that is of more exact conical configuration. Hence, the problem of lead wire fatigue failure or breakage is aggravated as a consequence of the structure almost invariably given to a speaker cone. Nevertheless, as seen in FIGURE 5, the provision of this invention still assures that the lead wires are bonded to the surface of the cone outwardly of the inner edge portion, including a considerable space from the radial portion **31** of the cone. Again, therefore, the lead wires join the cone at a location away from the portion of greatest vibration, and the leads are protected from breakage.

The foregoing detailed description is to be clearly understood as given by way of illustration and example only, the spirit and scope of this invention being limited solely by the appended claims.

I claim:

1. In combination with a loud speaker having a speaker cone having an aperture at the apex thereof, a voice coil arrangement comprising

a cylindrical bobbin extending through said aperture to an end portion adjacent and inwardly of said aperture, a coil of wire on the opposite end portion of said bobbin,

said coil having electrical leads extending therefrom through said aperture,

said leads extending to the surface of said cone adjacent but radially outward of said aperture,

a membrane extending over said leads adjacent said first-mentioned end of said bobbin for spacing said leads from said speaker cone at said aperture,

and adhesive means securing said leads to said surface.

2. A device as recited in claim **1** in which said membrane comprises

a layer of paper overlying said leads and bobbin.

3. In combination with a loud speaker having a speaker cone having an aperture through the apex thereof, a voice coil arrangement for said loud speaker comprising

a paper tube,

one end of said tube extending axially through said aperture to an edge inwardly of said speaker cone and adjacent said aperture,

a helically-wound coil of wire on the opposite end of said tube,

said wire having a duality of leads extending axially from the end of said helically-wound coil adjacent said one end of said tube,

said leads extending along the surface of said tube through said aperture,

a paper strip adhesively secured over said tube and said leads,

said strip extending substantially from said end of said coil to the first-mentioned end of said tube,

said leads thereby being constrained to said first-mentioned end of said tube and extending outwardly thereof,

and adhesive means securing said leads to the surface of said speaker cone adjacent but radially outwardly of said aperture.

4. In combination with a loud speaker having a conical diaphragm having an annular apical edge, a voice coil comprising

a tubular bobbin,

a helically-wrapped wire on one end of said bobbin, the opposite end of said bobbin extending into said conical diaphragm beyond said annular apical edge,

a barrier member secured to said opposite end of said bobbin and extending into said conical diaphragm beyond said apical edge,

said conical diaphragm being secured to said barrier member at said apical edge,

said helically-wrapped wire having a duality of leads, said leads extending over said bobbin and beneath said barrier to said opposite end, and from said opposite end to the inner face of said conical diaphragm at a location radially outward of said apical edge,

and means securing said leads to said conical diaphragm at said location.

5. A device as recited in claim **4** in which

said barrier is a paper sleeve on said bobbin, and said means for securing said leads to said conical diaphragm includes an adhesive.

6. A voice coil assembly for a loud speaker comprising

a cylindrical bobbin adapted to fit within a speaker cone at the apex thereof,

a helically-wound length of wire carried by said bobbin at one end thereof,

said helically-wound length of wire having a duality of leads extending therefrom along the surface of said bobbin to and beyond the opposite end of said bobbin,

and a barrier member secured over the surface of said bobbin and said leads for precluding separation of said leads from said bobbin,

said barrier member being a paper sleeve bonded to the circumferential surface of said bobbin.

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KATHLEEN H. CLAFFY, *Primary Examiner.*

ROBERT H. ROSE, *Examiner.*

F. N. CARTEN, *Assistant Examiner.*