Jan. 26, 1960 S. J. ZUERKER 2,922,850

LOUD-SPEAKER

Filed Jan. 28, 1957

FIG.1

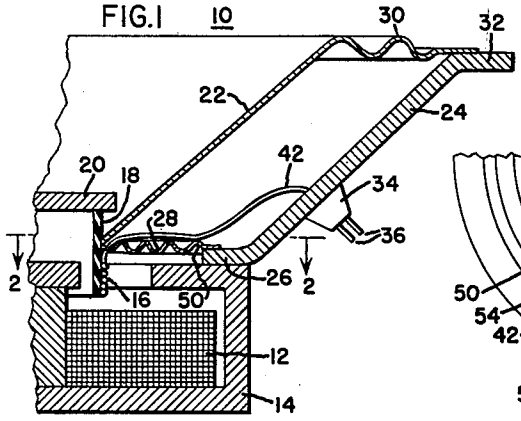


FIG.2

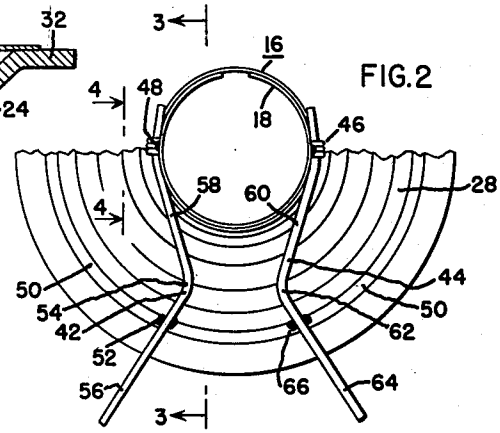


FIG.3

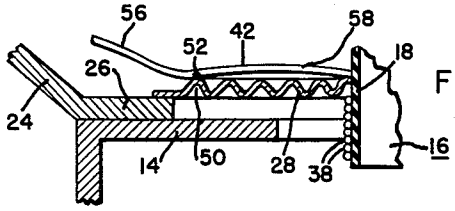


FIG.4

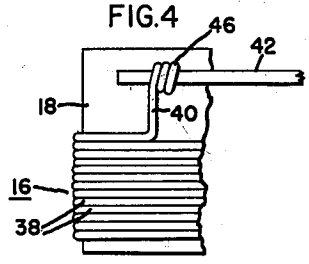


FIG.5

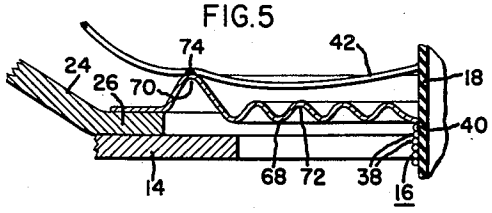
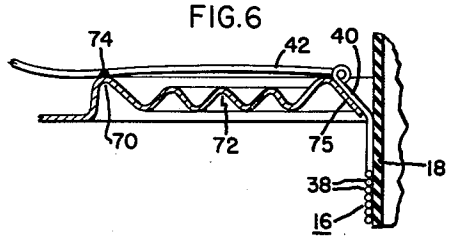


FIG.6



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LOUD-SPEAKER

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4 Claims. (Cl. 179—115.5)

This invention relates to loud-speaker construction and assembly and particularly to the construction and assembly of electrical connections from the voice coil of the loud-speaker to the outside connecting terminals.

At the present time there are two widely used methods of construction for providing an electrical connection from the voice coil to the outside terminal connections in commercial loud-speakers. One of these methods utilizes a flexible lead connecting with the voice coil and attached to the diaphragm at one end and to the external terminal at the other end. In the second method one end of the flexible lead is fastened to the voice coil collar and the other end to the external terminal. In both of these constructions a substantial amount of clearance must be provided between the flexible lead and adjacent parts to avoid slapping of the lead against these parts. Slapping of the lead against adjacent parts can cause unwanted noises and distortion. To further eliminate these undesirable effects special care has been used in assembling the loud-speakers to insure that the leads are properly positioned.

More specifically in assembly of loud-speakers made as described above the flexible leads are passed from the voice coil to an interior portion of the cone. The flexible lead is then run along the cone toward the outer edge thereof to a point opposite the external terminals and the lead at that point passed through the cone and connected to the external terminal. In some methods of manufacture the flexible leads from the voice coil must be connected to the outside terminals before the cone is assembled to the other loud-speaker components. This is necessitated by the fact that the assembly line arrangement is such that assemblers cannot reach underneath the cone to make the connections required in the above described conventional methods. The assemblers must work from the top of the cone; i.e., the normal open part of the loud-speaker assembly.

Accordingly, it is an important object of the invention to provide an improved loud-speaker construction and particularly an improved construction and mounting for providing electrical interconnection between the voice coil and the outside terminals.

Another object of the invention is to provide in loud-speakers of the type set forth a connection between the voice coil and the outside terminals which can be made before the cone is assembled on the loud-speaker whereby to provide efficient assembly procedures.

Yet another object of the invention is to provide a connection between the voice coil and the outside terminals of loud-speakers in which the connecting wire or tinsel does not create noise by contacting the cone or spider.

Still another object of the invention is to provide a loud-speaker construction and particularly a connection between the voice coil and the outside terminals which permits the use of a flatter cone as compared with constructions used heretofore.

Yet another object of the invention is to provide a

loud-speaker construction in which the connection between the voice coil and the outside terminals is so constructed and arranged that a minimum of stress is applied to these connections during operation of the loud-speaker thereby substantially reducing damage to the connection from vibration in use and thereby prolonging the life of the loud-speaker.

In connection with the foregoing object it is a further object of the invention to provide a loud-speaker having an improved connection between the voice coil and the outside terminals which eliminates breakage of the connection at the point of atachment to the voice coil collar.

These and other objects and advantages of the invention will be better understood from the following description when taken in conjunction with the accompanying drawing. In the drawng wherein like reference numerals have been utilized to designate like parts throughout:

Figure 1 is a partial view in vertical section through one preferred form of a loud-speaker made in accordance with and embodying the principles of the present invention;

Figure 2 is a partial view in horizontal section through the loud-speaker of Figure 1 substantially as seen in the direction of the arrows along the line 2—2 therein;

Figure 3 is a view in vertical section substantially as seen in the direction of the arrows along the line 3—3 of Figure 2;

Figure 4 is an enlarged view illustrating one version for the connection between the voice coil and the tinsel lead substantially as seen in the direction of the arrows along the line 4—4 of Figure 2;

Figure 5 is a view similar to Figure 3 and illustrating a second preferred embodiment of the present invention; and

Figure 6 is a view similar to Figure 3 and illustrating a third preferred embodiment of the present invention.

Referring to Figure 1 of the drawing there is shown a loud-speaker generally designated by the numeral **10** made in accordance with and embodying the principles of the present invention. Loud-speaker **10** includes a field coil **12** surrounded by a field coil case **14**. Mounted within the case **14** and movable with respect thereto is a voice coil **16** supported upon a collar **18**. Collar **18** is provided with the usual dust cap **20**. Also attached to collar **18** is a speaker cone **22** which is generally frusto-conical in shape with the larger diameter end thereof disposed away from collar **18**. Voice coil collar **18** and cone **22** are interconnected and move as a unit in the operation of loud-speaker **10**.

Cone **22** and the associated parts are mounted upon a cone housing **24** which surrounds cone **22**. The lower end of cone housing **24** as viewed in Figure 1 is provided with an inturned flange **26** mounted on and attached to the field coil case **14**. Spider **28** is provided to mount collar **18** upon flange **26**. Spider **28** is of the usual pleated form, is annular in shape, and serves as a resilient interconnection between collar **18** and cone housing **24** whereby to permit movement of cone **22** and the attached parts in a vertical direction as viewed in Figure 1. Cone **22** has an upper edge **30** that forms a suspension between the outer end of the conical portion of cone **22** and an outwardly directed flange **32** on the upper edge of cone housing **24**. Cone edge **30** also is annular in shape and pleated whereby to permit relative movement between the cone **22** and cone housing **24**.

Suitable electrical connections are made from voice coil **16** to an outside terminal box **34** mounted on the outer surface of cone housing **24**. Box **34** has mounted thereon and extending therefrom terminals **36** with which

electrical connection can readily be made by means of a socket to receive the terminals 36.

The specific mounting and construction of the leads interconnecting voice coil 16 and terminals 36 are best illustrated in Figures 2, 3 and 4 of the drawing. Referring to Figure 4 of the drawing it will be seen that the voice coil 16 includes a series of turns 38 of suitable conductive wire terminating in a pair of coil leads 40. One coil lead 40 is connected to a flexible tinsel lead 42 and the other coil lead 40 is connected to a similar flexible tinsel lead 44. More specifically the coil lead 40 is closely wound about one end of tinsel lead 42 as at 46 and the other coil lead 40 is similarly connected to tinsel lead 44.

Lead 40 extends upwardly above the lower spider 28 and tinsel lead 42 is disposed outwardly above the upper surface of spider 28 as is best seen in Figures 2 and 3. In addition tinsel lead 42 can be suitably attached as by gluing to collar 18 at point 48 (see Figure 2) and is similarly attached as by gluing to the outermost crest 50 of spider 28 as at point 52. Between points 48 and 52 tinsel lead 42 is curved partially around collar 18 and thence outwardly radially therefrom to a point 54 substantially midway between collar 18 and the outer edge of spider 28 and then curved to provide a portion 56 disposed at an obtuse angle of approximately 130° with respect to the portion 58 disposed between collar 18 and point 54. Tinsel lead 44 is likewise curved partially around collar 18 and then tangentially outwardly therefrom to provide a portion 60 extending to a point 62 disposed substantially midway between collar 18 and the outer periphery of spider 28. Tinsel lead 44 then is again curved to provide a portion 64 disposed at an obtuse angle of approximately 130° with respect to portion 60. A suitable glue or cement is utilized to fasten tinsel lead 44 to the outermost crest 50 of spider 28 as at point 66 in a manner similar to point 52 described above.

From Figure 2 it is seen that tinsel leads 42 and 44 contact collar 18 at points which are spaced apart approximately 140° around the periphery thereof. Portions 58 and 60 are disposed toward each other and tinsel lead portions 56 and 64 converge outwardly away from each other.

The distance between the point of attachment of tinsel lead 42 to collar 18 and the point of attachment 52 thereof to spider 28 is substantially less than the length of tinsel lead 42 between these two points. This construction provides in essence a partial loop in the lead, the loop being disposed in a plane perpendicular to the axis of the voice coil 16 and parallel to spider 28. Voice coil collar 18 may move as much as ¼ of an inch during operation. The loop provided in tinsel leads 42 and 44 between collar 18 and point 52 and between collar 18 and point 66, respectively, accommodates this movement of the voice coil. By disposing the loop in the tinsel leads 42 and 44 in a plane parallel to spider 28, bending of tinsel leads 42 and 44 at the point of attachment to collar 18 is minimized and therefore wear at these points is also minimized. The flexing of the tinsel leads 42 and 44 is distributed along the entire length of the leads between collar 18 and the points of attachment to spider 28, namely points 52 and 66, respectively. There is substantially no change in the angle at which leads 42 and 44 contact collar 18.

Referring to Figure 1 of the drawing it will be seen that the leads such as lead 42 extend upwardly and outwardly from the point of attachment 52 on spider 28 to terminal box 34 and associated terminal 36. Leads 42 and 44 throughout the length thereof are disposed below cone 22 as viewed in Figure 1. Accordingly, the leads can be completely assembled on the collar, completely assembled on the spider 28, and connected to the outer terminals 36 during assembly before cone 22 is placed in position. This facilitates assembly since it is preferred to wire the terminal box 34 from the inside, i.e. from the space between cone housing 24 and cone 22 in the assembled speaker.

There is shown in Figure 5 of the drawings a second embodiment of the present invention. Where applicable, like reference numerals have been applied as in Figures 1 through 4. The principal difference in construction of the speaker of Figure 5 lies in the fact that a modified form of lower spider 68 is provided. More specifically the outer raised portion or crest 70 thereof is raised above the adjacent crest such as crest 72. The tinsel lead such as lead 42 is then connected between collar 18 and crest 70, lead 42 being secured to crest 70 as at point 74 by a suitable cement or adhesive. The raised height of crest 70 permits separation between the leads 42 and 44 and the other upraised portions or crests 72 of spider 68. Such separation eliminates the possibility of contact between the leads 42 and 44 and crest 72 which might produce unwanted noise.

In Figure 2 tinsel lead 42 is shown attached by glue or the like to collar 18 at point 48. This lead does not have to be attached to collar 18. In the Figure 6 arrangement lead 42 is attached near collar 18 by one end of lead 40 that is wound around lead 42 as at 46. This end of lead 40 is attached by glue or the like to the slope 75 of the first crest 72. Lead 42 then has to be attached to spider 72 at only one point, point 74.

It will be seen that there has been provided a loud-speaker construction and more specifically a construction of the leads interconnecting the voice coil and the outside terminals which fulfills all of the objects and advantages set forth above. The tinsel leads making this connection can be assembled and interconnected before the cone is assembled on the speaker. This permits very efficient assembly methods and procedure. The tinsel leads do not create noise by contacting the cone or spiders. In addition a flatter cone such as cone 22 can be used as compared with cones employed heretofore because of the improved mounting of the tinsel leads. Stress applied to the points of attachment of the leads to collar 18 and to the spider is reduced whereby to increase the useful operating life of the loud-speaker. By mounting the tinsel leads so that they extend substantially tangentially with respect to the collar 18, failure of the tinsel leads at the collar connection is substantially eliminated.

Although two preferred forms of the invention have been shown for purposes of illustration, it is to be understood that various changes and modifications can be made therein without departing from the spirit and scope thereof. Accordingly, the invention is to be limited only as set forth in the following claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A loud-speaker comprising a cone housing, a cone disposed within said housing, a collar mounted upon said cone, a voice coil mounted upon said collar for movement therewith and with said cone, a spider attached to said collar between said voice coil and said cone and connecting said collar to said cone housing, said spider having concentric crests and troughs, a field magnet means mounted on said cone housing in position to interact with said voice coil to cause movement of said voice coil, said collar and said cone, a pair of outside terminals mounted on said cone housing, and a pair of flexible leads interconnecting said voice coil and said outside terminal, said flexible leads attached to said collar at a point between said cone and said spider and attached to said spider on the outermost crest thereof, the portion of said flexible leads between said points of attachment shaped as partial loops and lying in planes substantially parallel to the plane of said spider.

2. A loud-speaker comprising a cone housing, a cone disposed within said housing, a collar mounted upon said cone, a voice coil mounted upon said collar for

movement therewith and with said cone, a spider attached to said collar between said voice coil and said cone and connecting said collar to said cone housing, said spider having a plurality of concentric crests and troughs, the outermost crest having a substantially higher crest than the adjacent crests, a field magnet means mounted on said cone housing in position to interact with said voice coil to cause movement of said voice coil, said collar and said cone, a pair of outside terminals mounted on said cone housing, and a pair of flexible leads interconnecting said voice coil and said outside terminals, said flexible leads attached to said collar at a point between said cone and said spider and attached to said spider on the outermost crest thereof, the portions of said flexible leads between said points of attachment shaped as partial loops which are suspended out of contact with the remaining portions of said spider.

3. A loud-speaker comprising a cone housing, a cone disposed within said housing, a collar mounted upon said cone, a voice coil mounted upon said collar for movement therewith and with said cone, a first spider interconnecting the outer end of said cone and the outer end of said cone housing, a second spider attached to said collar between said voice coil and said cone and connecting said collar to said cone housing, a field magnet means mounted on said cone housing in position to interact said voice coil to cause movement of said voice coil and said collar and said cone, said second spider having a plurality of concentric crests and troughs, a pair of outside terminals mounted on said cone housing and having points of connection thereto disposed within said cone housing, and a pair of flexible leads interconnecting said voice coil and the connections to said outside terminals, said flexible leads attached to said collar between said second spider and said cone and extending partially around said collar and thereafter extending from said collar substantially tangentially therewith, the portions of said leads disposed tangentially with respect to said collar converging toward each other and thereafter diverging away from each other and attached to the outermost crest of said second spider, the portions of said flexible leads between said points of attachment shaped as partial loops and lying in a plane substantially parallel to the plane of said second spider.

4. A loud-speaker comprising a cone housing, a cone disposed within said housing, a collar mounted upon said cone, a voice coil mounted upon said collar for movement therewith and with said cone, a first spider interconnecting the outer end of said cone and the outer end of said cone housing, a second spider attached to said collar between said voice coil and said cone and connecting said collar to said cone housing, a field magnet means mounted on said cone housing in position to interact with said voice coil to cause movement of said voice coil and said collar and said cone, said second spider having a plurality of concentric crests and troughs, the outermost of said crests having a substantially higher crest than the adjacent crest, a pair of outside terminals mounted on said cone housing and having points of connection thereto disposed within said cone housing, and a pair of flexible leads interconnecting said voice coil and the connections to said outside terminals, said flexible leads attached to said collar between said second spider and said cone and extending partially around said collar and thereafter extending from said collar substantially tangentially therewith, the portions of said leads disposed tangentially with respect to said collar converging toward each other and thereafter diverging away from each other and attached to the outermost crest of said second spider, the portions of said flexible leads between said points of attachment shaped as partial loops and held away from the other portions of said spider.

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