United States Patent [19]

Wieder

[11] **3,835,256**

[45] **Sept. 10, 1974**

[54] **LOUDSPEAKER ENCLOSURE**

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[22] Filed: **July 9, 1973**

[21] Appl. No.: **377,761**

[52] **U.S. Cl.** ..... **179/1 E,** 181/31 B

[51] **Int. Cl.** **H04r 1/28**

[58] **Field of Search** ..... 179/1 E, 111 R; 181/31 B, 181/31.1

[56] **References Cited**

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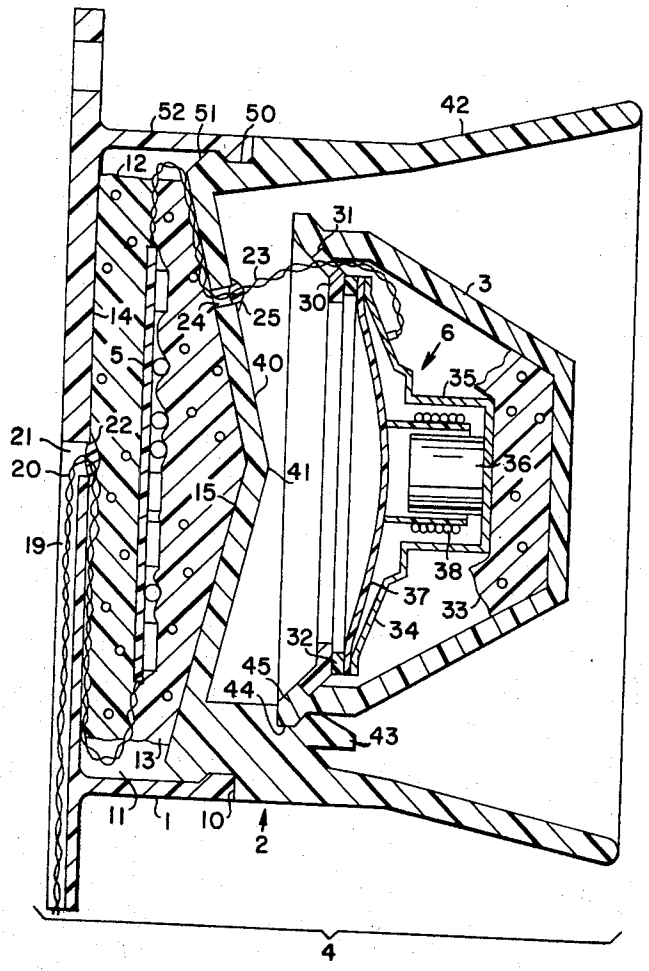
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[57] **ABSTRACT**

Enclosure and mounting for a loudspeaker is combined with enclosure and mounting for a printed circuit board associated with the loudspeaker. Mounting means for both the loudspeaker and printed circuit board are resilient. All parts of the combination enclosure and the mounting means interact in such fashion that the device is devoid of fasteners such as screws, rivets, adhesive or the like.

8 Claims, 5 Drawing Figures



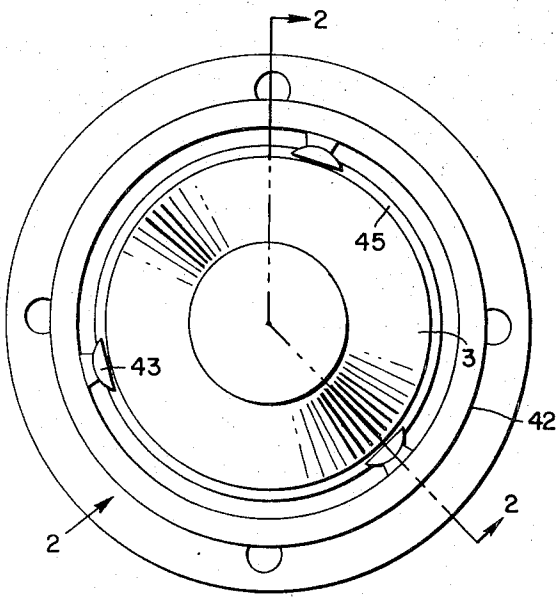

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45
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3
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Fig. 1.

Fig. 2.

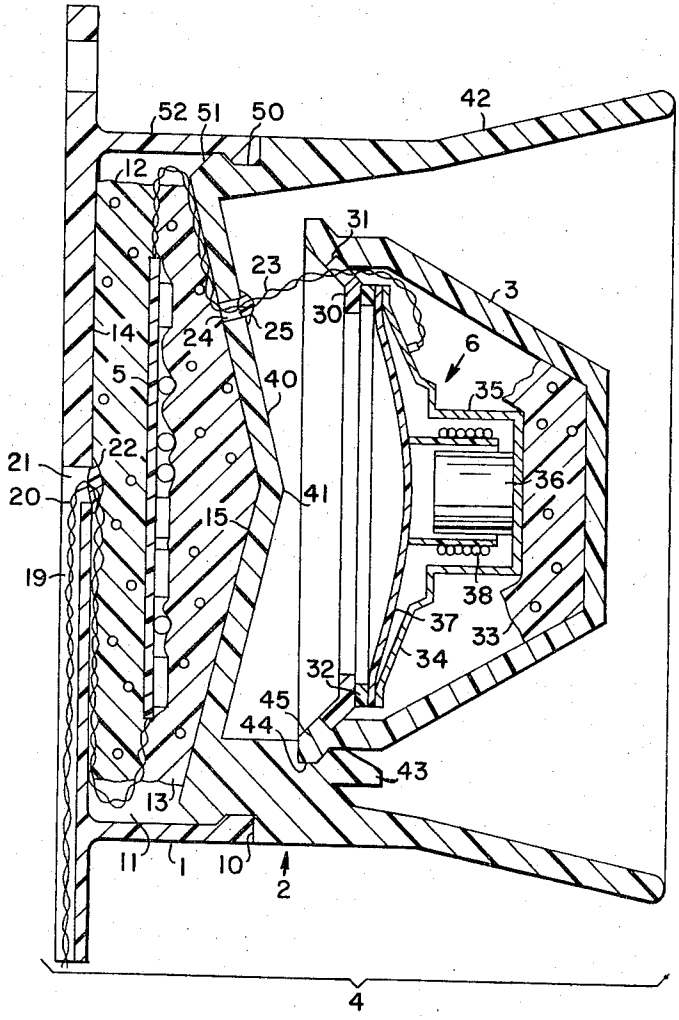
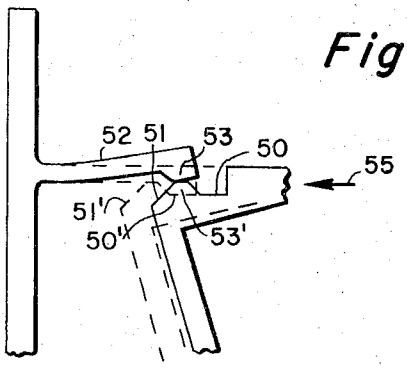

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Fig. 3.



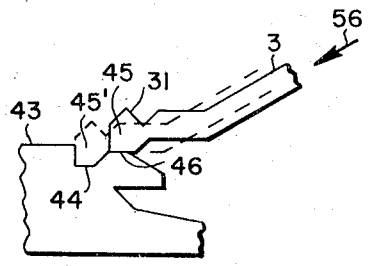


Fig. 4.

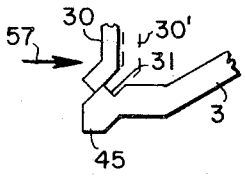


Fig. 5.

LOUDSPEAKER ENCLOSURE

CROSS-REFERENCES

None.

FIELD

This invention relates to a loudspeaker enclosure and more particularly to a combination loudspeaker and printed circuit board enclosure devoid of fasteners.

PRIOR ART

The device of the invention incorporates a rearwardly directed speaker, the audible output of which impinges on a conical member whereby the output is directed forwardly. Such a reverse horn or folded horn arrangement is well known and is not considered a novel portion of the invention.

Resilient mounting of a speaker has been accomplished heretofore but not in the manner or in the combination described in connection with the device of the invention and it is believed that incorporation of the printed circuit board in conjunction with the speaker mounted in the manner described is altogether devoid of suggestion in prior art. Likewise no disclosure of a loudspeaker enclosure has been found which is similar or which in any way discloses provision of such an enclosure alone or in combination with a printed circuit board assembly which is devoid of fasteners in the manner of the presently disclosed device.

SUMMARY

Combination speaker and printed circuit board assembly is provided which apart from the speaker itself, the printed circuit board and the associated wiring and mounting means for said portions comprises only three parts. These parts are made of slightly resilient plastic and are snapped together. Sealant may be provided at the joints and at openings through which wires pass. Thus is provided a highly weather resistant, highly abuse-resistant enclosure for the speaker and printed circuit board. The loudspeaker itself and the printed circuit board are held in place within the enclosure by resilient pads of foamed polymeric material such as plastic or rubber which serves to prevent damage to these electrical components in the event of severe blows or shocks to which the device may be subjected.

The device has particularly utility in providing a device which may be attached to the rear of an automotive vehicle to be sounded when the vehicle is backing up or when the vehicle is put into reverse gear. The device of the invention by reason of its weather and shock-resistance may be mounted without protection, outside the body of the vehicle and without any protective shielding.

OBJECTS

It is therefore an object of the invention to provide an improved speaker enclosure.

Another object is to provide an improved combination enclosure for printed circuit board and loudspeaker.

Another object is to provide such an enclosure which is highly shock resistant and weather resistant.

Another object is to provide such an enclosure which may be provided with great economy.

Another object is such an assembly which for purposes of economy as to both parts and labor may be assembled without fasteners.

Another object is such a device wherein the electrical components within the enclosure are protected to a high degree from shocks which may be imposed upon them.

Another object is such a device wherein the electrical components therewithin may be mounted not only to resist large shocks but with a minimum of parts and a maximum of economy.

Further objects will become apparent from the drawings and from the following detailed description.

DRAWINGS

In the description like reference numerals refer to like parts and:

FIG. **1** is a front elevation of the device.

FIG. **2** is a cross-sectional view of the device taken on lines **2—2** in FIG. **1.**

FIGS. **3, 4** and **5** are schematic fragmentary cross-sectional views of steps in the assembly of the device.

DESCRIPTION

In general the device which is provided in accordance with the invention is particularly and peculiarly highly adapted to be mounted at the rear of an automotive vehicle to provide an audible warning to pedestrians who may be in the way of the rear of the vehicle when the vehicle is backing up. Many types of alarm devices may be suitable for this purpose but a loudspeaker has been found particularly suitable. In order to provide an audible signal of distinctive characteristics, for example, one which might be characterized as emitting a sound such as "whoop," "whoop," "whoop," a printed circuit is associated with the loudspeaker in order to cause the loudspeaker to emit an audible signal having the desired repetitive distinctive characteristics.

In order to have reasonable service life it is necessary that the device be both highly shock resistant and highly weather resistant.

At the same time in order to provide such a device economically in connection with an automotive vehicle wherein great effort is devoted to reducing the cost of each part therein by the merest fraction of a cent, it is necessary from a practical point of view that the device be capable of being manufactured with great economy.

These objectives are accomplished by mounting the printed circuit board and loudspeaker in a single combination enclosure, providing means devoid of fasteners such as screws, bolts, rivets and the like for resiliently mounting the electrical components within the enclosure and providing a minimum of parts and providing means for assemblying the enclosure without fasteners and with a very small amount of labor.

Accordingly, referring to FIGS. **1** and **2**, the enclosure comprises base portion **1**, horn portion **2** and loudspeaker container portion **3.** Mounted within the enclosure, which is indicated generally as **4**, are loudspeaker **6** and printed circuit board **5.**

Base portion **1** is attached to horn portion **2** at a joint which may be filled with sealant **10.** Thus attached portions **1** and **2** provide an enclosed space **11** within which printed circuit board **5** is disposed. Resilient pads **12** and **13** of resilient foamed polymeric material such as rubber, polyurethane, polyvinyl chloride, poly-

ethylene or the like, are disposed on each side of printed circuit board **5**, pad **12** being interposed between board **5** and wall **14** of base portion **1** and pad **13** being disposed between printed circuit board **5** and surface **15** of wall **40** of horn portion **2**. Pads **12** and **13** are somewhat compressed to positively position board **5**. Wires **20** may extend from board **5** through aperture **21** in base portion **1** to a source of electrical current (not shown). Aperture **21** may be filled with sealant **22** surrounding wires **20**. Wires **23** may connect printed circuit board **5** to loudspeaker **6** and may extend through aperture **24** in horn portion **2** which may be filled with sealant **25** surrounding wires **23**. Base portion **1** may be provided with groove **19** in its rear surface to receive wires **20**.

Loudspeaker **6** may be retained within loudspeaker enclosure portion **3** by resilient retainer ring **30** which may be received against shoulder **31** of portion **3**. Gasket **32** which may be of rubber or the like may be provided between ring **30** and loudspeaker **6** for sealing purposes. Loudspeaker **6** may be of conventional construction and may comprise frame **34** having cup portion **35** within which is mounted permanent magnet **36**. Attached to frame **34** there may be provided diaphragm **37** which may be of any suitable material but which is preferably of polyethylene terephthalate sold commercially as "Mylar" by Dupont de Nemours. Attached to diaphragm **37** there may be provided voice call **38** extending into cup **35** and surrounding magnet **36**.

A body **33** of resilient foamed material such as of rubber foam, polyurethane foam, polyvinyl chloride foam, or polyethylene foam is interposed between cup **35** and the interior of member **3** and is somewhat compressed therebetween to urge loudspeaker **6** against retainer ring **30**.

Horn portion **2** preferably comprises an outwardly extending substantially conical base wall **40** having apex **41** and a divergent wall **42** diverging outwardly from substantially the outer edge of wall **40**. A plurality of members **43** extend inwardly from walls **40** and **42** and are provided with notches **44**. Member **3** is provided with an annular outwardly extending portion **45** which is received in notches **44** so that loudspeaker **6** is disposed in horn portion **2** facing apex **41**.

Horn portion **2** is preferably provided with an annular groove **50** adjacent the outer edge of wall **40**. Adjacent to annular groove **50** are preferably provided a plurality of projections **51**. Member **1** is provided with a substantially cylindrical somewhat resilient wall **52** having an annular inwardly extending portion **53** adjacent the terminal edge thereof.

As shown in FIG. **3**, wall **52** during assembly is somewhat slightly resiliently deformed and members **1** and **2** are forced together in the direction indicated by arrow **55** until member **53** interlocks with projections **51** and is seated in groove **50** as indicated in dashed lines at **53'**, **51'** and **50'**.

During assembly, member **3** is somewhat deformed as shown in FIG. **4** so that portion **45** slides past extending portions **46** of members **43** until it snaps into place into notches **44** as indicated in FIG. **4** in dashed lines at **45'**, member **3** being pushed in the direction indicated by arrow **56**.

Referring now to FIG. **5**, the assembly of ring **30** together with portion **3** is accomplished by forcing ring **30** toward portion **3** in the direction indicated by arrow **57** so that ring **30** is resiliently deformed as indicated in full linea at **30**, until ring **30** snaps into place as indicated in dashed lines at **30'** with the outer edge of ring **30** being received on shoulder **31**.

Thus assembly is accomplished entirely by placing printed circuit board **5** and loudspeaker **6** and the associated resilient foam pads in appropriate locations and snapping the remaining parts together, no fasteners such as rivets, screws or the like being used at any place in the entire assembly.

It will be apparent to those skilled in the art that equivalents may be utilized.

Accordingly, the present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification, as indicating the scope of the invention.

It is claimed:

1. A combination loudspeaker and printed circuit board enclosure device comprising the combination of:

a horn portion having an aperture extending therethrough,

a base portion having an aperture extending therethrough,

a loudspeaker container portion,

a printed circuit board,

a loudspeaker comprising a cup for a magnet and speaker coil,

a resilient speaker retainer ring,

said loudspeaker connected with wires to said printed circuit board, said wires extending through said aperture in said horn portion,

wires extending from said printed circuit board to be connected to a source of electrical current,

said horn portion and base portion attached to each other to provide an enclosed space surrounded by walls provided by said horn and base portions,

said printed circuit board disposed in said enclosed space with said wires extending to said loudspeaker extending through said aperture in said horn portion and said wires extending to said source of electric current extending through said aperture in said base portion,

a first resilient body of foamed polymeric material disposed on one side of said printed circuit board and bearing against a wall of said enclosed space provided by said horn portion,

a second resilient body of foamed polymeric material disposed on the other side of said printed circuit board and bearing against a wall of said enclosed space provided by said base portion,

said first and second resilient bodies of foamed material providing the sole means of mounting said printed circuit board in said enclosed space,

said loudspeaker retained in said loudspeaker container portion by said speaker retainer ring resiliently snapped into place against a retainer surface in said loudspeaker retainer portion,

a third resilient body of foamed polymeric material disposed between said loudspeaker and the interior of said loudspeaker container to act against said cup to urge said loudspeaker against said retainer ring,

said retainer ring and third resilient body of foamed material providing substantially the sole means of

mounting said loudspeaker within said loudspeaker container portion,

said base portion and said loudspeaker container portion each attached to said horn portion by resiliently deformable interlocking portions of said respective portions.

2. The device of claim **1** provided with sealant in said apertures and in the joint between said base portion and said horn portion.

3. The device of claim **1** provided with a rubber gasket between said loudspeaker and said retainer ring.

4. The device of claim **1** wherein said horn portion comprises a divergent substantially conical sound-directing wall and a substantially conical base wall having an apex extending outwardly, said divergent wall diverging outwardly substantially from the outer edge of said base wall, projections to receive said loudspeaker container portion extend inwardly from said divergent wall and said loudspeaker container is resiliently interlocked to said projections with said loudspeaker facing said apex.

5. The device of claim **1** wherein said base portion comprises a base wall and a substantially cylindrical side wall extending therefrom toward said horn portion to a peripheral edge having an annular portion extending inwardly therefrom, said annular portion being resiliently interlocked to said horn portion to attach together said base and horn portions.

6. The device of claim **5** wherein said horn portion comprises a divergent substantially conical sound-directing wall and a substantially conical base wall having an apex extending outwardly, said divergent wall diverging outwardly substantially from the outer edge of said base wall, projections to receive said loudspeaker container portion extend inwardly from said divergent wall and said loudspeaker container is resiliently interlocked to said projections with said loudspeaker facing said apex.

7. The device of claim **6** provided with a rubber gasket between said loudspeaker and said retainer ring.

8. The device of claim **7** provided with sealant in said apertures and in the joint between said base portion and said horn portion.

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