

[54] LOUDSPEAKER ARRANGEMENT

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[58] Field of Search 179/1 E; 240/78 HA, 78 N

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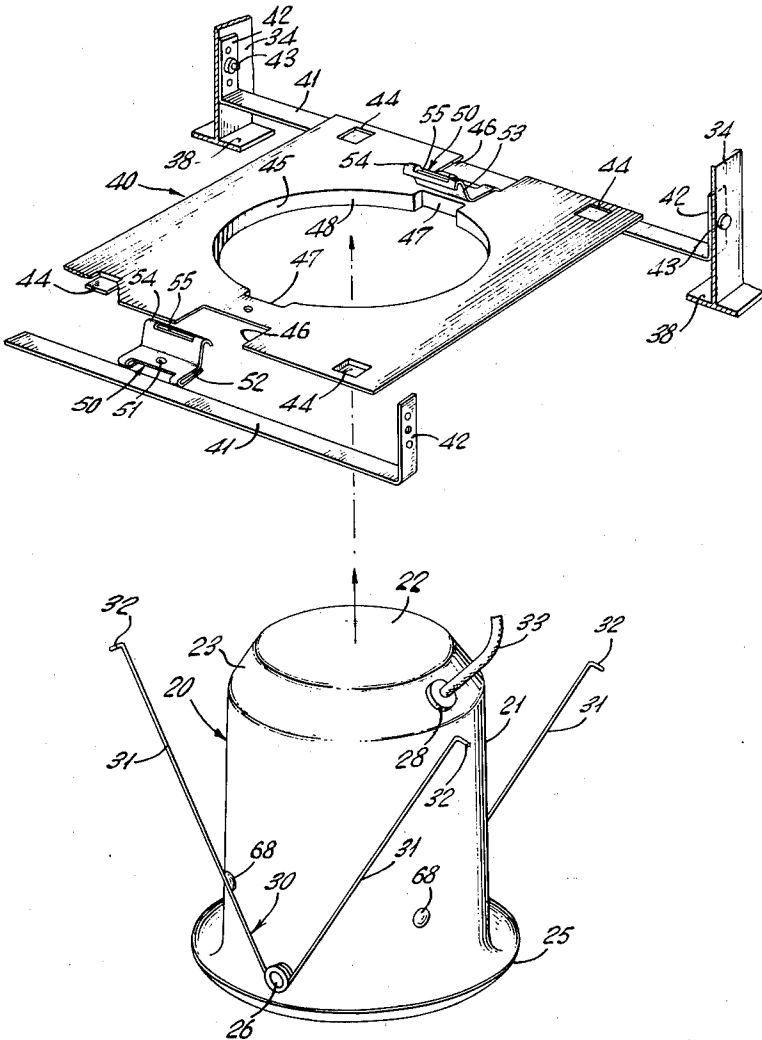
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[57] ABSTRACT

A loudspeaker arrangement of the type employed in public address systems is provided and may be installed within a ceiling or wall recess of the type which usually accommodates a lighting fixture. A mounting for the arrangement includes a housing having a side wall, a closed upper end and an open lower end. A decorative grill may overlie the open lower end of the housing. The housing is insertable, for instance, upwardly through a conforming recess in a ceiling panel and the open lower end thereof is provided with a peripheral flange engageable with the lower surface of the ceiling panel defining the conforming recess. A loudspeaker connector means is secured to the housing adjacent its closed upper end, and mounting means secure the housing to the ceiling structure with its peripheral flange sitting on the ceiling panel surface. A loudspeaker provided with electrical leads which extend into the connector means is positioned within and protected by the housing. Retaining means secure the loudspeaker within the housing with the decorative grill facing downwardly.

10 Claims, 14 Drawing Figures



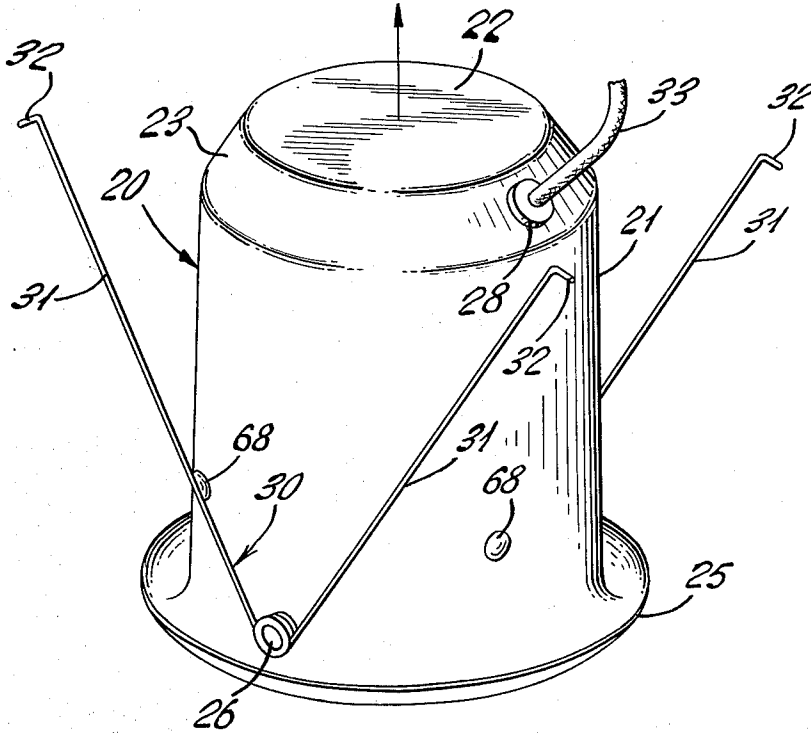
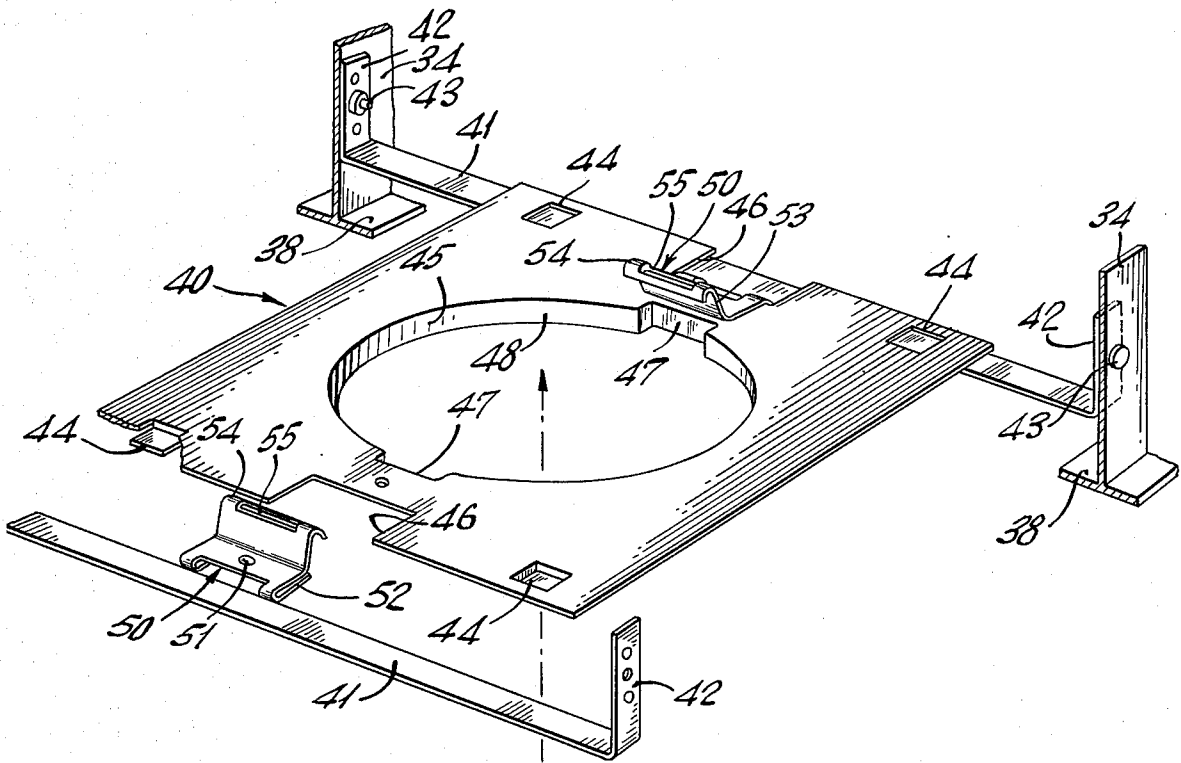
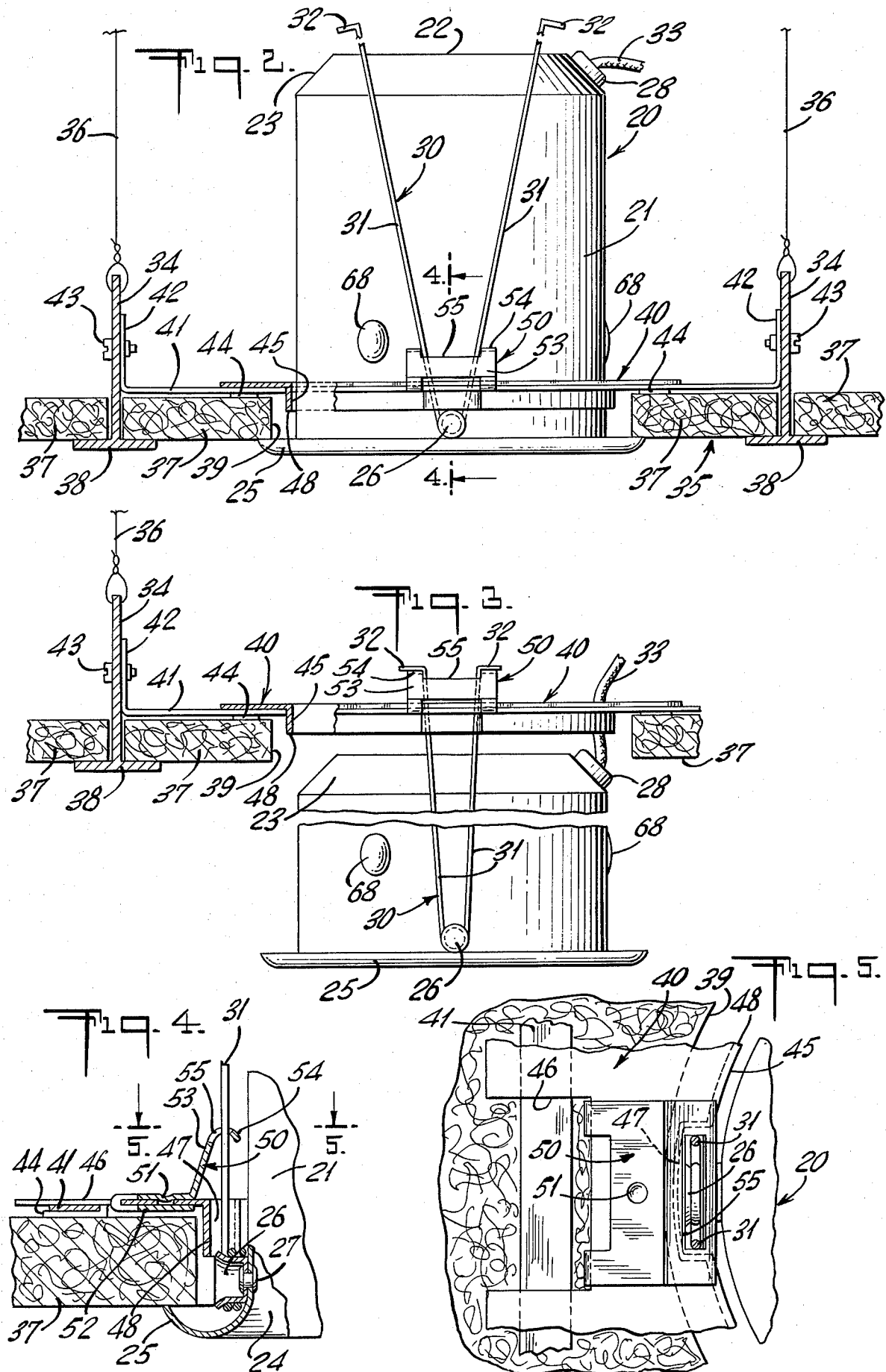
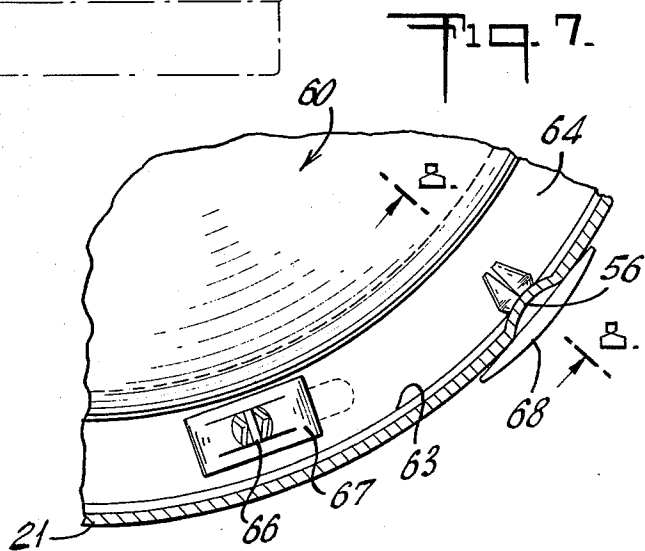
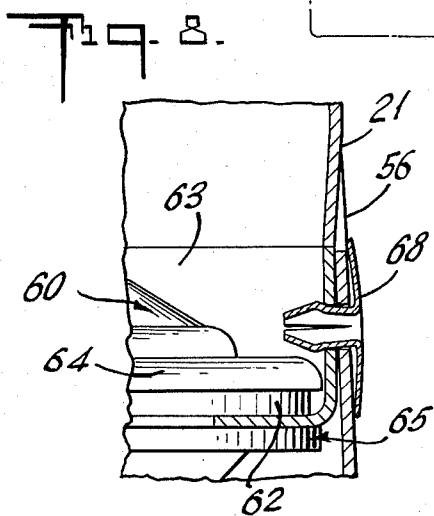
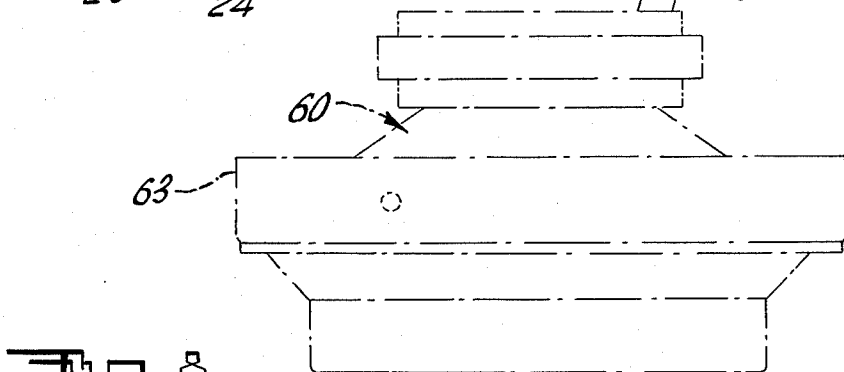
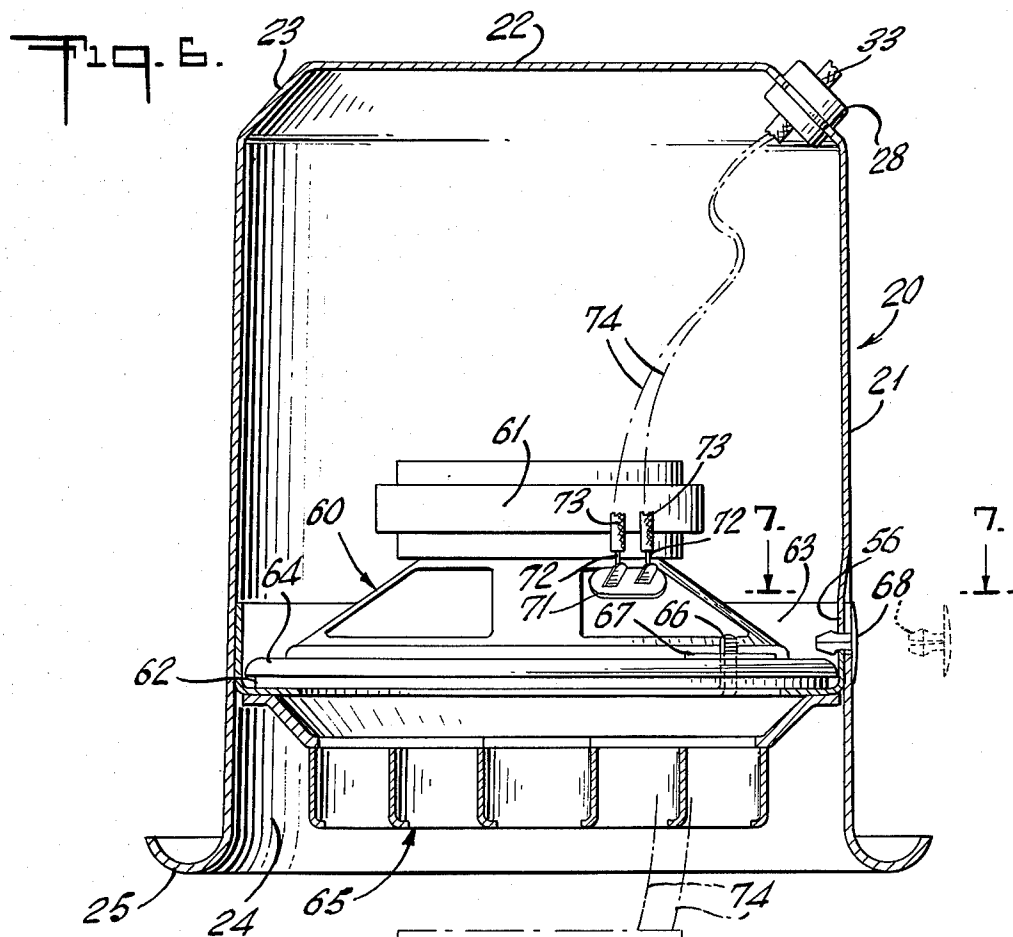


Fig. 1.





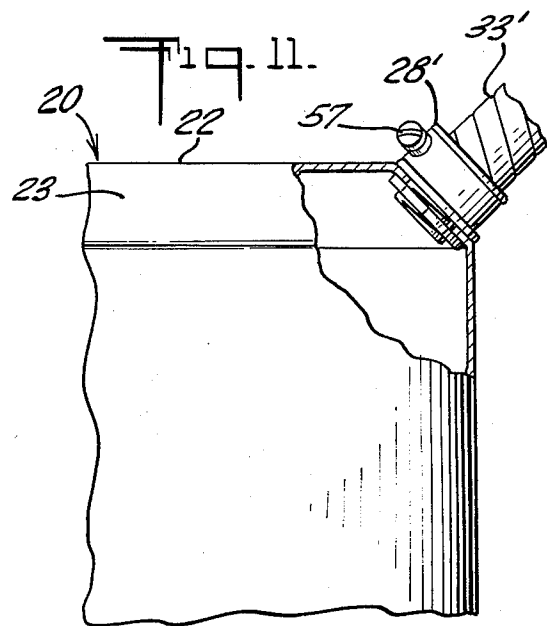
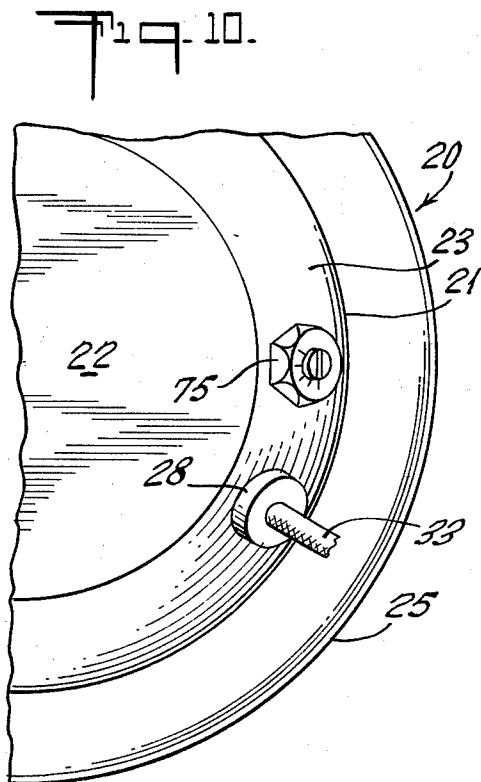
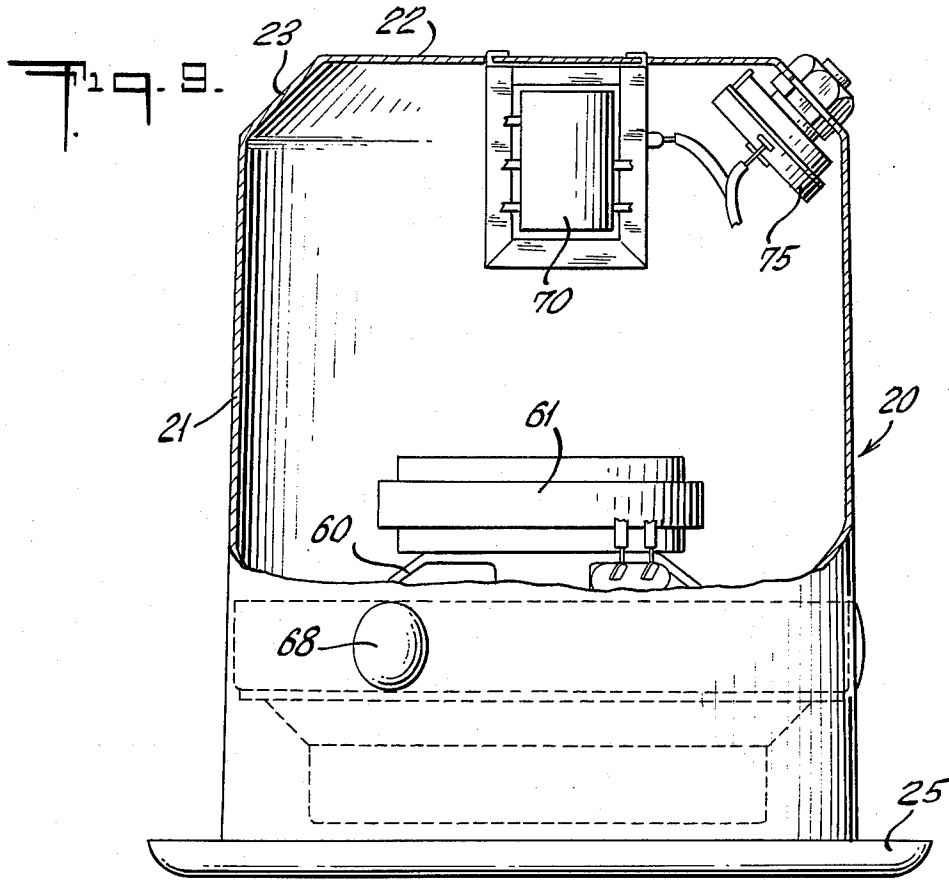


Fig. 12.

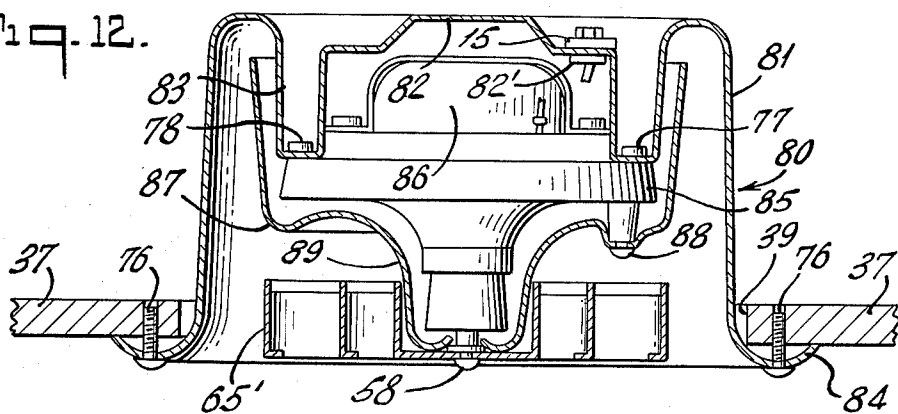


Fig. 13.

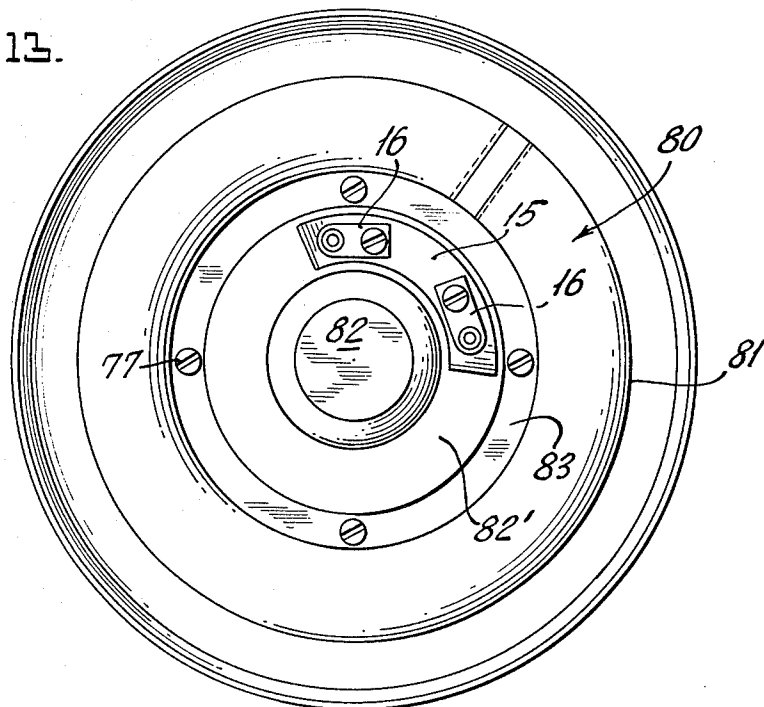
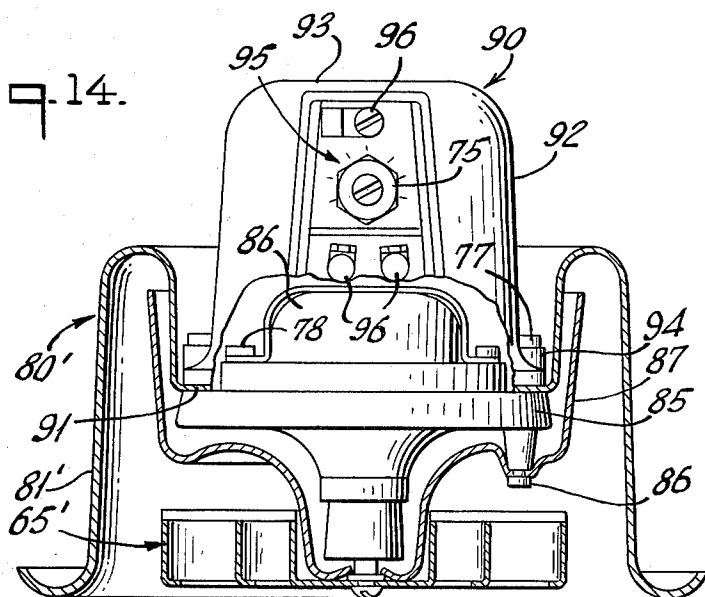


Fig. 14.



LOUDSPEAKER ARRANGEMENT

BACKGROUND OF THE INVENTION

This invention relates generally to mountings for loudspeakers of a public address system and, more particularly, to a novel sealed protective mounting for securing a loudspeaker in a ceiling recess.

Currently available public address system loudspeakers are readily accessible to rodents, vermin and the like and enjoy a relatively short useful life. These loudspeakers are usually wall mounted or suspended from the ceiling of a public room or hallway and detract from the interior decor of the area in which they are used. They are dust and debris collectors and their upkeep is constant.

Accordingly, this invention provides a fully housed loudspeaker for installation within a ceiling or wall recess of the type which usually accommodates a lighting fixture. With conventional structural steel construction giving way to poured concrete techniques, "drop ceilings" underlying the bare cement surface are commonly used and the loudspeakers of this invention are particularly well adapted for installation within a drop type ceiling.

Among the advantages of this invention, it provides a fully protected loudspeaker and means for recessed installation of the loudspeaker in an area of use. The loudspeaker, therefore, is protected from rodents, vermin and the like, is not a dust collector and contributes to rather than detracting from the appearance of the area in which it is installed. Furthermore, electrical connections for the loudspeaker set-up are easily installed, serviced and maintained. These cumulative advantages lengthen the useful life of the device, minimize upkeep and maintenance of the device and reduce the over-all costs of operating public address systems.

SUMMARY OF THE INVENTION

Generally speaking, in accordance with the invention, a loudspeaker arrangement is provided which may be installed within a ceiling or wall recess of the type which usually accommodates a lighting fixture, for instance a so-called "high hat" type lamp fixture. The loudspeaker arrangement includes a housing having a side wall preferably continuous, a closed upper end and an open lower end. A decorative grill may overlie the open lower end of the housing or interfit within the housing side wall at points proximate the open lower end thereof. The housing is insertable, for instance, upwardly through a conforming recess in a ceiling panel and the open lower end thereof is provided with a peripheral flange engageable with the exterior panel surface.

A loudspeaker connector means, for connecting the loudspeaker into an audio system, is secured to the housing adjacent its closed upper end, and mounting means secure the housing to the ceiling structure with its peripheral flange engaging the ceiling panel surface. A loudspeaker provided with electrical leads which extend into the connector means is positioned within and protected by the housing. The loudspeaker may be further protected by providing it with a speaker grill. Retaining means secure the loudspeaker within the housing with the decorative, protective grill facing downwardly.

As desired, the arrangement may be provided with a loudspeaker transformer, or an impedance selector

switch, or both. The transformer and impedance selector switch may be suitably mounted within the housing or secured thereto and each may suitably connect with the speaker leads.

One embodiment of the invention is particularly adapted for installation in a drop ceiling of the type wherein ceiling panels or tiles are supported on horizontal beams suspended from a support structure, such as horizontal main beams. This embodiment includes a pair of laterally spaced straps which are secured to adjacent horizontal suspension beams supporting the ceiling panels or tiles. A plaster ring is carried on these straps in somewhat upwardly spaced relation to a ceiling panel or tile provided with an aperture for receiving the housing. The plaster ring is provided with a conforming aperture and apertures of the panel or tile and plaster ring are registered. Slotted clips further secure straps and plaster ring, one to the other.

The loudspeaker housing is provided with a pair of torsion springs, secured thereto adjacent the peripheral flange at its open lower end. Each torsion spring includes a pair of diverging legs extending upwardly and having hooked outer ends. When legs of each torsion spring are compressed toward each other, each spring may be inserted through a slot of a slotted clip, and the housing may be driven upwardly until its peripheral flange engages the ceiling panel or tile surface. The housing is retained in this position by the bias imparted to the diverging legs of the torsion springs. To service the mounted loudspeaker, one merely pulls the housing downwardly until hooked ends of the torsion spring legs engage the clips, limiting further downward movement. After service, the housing is driven upwardly into operating position, as previously described.

In another embodiment of the invention, the closed end of the housing has a downwardly projecting annular channel, and the flange at the lower end of the housing is secured directly to the ceiling tile or panel by studs or bolts and nuts. The loudspeaker is disengageably secured to the downwardly projecting annular channel, and a decorative protective grill or the like may be disengageably secured to the loudspeaker.

Still other advantages of the invention will in part be obvious and will in part be apparent from the specification and drawings.

The invention accordingly comprises the features of construction, combinations of elements, and arrangements of parts which will be exemplified in the constructions hereinafter set forth, and the scope of the invention will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the invention, reference is had to the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is an exploded perspective view illustrating a sealed protective housing for a loudspeaker, embodying the invention, and portions of a drop ceiling structure in which the housing is mounted;

FIG. 2 is a side elevational view illustrating the housing as mounted in the drop ceiling structure;

FIG. 3 is a view, similar to FIG. 2, illustrating the housing as drawn downwardly for inspection, repair, or maintenance of the loud speaker;

FIG. 4 is a partial vertical sectional view taken on the line 4-4 of FIG. 2;

FIG. 5 is a partial horizontal sectional view taken on the line 5—5 of FIG. 4;

FIG. 6 is an axial sectional view through the housing illustrating the mounting of the loudspeaker therein with the loudspeaker, as lowered out of the housing, being shown in broken lines;

FIG. 7 is a partial horizontal sectional view on the line 7—7 of FIG. 6;

FIG. 8 is a vertical sectional view taken on the line 8—8 of FIG. 7;

FIG. 9 is an elevational view, partly in section, of the housing as provided with a loudspeaker transformer and an impedance selector switch;

FIG. 10 is a partial plan view illustrating a connector means and the selector switch as mounted at the upper closed end of the housing;

FIG. 11 is a partial elevational view, partly in section, illustrating a BX cable and connector associated with the upper closed end of the housing;

FIG. 12 is a vertical sectional view of another form of housing mounting a horn-type loudspeaker and without any impedance adjustment;

FIG. 13 is a plan view corresponding to FIG. 12; and

FIG. 14 is an elevational view, partly in section, of a housing similar to that shown in FIGS. 12 and 13 and further mounting a sealed and protective enclosure for the driver assembly, transformer, switch or volume control for the loudspeaker.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. 1 through 11 of the drawings, a sealed protective mounting embodying the invention includes a bell shaped housing 20 having a side wall 21, a closed upper end 22 joined to side wall 21 by a bevelled transition wall 23 and an open lower end 24 having a preferably upwardly concave peripheral flange 25. Adjacent its bottom end, side wall 21 of housing 20 has a pair of diametrically oppositely located upwardly flared, cup-shaped bushings 26 secured thereto by rivets 27, as best seen in FIGS. 4 and 5. For a purpose to be described, each bushing 26 has coiled therearound several turns of a torsion spring 30 having a pair of upwardly diverging legs 31 whose outer ends are formed with outwardly directed hooks 32. Adjacent its upper closed end, and on the bevel transition surface 23, housing 20 mounts a strain relief 28 for connecting a loudspeaker, mounted within protective housing 20, to a public address system, for example. For this purpose, an electrical cable 33 is connected into relief 28 from the exterior.

Housing 20 is arranged to be mounted in a "drop" or false ceiling 35, by means shown for example in FIGS. 1 through 5 comprising horizontal inverted T-beams 34 suspended, as by wires 36, from a support structure, ceiling 35 further including panels or tiles 37 supported on the flanges 38 of beams 34. Each panel or tile 37 designed to have a housing 20 mounted therethrough is formed with a circular aperture 39.

In the embodiments of the invention shown in FIGS. 1 through 11, the housing 20 is actually supported in a plaster ring 40 in turn supported from beams 34 slightly above the upper surface of the apertured tile 37. Plaster ring 40 is supported on a pair of laterally spaced metal straps 41 each extending between a pair of adjacent T-beams 34 and each having a pair of apertured bent ends 42 arranged to be secured by bolts 43

to the beams 34. By virtue of the apertures in their upwardly bent ends, straps 41 may be adjusted in height relative to the flanges 38 of beams 34 to accommodate drop ceilings of varying heights therebetween. The vertical spacing between plaster ring 40 and the upper surface of the apertured panel or tile 37 is best illustrated in FIGS. 2, 3 and 4. Therefore, the weights of speaker housing 20, internal speaker elements and plaster ring 40 are distributed over supporting beams 34 rather than ceiling tile 37. Plaster ring 40 is secured to straps 41 by means of pairs of struck out tongues 44 adjacent each of a pair of opposite edges of the plaster ring, the tongues 44 gripping beneath the undersurface of the straps 41. Between the tongues of each pair, the adjacent edge of plaster ring 40 is formed with a rectangular recess 46 for a purpose to be described. Plaster ring 40 is formed with a circular aperture 45 arranged for registration with aperture 39 in associated panel or tile 37 and, in alignment with rectangular notches 46, the periphery of opening 45 has rectangular notches 47. Opening 45 is surrounded by a depending circular flange 48.

Notches 46 of plaster ring 40 receive a pair of assembly clips 50 which are seated in these notches and secured in position by detents 51 registered in apertures in plaster ring 40. Each clip 50 grips plaster ring 40 through the medium of spring fingers or tongues 52 engaging beneath the plaster ring. Each assembly clip 50 further has an upwardly extending leg 53 with a convexly curved upper edge 54 formed with a rectangular slot 55.

Housing 20 is mounted through plaster ring 40, for support thereby, by compressing the legs 31 of torsion springs 30 to an extent sufficient to allow the hooked ends 32 to pass through the rectangular slots 55, after which the legs 31 are allowed to expand outwardly under the torsion spring bias. The housing 20 is then pushed upwardly until the flange 25 abuts against the lower surface of the apertured panel 37, and the housing is retained releasably in its upper position, shown in FIG. 2, by virtue of the bias of the torsion springs 30. For inspection, maintenance or repair of a loudspeaker or other component element of the arrangement mounted within housing 20, the latter may be pulled down, as indicated in FIG. 3 until the hooked ends 32 engage the curved upper edges 54 of the clips 50, thus limiting further downward movement of the housing 20.

A typical mounting of a cone type loudspeaker 60 is illustrated in FIGS. 6 through 9. Loudspeaker 60 includes a driver assembly 61, and speaker 60 is supported, through the medium of a gasket 62, on an annular cross section ring 63. The rim 64 of loudspeaker 60 is secured to the horizontal leg of annular cross section ring 63 by prongs 66 integrally formed on horizontal leg of ring 63 extending upwardly through aligned apertures in gasket 62 and rim 64, and engaged in clip type nut 67 on the upper surface of rim 64.

Ring 63 is secured in the side wall 21 of housing 20 by clip type rivets 68 inserted through aligned apertures in side wall 21 of housing 20 and in the vertical leg of annular ring 63. To properly locate ring 63 in housing 20, side wall 21 of housing 20 is deformed inwardly, as indicated in FIGS. 6, 7 and 8, to provide inwardly projecting abutments or tongues 56 which abut the upper edge of the vertical leg of annular ring 63. By extracting spring type rivets 68, loudspeaker 60, to-

gether with its annular mounting ring 63 may be removed downwardly out of housing 20, for inspection, maintenance or repair as indicated in phantom in FIG. 6.

The horizontal leg or flange of annular ring 63 preferably has secured thereto a speaker protecting grill 65. The loudspeaker is further provided with a terminal plate 71 carrying a pair of male terminals 72 engageable by female terminals 73 on the ends of wires 74 forming part of a cable connected into strain relief 28 where wires 74 are joined to the wires of the cable 33 connected to the public address system.

In the embodiment of the invention shown in FIGS. 9 and 10, a speaker transformer 70 and an impedance selector switch are mounted within the housing 20, with transformer 70 being mounted on closed top wall 22 and impedance selector switch 75 being mounted on the bevelled transition wall 23.

In FIG. 11, the housing 20 is illustrated as provided with an electrical connector which is in the form of a BX-cable connector 28' mounted on the bevelled transition wall 23, and having a BX cable secured therein by the usual clamping screw 57 and extending therefrom to the public address system. Alternatively, a BX-cable adapter may be removably engaged to bevelled transition wall 23 over existing cable 33 and cable connector 28 to thereby facilitate change-over to a BX-cable system. It should be noted that in FIGS. 9 and 10 the speaker leads are connected to the transformer 70, the latter is electrically connected to the impedance selector switch 75, and switch 75 is connected, in electrical connector 28, to the cable 33 leading to the public address system.

In FIGS. 12 and 13, a modified housing 80 is mounted to extend upwardly through the circular aperture 39 in a panel 37. Housing 80 includes a side wall 81 and a top wall 82, and the housing is offset inwardly, at its upper end, to form an annular substantially rectangular channel 83. The open lower end of housing 80 has a peripheral flange 84 and flange 84 is secured directly to panel 37 by bolts or studs 76.

A horn type speaker 85 is secured within the housing 80 by bolts 77 extending through apertures in the base of channel 83, and bolts 78 secure a driver assembly 86 to the loudspeaker. An inverted skirt member 87 is secured to horn speaker 85 through the medium of studs or bolts 88. Skirt member 87 extends in spaced relation to the outer wall of annular channel 83, and the skirt member 87 further has a central annular extension 89 surrounding, in spaced relation, the lower portion of the horn speaker 85. A speaker grill 65' is secured to horn speaker 85 by a central bolt or stud 58. A contact strip 15 is secured to the peripheral portion 82' of top wall 82 of housing 80, and carries terminals 16 for connection of the horn speaker 85 to a public address system, the connection of the speaker to the contact strips being only partially illustrated in FIG. 12.

In the embodiment of the invention shown in FIG. 14, the driver assembly 86 of the horn speaker 85 is enclosed within a separate housing which forms the closed inner or top wall of the main housing mounting speaker 85. In effect, the housing 80' of FIG. 14 includes side wall 81' and mounting flange 84', which correspond to the side wall 81 and mounting flange 84 of the housing 80 of FIGS. 12 and 13. However, the top wall 82 and the inner side wall or flange of channel 83 of the housing 80 of FIGS. 12 and 13 are cut away to

provide the housing 80' of FIG. 14. This leaves an inwardly projecting flange 91 as the "base" of the cut away channel 83, and the bolts or studs 87 secure horn speaker 85 to flange 91, with skirt member 87 again being secured to speaker 85 by the bolts or studs 88.

Replacing the cut away top wall 82 and the cut away inner wall of the annular channel, there is the separate housing 90 which has a side wall 92, a closed top wall 93 and a peripheral flange 94 delimiting its lower open end. Flange 94 is secured to the flange 91 of main housing 85, and to horn speaker 85, by the bolts 77. Housing 90 encloses the speaker driver assembly 86, and a control assembly, generally indicated at 95, is mounted on the outer surface of side wall 92 of driver housing 90. Control assembly 95 includes the impedance selector switch, transformer and terminals 96 for effecting connections between the switch 75, the driver assembly 86, and a public address system. Otherwise, the arrangement of FIG. 14 is essentially similar to that of FIGS. 12 and 13.

As is apparent from the preceding paragraphs, this invention affords its user utilitarian advantages as well as novel safety-oriented features. For instance, for fire protection of the speaker system, an armored cable provides complete metal enclosure of hook-up leads. When employed, the transformer and switch may be enclosed within the speaker housing and may be protected thereby, while the units are readily accessible for adjustment. As a practical matter, these units may be factory assembled, factory tested for assurance of reliability and quickly installed. Prior units assembled at a situs of use cannot be pre-tested.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above constructions without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. A mounting for a loudspeaker in a drop ceiling or "false wall" structure of a type having panels or tiles, said mounting being supportable on beams suspended from a support structure or said panels or tiles, said mounting comprising, in combination, housing means including a substantially cylindrical housing having a side wall, a closed upper end, an open lower end, and a peripheral flange at said open lower end, said housing means being insertable through a conforming opening in a panel or tile, said peripheral flange being engageable with the exterior surface of the panel or tile around said conforming opening; a loudspeaker connector means secured to said housing means adjacent its closed upper end, mounting means securing said housing means to said structure with said flange sitting against the exterior surface of a panel or tile; a loudspeaker positioned within and protected by said housing means, and having electrical leads extending to said connector means, said loudspeaker having a peripheral rim, an annular cross section ring having an outer diam-

eter substantially equal to the inner diameter of the side wall of said housing, means securing the rim of said loudspeaker to a horizontal leg of said annular cross section ring, the vertical leg of said annular cross section ring having apertures alignable with apertures in the side wall of said housing, and resilient clip-type rivets insertable, from the exterior of said housing, through the aligned openings in the side wall of said housing and in the vertical leg of said ring to mount said ring and said loudspeaker within said housing.

2. A mounting for a loudspeaker, as claimed in claim 1, including a speaker grill having a flange secured to the horizontal leg of said annular cross-section ring in engagement with the lower surface of said horizontal leg.

3. The mounting for a loudspeaker, as claimed in claim 1, including a plaster ring having a central circular opening therethrough; support means supporting said plaster ring on said suspended beams with said plaster ring positioned in spaced relation beyond a panel or tile having a conforming opening for receiving said housing with a circular aperture in said plaster panel being aligned with the opening in said panel or tile; said mounting means securing said housing to said plaster panel.

4. A mounting for a loudspeaker, as claimed in claim 3, in which said supporting means comprises a pair of laterally spaced straps each extending between and secured to a pair of adjacent suspended beams; said plaster ring being substantially rectangular in plan and having, along a pair of opposite edges, struck-out tongues engageable in gripping relation beneath a strap when said plaster ring is supported on said straps; said plaster ring being formed, along each of said opposite edges, with a central rectangular recess therein, and said circular aperture being offset at a pair of diametrically opposite points to form shallow rectangular recesses each aligned with one of said first mentioned rectangular recesses; said mounting means including a pair of resilient clips each seated in a respective one of said first-mentioned rectangular recesses and gripping said plaster ring inwardly thereof, each clip including an upwardly and inwardly sloping leg having a curved upper edge formed with a rectangular slot which is substantially aligned with the associated one of said shallow rectangular recesses when the respective clip is mounted on said plaster board; said housing having a pair of bushings extending from its side wall in diametrically opposed relation adjacent the lower end of said housing; and a pair of torsion springs each wound around a respective bushing and having a pair of diverging legs extending upwardly from the associated bushing and having outturned ends forming hooks; said housing being mounted on said plaster ring by compressing the legs of the two torsion springs to insert the

hooked ends thereof through the slots in the clips, followed by pushing the housing through the aperture in said plaster ring until the housing flange engages the surface of said panel having such conforming opening; said housing being retained in position by the friction of the diverging legs of said torsion springs against the end edges of the associated slots of said clips; said housing being movable relative to said structure, for inspection maintenance and repair of a loudspeaker mounted in said housing, by pulling on said flange, with the hooked outer ends of the legs of said torsion spring limiting such movement by engaging the curved upper ends of the legs of said clips.

5. A mounting for a loudspeaker, as claimed in claim 4, in which each strap includes an upturned leg at each end thereof formed with a series of apertures whereby the associated strap may be secured in adjusted relation to said suspended beams.

6. A mounting for a loudspeaker, as claimed in claim 1, in which said loudspeaker connector means comprises a BX connector mounted through said housing adjacent said closed upper end thereof and arranged to have a BX cable connected thereto for connection of said loudspeaker to a public address system and the like.

7. A mounting for a loudspeaker, as claimed in claim 1, including an annular gasket interposed between said loudspeaker rim and said horizontal leg of said annular cross section ring; and threaded connector means extending through aligned apertures in said rim and in the horizontal leg of said annular cross section ring and securing said rim to said annular cross section ring.

8. A mounting for a loudspeaker, as claimed in claim 7, in which said housing is formed with plural inwardly directed abutments in its side wall at uniform distances above said rivet receiving apertures in said side wall; said abutments engaging the upper edge of said annular cross-section ring to limit upward movement of said annular cross-section ring in said housing to a predetermined distance above the open lower end of said housing.

9. A mounting for a loudspeaker, as claimed in claim 1, including a driver assembly secured to said speaker within said housing and enclosed thereby; and a speaker transformer mounted on said closed upper end of said housing and disposed within and enclosed by said housing, said transformer being electrically connected to said driver assembly.

10. A mounting for a loudspeaker, as claimed in claim 9, including a speaker impedance selector switch mounted within said housing adjacent said closed upper end thereof and connected to said loudspeaker, said selector switch being adjustable from the exterior of said housing.

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