Sept. 24, 1963 C. S. BROWN 3,104,730

SPEAKER ENCLOSURE

Filed Feb. 2, 1960

Fig. 1.

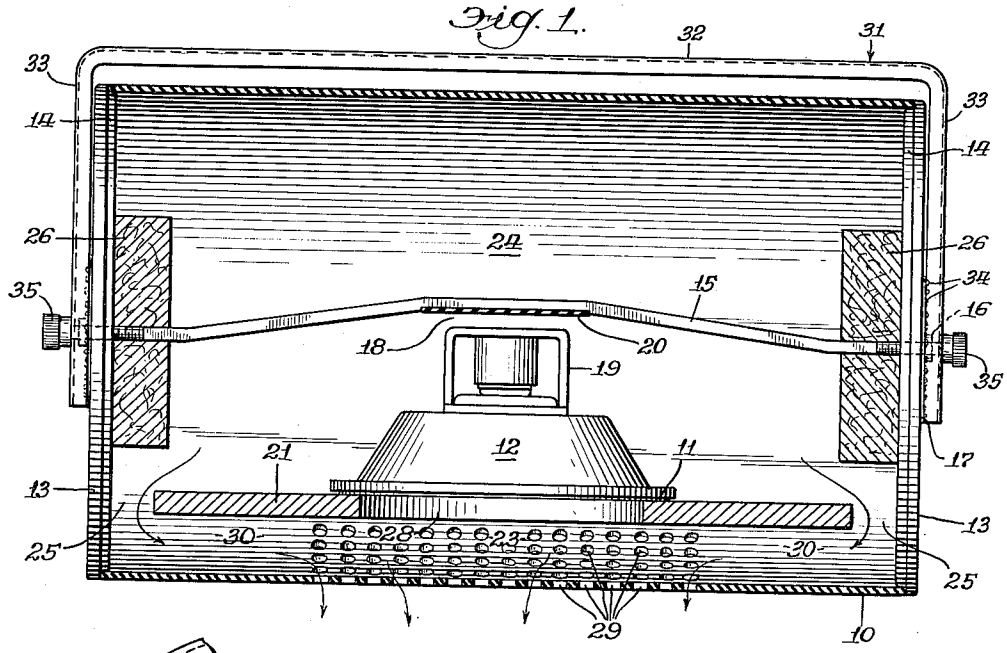


Fig. 3.

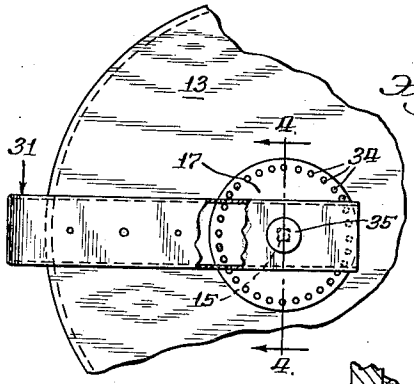


Fig. 2.

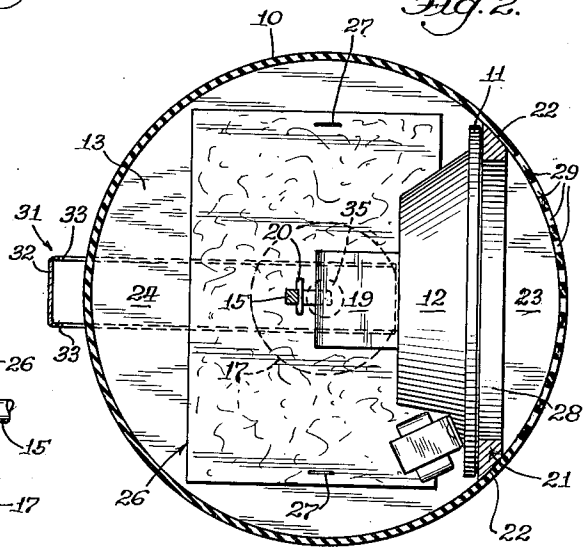


Fig. 4.

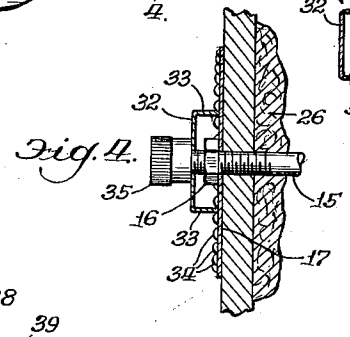
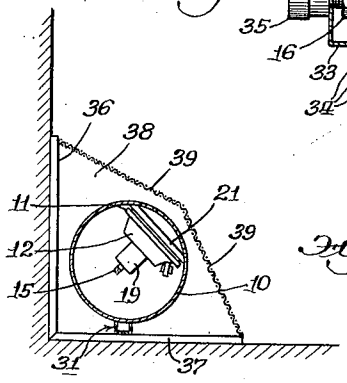


Fig. 5.



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SPEAKER ENCLOSURE

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5 Claims. (Cl. 181—31)

This invention relates to loud speakers, and particularly to an improved and simplified acoustic enclosure for a transducer capable of achieving an unusually high degree of acoustic efficiency with a given transducer, yet relatively inexpensive to manufacture, light in weight, and so designed as to be easily adaptable to different types of mountings.

It is known that acoustic enclosures must be surprisingly rigid to prevent undue energy absorption and losses. It follows that while acoustic enclosures of the Helmholtz resonator type, for example, have long been recognized as being highly desirable from a standpoint of efficiency and sound quality, yet they have heretofore been so expensive as to sharply curtail their adoption in highly competitive fields.

It is accordingly a primary object of the present invention to provide a speaker enclosure wherein the structural parts surrounding the transducer unit and functioning as the sound chamber therefor may be constructed of relatively light and inexpensive materials, yet arranged to achieve the high degree of over-all rigidity necessary for the efficient distribution of sound.

A further object is the provision of an improved speaker enclosure of shape and configuration suitable for mounting in either vertical or horizontal position, well adapted for use as a corner unit at either a wall or ceiling intersection, and at the same time arranged for easy and convenient directional adjustment.

According to the present invention, these objects are achieved by a unique formation and arrangement of the component parts of a duct-loaded reflex enclosure, with the parts shaped and pre-stressed in a manner such that their over-all rigidity is considerably greater than would be expected. The result is a product having an important cost-performance advantage over prior art devices.

A present preferred embodiment of the invention is shown in the drawing attached to and forming a part of the present specification, wherein:

FIGURE 1 is a longitudinal sectional view:

FIGURE 2 is a transverse sectional view;

FIGURE 3 is a fragmental end elevational view, showing mounting means for the assembly;

FIGURE 4 is a detail sectional view taken substantially on the plane of the line 4—4 of FIGURE 3; and

FIGURE 5 is a detail sectional plan view showing the manner in which the assembly may be enclosed in a corner cabinet, for example.

The speaker enclosure includes exterior housing **10** in the form of a cylindrical tube surrounding the transducer **12**. This transducer may be a conventional loud-speaker, in which case the tube **10** is preferably of a diameter approximately half again the diameter of the mounting flange **11** of the speaker for which the enclosure is designed. The tube is preferably of length greater than twice the diameter of the speaker cone, and less than twice the diameter of the tube. This exterior housing may be formed of any material having the requisite degree of stiffness and rigidity and it has been found that, by the practice of the inventive teachings disclosed hereinafter, it is entirely practicable to form the housing of spiral wound seamless laminated paper tube. A tube having wall thickness of .150 inch is quite satisfactory for an 8 inch speaker of conventional design, and the over-all dimensions of the tubular housing suited to such a

transducer may be about 19 inches in length and about 11 inches in diameter.

The ends of the tubular housing **10** are closed by paired end plates **13** which may be formed of wood, plywood, synthetic wood, fiber or plastic and are preferably provided with shoulders **14** seated within the opposite ends of the tubular housing **10**. The plates **13** are held in position by a tie rod **15** extended through central apertures in the opposite plates **13** and provided with threaded ends carrying paired nuts **16**. As shown in FIGURE 4, these are arranged to be tightened against the outer faces of a pair of adjustment discs **17** located on the exterior surfaces of the plates **13**. Tightening of the nuts **16** will thus pre-stress the tubular housing **10** in a longitudinal direction and will also flex the end plates **13** slightly inwardly from their original planar position, rendering the housing structure quite rigid notwithstanding its relatively light and inexpensive construction.

In the case of a speaker assembly proportioned according to the preferred example of the invention illustrated, it is desirable that the central tie rod **15** be bent or offset intermediate its threaded ends, so that there will be a clearance space **18** between the tie rod and the magnetic yoke **19** of the speaker. Also, as illustrated, a rubber pad **20** may be provided to prevent any possibility of accidental contact between the tie rod and the speaker yoke.

The speaker unit **12** is mounted behind a suitable sound aperture in a relatively rigid divider panel **21** of width substantially equal to the flange diameter of the speaker (FIGURE 2) and beveled along its longitudinal edges **22** to fit closely within the inner walls of the tubular housing **10** where it may be nailed, stapled or glued in position. In the preferred proportions illustrated, the panel **21** subtends an arc of about 90° within the interior surface of the tube **10**, and thus divides the entire housing into a relatively small frontal compartment **23** and a larger rear compartment **24**.

The divider panel **21** is preferably formed of relatively rigid plywood and in an enclosure of the proportions shown it will be of a length about double its width. It is preferably centrally disposed with respect to the length of the tube **10**, so that the ends of the panel terminate short of the end plates **13** of the housing and leave a pair of sound passages **25** interconnecting the rear compartment **24** and the opposite ends of the front compartment **23**. If desired, bats of acoustic insulation **26** may be secured to the inner faces of the end plates **13** by staples **27** or otherwise.

With the construction as thus far described, it will be apparent that sound generated by the transducer **12** will pass through the central aperture **28** of the divider panel **21** and thence be discharged through a registering sound outlet aperture in the exterior wall of the tube **10**. This sound outlet aperture may be a single opening if desired, although in practice it is preferable to provide a grill consisting of a multiplicity of relatively small perforations **29** centrally grouped in front of the speaker and spaced away from the ends of the tube so as to provide inwardly extending longitudinal duct portions **30** leading from the passages **25** to the perforations **29**. In either case, the opening or openings through the wall of the tube should be large enough not to restrict the performance of the transducer or the ducts, so that it will not affect the resonant frequency of the enclosure. In practice, this result is accomplished by providing a grill consisting of 224 round holes, each of ⅜ inch diameter and arranged in 16 longitudinal rows and on 9/16 inch centers with respect to each other.

The speaker enclosure may be mounted in any convenient manner and in either horizontal or vertical position, but for greatest convenience and flexibility in mounting it is provided with a generally U-shaped bracket **31**

of channel-like shape, including a central web 32 having narrow side flanges 33 projecting inwardly from the opposite edges of the web (FIGURE 4). The adjustment discs 17 heretofore described, are provided with a series of small bulged detent projections 34 circularly disposed around the periphery of the discs, so that the flanges 33 of the bracket will engage the detents 34 when the opposite arms of the bracket are drawn inwardly by paired thumb nuts 35 threaded on the extreme ends of the central tie rod 15. It follows that the entire speaker housing may be rotated to any desired angular position by loosening the thumb nuts 35, and that it will be firmly held in the selected position by retightening the nuts.

It is also contemplated, however, that the essential operating parts of the speaker enclosure may also be enclosed in an ornamental cabinet or concealed behind a decorative grill cloth. As an example, an assembly is shown in FIGURE 5 wherein the structure thus described is enclosed within a corner cabinet formed of back panels 36 and 37 which may have end panels 38 to define a frame over which speaker grill cloth 39 may be positioned. It is believed obvious that a cabinet of this general form may be used in various types of installations either with the speaker cylinder in vertical position as at the corner of a room or with the speaker cylinder horizontally disposed as in an overhead mounting at the intersection of a wall and ceiling.

From the foregoing, it will be apparent that the invention here disclosed achieves important advantages over the prior art in that it provides a speaker enclosure of highly efficient acoustical design, yet with the several component parts so related that maximum rigidity is achieved by the use of materials which are themselves comparatively light and inexpensive. This is due largely to the fact that the exterior housing of the enclosure is of cylindrical form, and also by reason of the fact that both the cylinder and the end plates are pre-stressed in a manner to increase their rigidity. This structure permits the successful operation of a Helmholtz resonator of the duct-loaded reflex type without excessive losses in efficiency due to the relatively light and inexpensive materials from which the enclosure is constructed, and thus makes possible low cost equipment capable of unusually high efficiency sound radiation.

Having thus described my invention, what I claim as new and desire to secure by United States Letters Patent is:

1. A speaker enclosure comprising, in combination, a relatively rigid exterior housing comprising an elongated cylinder of thin-walled, non-metallic tubing of length substantially greater than its diameter and a pair of relatively flat end caps closing the ends of said cylinder, and a relatively flat rigid interior divider panel of generally rectangular configuration in offset position within the housing and subtending a minor arcuate portion of the cylinder; with two opposite edges of the panel secured to the interior surface of the housing and dividing the interior of the housing into a relatively small frontal chamber and a substantially larger rearward chamber, and with at least one of the other edges of the panel inwardly spaced from a portion of said housing so as to define a space therebetween; said cylinder being held under longitudinal compression and said end caps being under tension and flexed from normal planar position by a tie rod extending through said cylinder and secured in a central position with resepct to each of said end caps; the panel having an accommodating speaker mounting aperture intermediate its ends, a speaker mounted in said accommodating aperture, the external cylinder wall having a plurality of sound discharge apertures therein generally inwardly spaced from said other edges of said panel and in substantial registry with the aperture in the panel, whereby said rearward chamber is joined to said frontal chamber by at least one duct extending around an edge of the aforesaid divider panel and toward the sound discharge apertures in said external cylinder wall.

2. The device of claim 1 wherein said cylinder is formed of paper and both of said other edges of said panel are inwardly spaced from portions of said housing so as to define a space therebetween wherein two generally similar ducts are formed.

3. The device of claim 1 wherein means are provided to prevent contact between portions of said speaker and said tie rod.

4. The device of claim 1 further characterized in that acoustic insulation is provided on the inner faces of said end caps.

5. The device of claim 1 further characterized in that a mounting bracket assembly is adjustably secured to the housing to enable said housing to be fixedly positioned at any one of a number of angular positions.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,104,730 September 24, 1963

Charles Scott Brown

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, lines 2 and 12, and in the heading to the printed specification, line 4, for "Automatic Canteen of America", each occurrence, read -- Automatic Canteen Company of America --.

Signed and sealed this 14th day of April 1964.

(SEAL)
Attest:

ERNEST W. SWIDER

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents