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ACOUSTIC TRANSLATING DEVICE

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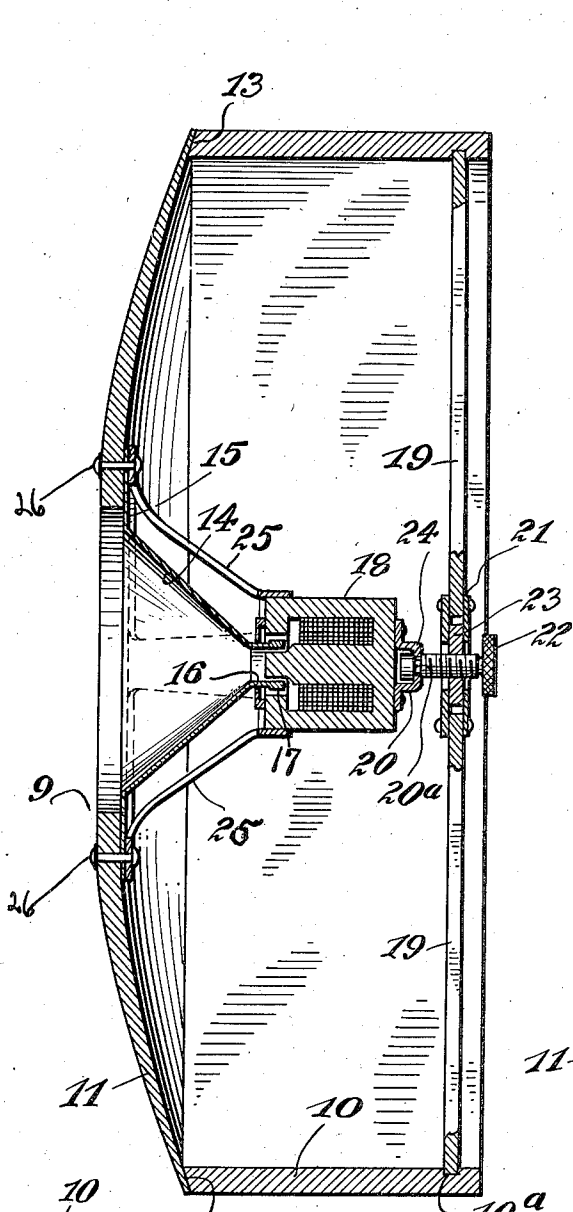


Fig. 1.

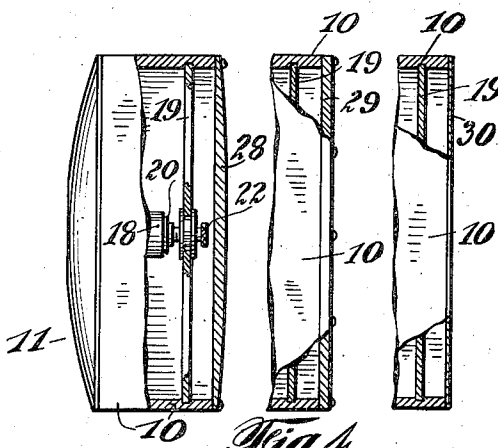


Fig. 2.

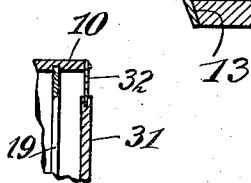


Fig. 3.

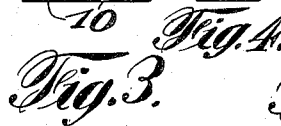


Fig. 4.

Fig. 5.

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ACOUSTIC TRANSLATING DEVICE

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11 Claims. (Cl. 181—31)

This invention relates to mountings for sound reproducing equipment, as for instance, loud-speakers.

One object of the invention is to provide means for improving the low frequency response. Another object of the invention is to provide means for increasing the clarity of the response.

Still another object of the invention is to provide means for reinforcing the output of the loud-speaker unit.

Another object of the invention is to provide for yieldingly supporting the outer end of the conical diaphragm of a loud-speaker, said support being in the nature of a vibratory continuance of the diaphragm, responsive to said diaphragm.

Another object of the invention is to induce and locate the resonant frequency at some desired portion of the low frequency spectrum.

For this purpose, the invention consists in an improved baffle under pressure or tension, so arranged and combined with a housing and a diaphragm of a loud-speaker mechanism as to carry out the foregoing objects. In a pre-stressed panel made in accordance with my invention, considerably less absorption or vibromotive impulses occur than in the panels heretofore used.

Another feature results from pre-determining the stiffness of the rear panel, its effective area, and the volume of the chamber, between the rear panel and baffle, thereby greatly enhancing the sound reproduction. Another feature of my invention consists in introducing one more mass, and at least one more resiliency, into the vibrating system, by enclosing said chamber by a substantially closed rear panel. In such a case, the mass of the rear panel, the stiffness of the same, and the effective stiffness of the entire air cavity, cooperate to give better results, the regulated body of air being subjected to the vibration of a controlled baffle.

Other objects of the invention, and the novel effects thereof, will appear from the following description and from the appended drawing; and will be finally pointed out in the subjoined claims.

In the accompanying drawing:—

Figure 1 is a perspective exterior view of my improved loud-speaker mounting;

Figure 2 is a vertical sectional view taken on the line 2—2 of Figure 1, showing my improved resilient baffle in combination with a loud-speaker unit and a housing therefor;

Figure 3 is a partial sectional view with the addition of a rear closing panel; and

Figures 4, 5, and 6 are similar views of different forms or rear closing panels.

Referring to the drawing, and more particularly to Figure 1, a rectangularly shaped casing or housing 10 is there shown, which at its front is provided with a baffle 11. A diaphragm 14 is placed centrally of the baffle 11, and a line of flexure 12 is indicated by a dot-dash line.

Referring to Figure 2, the baffle 11 is preferably tapered towards the edges thereof. The baffle 11 is made in the shape of a crown by being flexed with the fibers of the outer surface portion under tension and the fibers of the inner surface portion thereof under compression, and so flexed is applied to the casing. The frame of the housing 10 is relatively rigid and of thick non-absorbing wood, and is cut so as to be at an angle at its open end, as shown in 13, this angle being chosen to have the frame shaped to the bend or curvature of the interior of the baffle. When the baffle is supplied to the housing the peripheral portion of the baffle 11 is then glued or fixedly cemented to this beveled edge of the housing while pressure is being applied, so as to obtain a secure anchorage. All this is carried out in such manner as to maintain the initial crowned shape of the baffle. After the baffle has been applied to the housing, as described, it still has its initial flexure. This flexured baffle 11 is provided with a central opening 9, preferably of circular shape. The baffle is preferably made of light and resonant wood, such as spruce.

At the rim portion of the opening 9, there is applied any form of suitable loud-speaker mechanism, as a dynamic, magnetic, or crystal driving unit. In the embodiment shown, a free acting conoidal diaphragm 14 is shown. This diaphragm 14 is provided with a ring 15 applied to the rim portion of the opening 9 of the flexured baffle. It will be noted that the diaphragm 14 flares outwardly as it merges into its ring portion 15, which forms a continuation of the flexured baffle 11, around the rim of the opening 9, at the thickest part of the baffle. As a result, vibrations of the diaphragm traveling along the conical sides of the diaphragm from its apex to its flaring portion, transpose themselves to the baffle 11, and travel along the latter. In other words, the vibrations of the diaphragm are communicated in like phase to the baffle with a minimum impedance, if any.

A conventional movable centering device 16, generally known as a work element and located near the apex of the diaphragm 14, is arranged to move in a flux generated by the field struc-

ture 18. In this field structure 18 is embodied the mass of the driving unit. The weight of this driving unit 18 may be supported by a cross-member 19, which is affixed to the rigid frame of the housing at its rear, in this instance, through the groove connection 10a, as shown in Fig. 2. Said cross member 19 leaves the rear of the housing open, and this cross-member 19 may be replaced by other suitable support for the driving unit 18. The driving unit is supported by the cross-member 19 through the instrumentality of a knurled screw 22, threaded into the bushing 23, which is supported by the gasket 21 applied to the cross-member 19. The free end of the screw 22 engages a split collar 24 affixed to the driving unit 18. The adjusting screw 22 is provided with a groove 20a to permit the rotation of the screw in respect to the split collar 24. By turning screw 22, the driving unit can be moved inwardly or outwardly in respect to the cross-bar 19, and in consequence the rim portion of the opening 9 of the flexured baffle 11 is moved either inwardly or outwardly. The rigidity of the cross-bar 19 is such that it acts as a base to enable the baffle to be so adjusted that thereby the baffle may be adjusted and subjected to either tension or pressure by the turning of the adjusting screw 22, the driving unit having rigid bars or rods 25 connected therewith which are in turn connected by bolts 26, or the like, to the rim portion of the baffle 11. The rigidity of the cross-member 19 is such that it resists the action of the screw 22 so that the rim portion of the opening 9 of the baffle plate can be moved.

The baffle 11 is of crowned shape, and as tension is applied to the baffle from the inside thereof, the stresses set up in the baffle by the crowning process employed resisting such additional tension, become neutralized around a line shown at 12, Figure 1. The resiliency is greatest when the baffle has been so adjusted and the baffle may be controlled in the manner described. When the loud-speaker is being used, the part of the baffle from the flexure line 12 inwardly towards the center of the baffle 11, acts in the nature of a pivoted arm with its pivot on the line 12. The flexure line may also be called a neutralization line, since the stresses set up by the crowning process employed in the making of the baffle and in its application to the housing, become neutralized along that line. With each baffle the position of this line of flexure naturally varies, as its position depends upon the initial flexure of the baffle, its texture, its thickness, etc., as also the weight of the loud-speaker unit, etc.

The improved device operates by reason of the interaction of the various masses and resilient members associated therewith, in that the combined mass of the diaphragm 14 and its work element 16 and its enlargement 17, within the driving unit 18, the mass of the driving unit 18, the combined stiffness of the cone suspension members 25, and the stiffness of the suspension of the driving unit 18 relative to the rigid frame constitute a function of the thickness and curvature of the baffle when all these parts act together.

In the conventional rigid type of baffle, only one exchange of energy occurs, namely, between the mass of the baffle and the stiffness of the suspension members. In the improved construction, a second exchange of energy occurs between the mass of the driving unit 18 and the stiffness of the suspension of the driving unit. By adjusting the stiffness of this driving unit suspension, these natural frequencies are placed in any desired regions

of the low frequency spectrum, thereby greatly enhancing the sound reproduction which may be secured.

The invention may be further carried out by other embodiments. The rear of the rigid frame 10 may be enclosed as shown in Figure 4 where a closed rear panel 29 with parallel sides is shown, the thickness of which may be equal to or greater than that of the walls of frame 10; and in Figure 5 is shown a closed panel 30 with parallel sides and with a thin wall which may be parchment, leather, rubber, felt, etc. In Figure 3 is shown a closing panel 28 of a thickness gradually tapering towards the edges. In Figure 6 is shown an entirely closed rear panel 31, with peripheral flap extensions 32, enabling flexibility to be obtained. The closing panels 28, 29, 30 and 31 may or may not be provided with suitable openings regulating the braking action of the confined air, which openings may be regulated or controlled.

In each of the embodiments of the cross-bar where one is used this must be stiffer than the baffle.

By a closed rear panel, one more mass and at least one more resiliency is introduced into the vibrating system by flexibly enclosing this structure, namely, by the mass of the rear panel, by the effective stiffness of the enclosed air cavity, and by the stiffness of the rear panel to enable the baffle to be regulated.

By pre-determining the stiffness of the rear panel, its effective area, and the volume of the chamber, the resonant frequency induced and located at some desired portion of the low frequency sound spectrum, may be determined.

In the preferred form of baffle, the fibers thereof are parallel with the largest dimension of the frame to which the baffle is applied.

From the foregoing, it will be seen that the invention is embodied in the flexured baffle regulatable against its pre-stressed crowned shape; by the enclosed volume of air; and by the momentum of weighted parts as hereinabove described.

By non-absorbing wood is meant a wood such as a hard wood, as birch or maple, which does not absorb sound as readily as a softer wood.

The baffle itself, may be made thick or thin, or of various flexures; and tapering of the same may be varied.

The tones produced by the vibration of the improved baffle are less directional than the tones of the loud-speaker diaphragm alone due to the largely increased vibratory area of the resilient baffle.

It will also be noted that the foregoing description sets forth a mode of operation which consists in subjecting a column of air in like phase to and in addition to vibrations of a diaphragm of a loud-speaker, and modifying the vibrations of a column of air. It might also be pointed out that the space enclosed between the frame, the baffle, and the rear wall, forms an acoustic chamber in which space the air vibrations produced by the baffle react upon the baffle and set up by vibrations, the phase relations of which with respect to the baffle, are a function of the audio frequency, and these vibrations increase the effectiveness of the sound radiation over a predetermined low frequency band.

I have shown herein various embodiments of my invention, but it is clear that changes may be made therein without departing from the spirit of the invention, as defined in the appended claims.

I claim:—

1. In an acoustic translating device, the combination of a casing, a crowned and longitudinally and transversely flexed baffle supported on the front of said casing and having an opening, a diaphragm connected at its largest diametrical portion with the inner side of the baffle near its opening, a work element connected with the apex of said diaphragm, a support on the rear side of said casing, and a relatively stationary driving unit affixed to the inner sides of said baffle near its opening and to said support, said driving unit being heavier than the work element.

2. In an acoustic translating device, the combination of a rigid frame, a resilient baffle affixed around its periphery to said frame at the front thereof, a cross-bar on said frame at the rear thereof, a relatively stationary driving unit connected to said baffle and to said cross-bar, means on said cross-bar for adjusting the pressure or tension on said baffle in respect to said cross-bar, a diaphragm connected with the baffle, and a movable work element cooperating with said driving unit and connected with the diaphragm.

3. In an acoustic translating device, the combination of a rigid solid frame, a pre-stressed wooden tapering baffle rigidly affixed to said frame around its periphery and having the fibers thereof directed parallel to the longest dimension of said frame and having a central opening, a diaphragm connected with the baffle at its central opening and forming a continuation of the baffle, and having a free end, a driving unit supported by said baffle, a work element supported by the free end of the diaphragm and cooperating with the driving unit, and means supported by said rigid frame for adjusting the baffle flexure by moving the driving unit for moving the baffle at its opening.

4. In an acoustic translating device, the combination of a rigid solid frame, a resilient crown-shaped longitudinally and transversely flexured baffle affixed around its periphery to said frame, said baffle having an opening, means connected to said baffle for changing its flexure, a conical diaphragm connected with the baffle at the opening therein, and means for actuating the diaphragm.

5. In an acoustic translating device, the combination of a rigid frame, a crowned and longitudinally and transversely flexed baffle having a thickness tapering from the center to the edges and rigidly affixed at said edges to said frame around its periphery, a diaphragm affixed to the baffle, a loud-speaker mechanism rigidly affixed to said baffle and adapted to move the diaphragm, and means for adjusting the baffle flexure.

6. In an acoustic translating device, the combination of a rigid frame, a resilient baffle affixed thereto, a loud-speaker mechanism connected with said baffle, a diaphragm affixed to the baffle and movable by the loud-speaker, and means for enclosing said frame at the rear thereof, all of the aforesaid parts forming an acoustically enclosed space.

7. In an acoustic translating device, a frame, a baffle of crowned-shape on the front of said

frame, means for adjusting the tension of said baffle, a loud-speaker mechanism, a diaphragm moved by the loud-speaker, and a substantially closed rear wall for said frame of a thickness less than that of the frame supporting part of the loud-speaker mechanism.

8. In an acoustic translating device, the combination of a frame, a baffle of crown-shape on the front of said frame, means for adjusting the tension of said baffle, a loud-speaker mechanism connected with said baffle, a diaphragm moved by the loud-speaker, and a substantially closed rear wall for said frame, said rear wall being relatively thick and substantially equal to or greater than the thickness of the frame.

9. In an acoustic translating device, a frame, a baffle of crown-shape on the front of said frame, means for adjusting the tension of said baffle, a loud-speaker mechanism connected with said baffle, a diaphragm moved by the loud-speaker, and a substantially closed rear wall for said frame, said rear wall being of tapering shape with its greatest thickness at its central portion.

10. In an acoustic translating device, the combination of a solid non-absorbing frame, a resilient baffle secured at its perimeter to said frame, having a central opening, a conical diaphragm connected at its largest diametrical portion with the rim portion of said opening for having the rim portion of the baffle and the largest portion of the diaphragm in continuation with each other, means for vibrating the apex portion of said diaphragm and for vibrating the diaphragm and baffle, whereby the vibrations of the diaphragm are communicated in like phase to the baffle, and a magnetic unit supported by said frame and connected with the baffle which is adapted to act upon said apex vibrating means.

11. In an acoustic translating device, a frame having an open front and back, the combination of a baffle having an opening and having a thickness tapering from its portion of greatest depth at the opening to the edge of the baffle, said baffle being flexed and secured in flexed condition to the open front of the frame, a rear wall closing the rear open end of the frame, a loud-speaker unit including a magnetic portion and a light working element actuated by said magnetic portion, means for supporting the magnet portion to the baffle, means supported by the rear wall for moving the magnetic portion for adjusting the tension of the baffle in respect to the rear wall, and a conical diaphragm having its largest diametrical portion connected with the baffle at the opening thereof, and having its apex portion connected with the light working element of the loud-speaker unit, said diaphragm forming a continuation of the baffle, whereby the space enclosed within the frame, baffle and rear wall, forms an acoustic chamber in which the air vibrations produced by the baffle within said space react upon the baffle so as to set up vibrations, the phase relations of which with respect to the baffle are a function of the audio frequency, this vibration increasing the effective sound radiation over a predetermined low frequency band.

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