July 16, 1963 G. H. TAYLOR, JR 3,097,720

ACOUSTICAL ENCLOSURE AND LOW FREQUENCY SOUND AMPLIFIER FOR A LOUDSPEAKER

Filed Sept. 20, 1960 3 Sheets-Sheet 1

FIG. 1

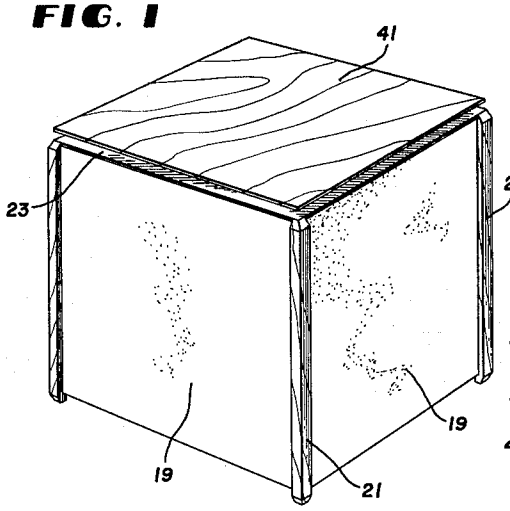


FIG. 3

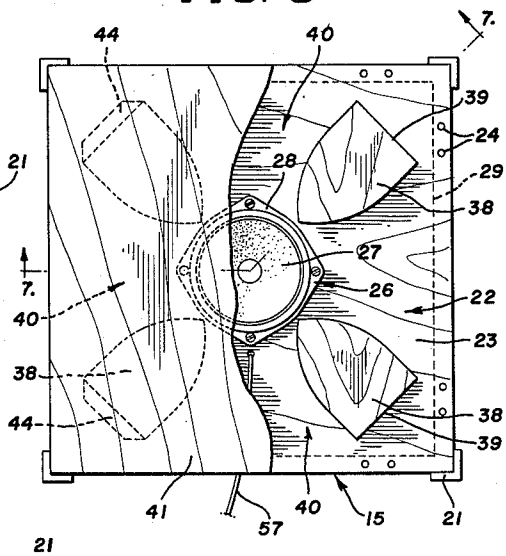


FIG. 4

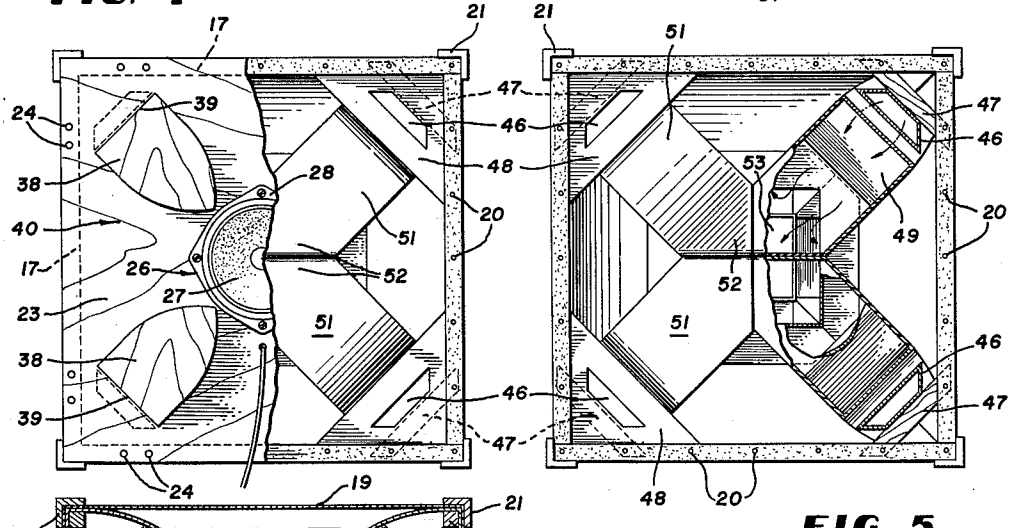


FIG. 5

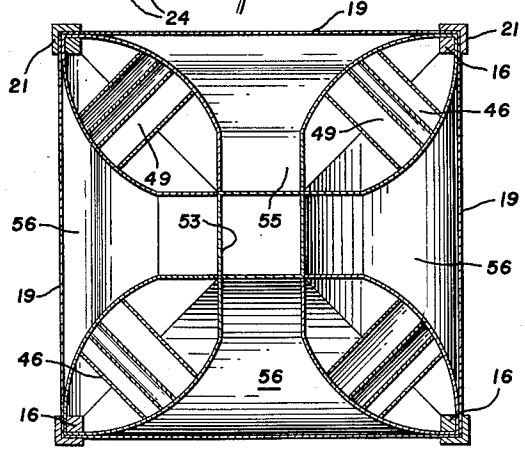


FIG. 6

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ACOUSTICAL ENCLOSURE AND LOW FREQUENCY SOUND AMPLIFIER FOR A LOUDSPEAKER

Filed Sept. 20, 1960 3 Sheets-Sheet 2

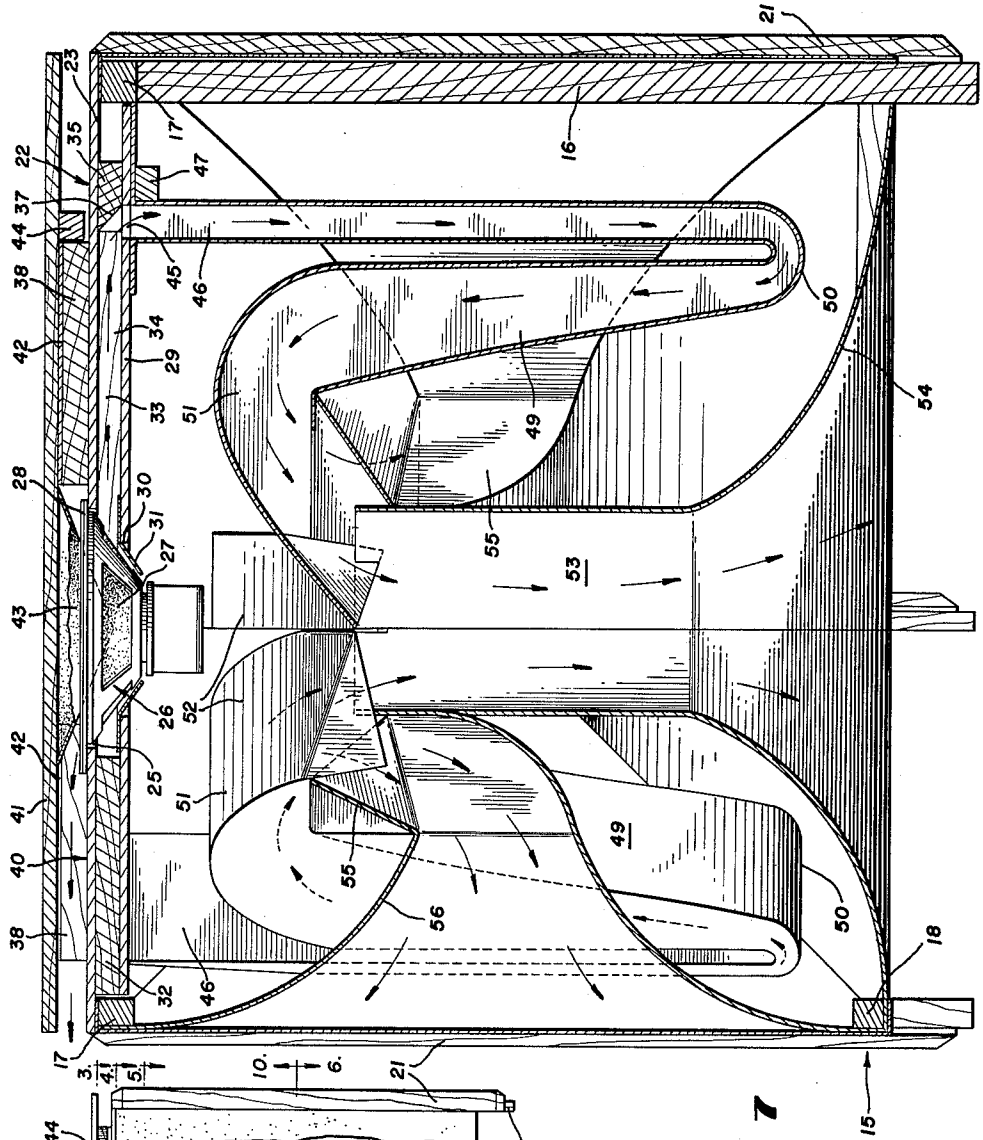


FIG. 7

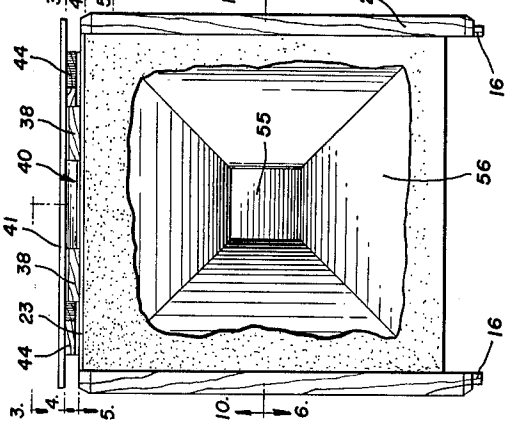


FIG. 2

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ACOUSTICAL ENCLOSURE AND LOW FREQUENCY SOUND AMPLIFIER FOR A LOUDSPEAKER

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FIG. 8

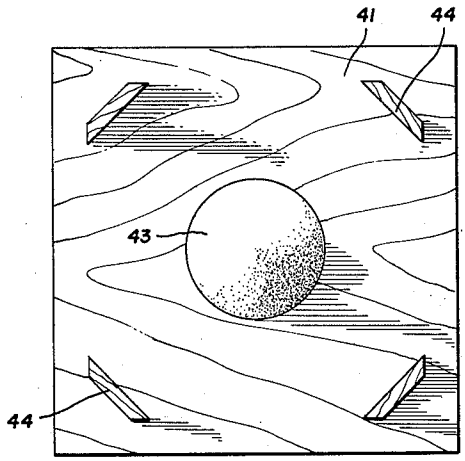
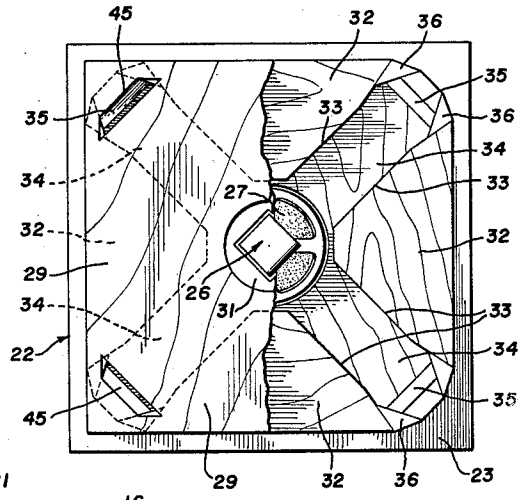
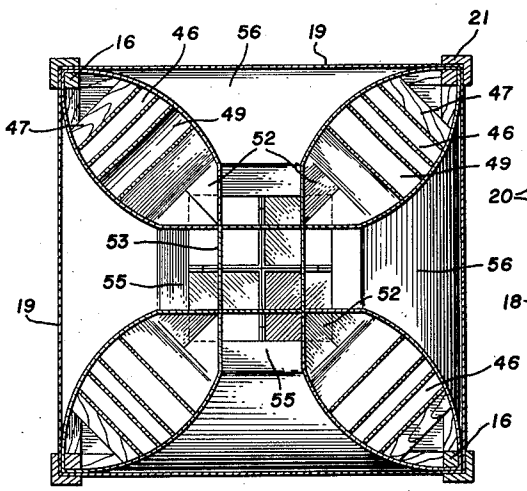


FIG. 9





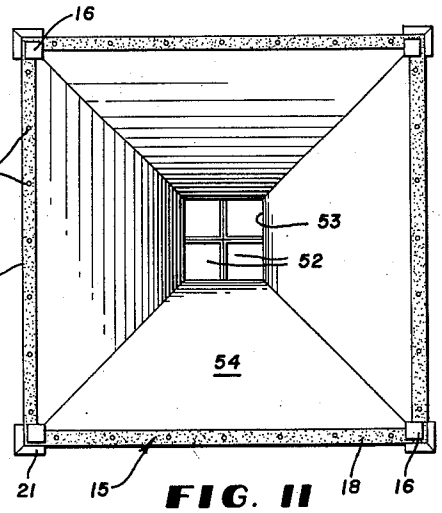


FIG. 10

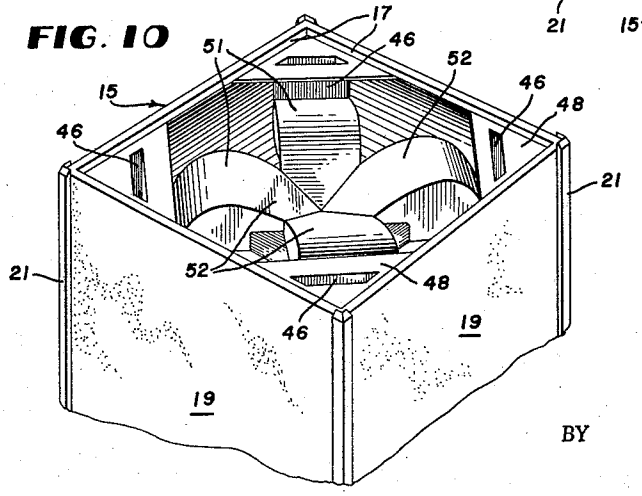


FIG. 11

FIG. 12

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ACOUSTICAL ENCLOSURE AND LOW FREQUENCY SOUND AMPLIFIER FOR A LOUDSPEAKER

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9 Claims. (Cl. 181—31)

This invention relates broadly to acoustic devices and more particularly to acoustical enclosures for loudspeakers.

An object of the invention is to provide a novel and simplified system of horns for use in conjunction with a single loudspeaker of the permanent magnet or dynamic type, particularly for amplifying the low frequency sound waves.

A further object is to provide an acoustical enclosure or cabinet for a loudspeaker substantially in cubical form and embodying a system of folded low frequency sound amplifying horns adapted to emit sound from the bottom and from the four sides of the cubical enclosure, in resonant relation to the high frequency sound waves emitted at the top of the enclosure and directed outwardly therefrom in parallelism and in superposed relation to the sound waves emitted by the side horns.

Another important object of the invention is to provide a speaker enclosure of the above-mentioned character which is highly compact and neat and attractive in appearance, so as to serve well as a furniture adjunct in the home.

Another object is to provide a loudspeaker enclosure embodying a maximum effective length of low frequency sound emitting horn structure in the minimum possible cubical space to produce desirable total sound amplification of high fidelity which is non-directional in character.

Still another object is to provide an acoustic device of the above-mentioned character which permits the usage of a single medium range and relatively low priced loudspeaker with great efficiency, and capable of emitting sound with high fidelity in all directions from the center of a room or from substantially any location in a room.

Another object is to provide an acoustic device of the mentioned character which is economical to produce in comparison with conventional high fidelity speaker enclosures utilizing a number of separate loudspeakers and expensive cabinetry and baffling structures.

Other objects and advantages of the invention will become apparent during the course of the following detailed description.

In the accompanying drawings forming a part of this application and in which like numerals are employed to designate like parts throughout the same,

FIGURE 1 is a perspective view of a loudspeaker enclosure according to the invention,

FIGURE 2 is a side elevation of the same, partly broken away,

FIGURE 3 is a plan view taken on line 3—3 of FIGURE 2 and drawn on an enlarged scale,

FIGURE 4 is a horizontal section taken on line 4—4 of FIGURE 2,

FIGURE 5 is a similar section taken on line 5—5 of FIGURE 2,

FIGURE 6 is a similar section taken on line 6—6 of FIGURE 2,

FIGURE 7 is an enlarged vertical section taken on line 7—7 of FIGURE 3,

FIGURE 8 is a bottom plan view of a top panel and baffle removed,

FIGURE 9 is a bottom plan view, partly broken away, of a loudspeaker supporting and baffle assembly,

FIGURE 10 is a horizontal section taken on line 10—10 of FIGURE 2,

FIGURE 11 is a bottom plan view of the loudspeaker enclosure,

FIGURE 12 is a fragmentary perspective view of the enclosure with the top panel and speaker assembly removed.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of the invention, the numeral 15 designates generally a substantially cubical frame including corner vertical legs or frame members 16, top horizontal frame bars 17 and bottom horizontal frame bars 18, all suitably rigidly connected to provide the cubical frame of the speaker enclosure.

Fabric sound transmitting side panels 19 formed of burlap or the like are suitably secured to the legs 16 and the top and bottom frame bars 17 and 18 by tacking or the like as indicated at 20. Corner vertical finishing strips or angles 21 are preferably applied over the fabric side panels 19 and over the legs 16 at the four vertical corners of the cubical enclosure, as shown. The top and bottom of the enclosure are not provided with the fabric panels.

Removably mounted atop the cubical framework of the enclosure is a square horizontal loudspeaker supporting and baffle assembly 22 of vertically shallow construction as shown particularly in FIGURE 9. The assembly 22 comprises a square horizontal panel 23 which rests directly upon the top frame bars 17 and may be suitably rigidly secured thereto by means of screws 24 or the like. The panel 23 has a central opening 25 within which is mounted a loudspeaker 26, which may be of the permanent magnet type embodying the usual vibratory speaker cone 27. The forward or upper flange 28 of the loudspeaker 26 rests directly upon the horizontal panel 23 and the conical loudspeaker depends from the panel 23 as shown particularly in FIGURE 7.

The assembly 22 further embodies a lower horizontal square panel 29 of somewhat smaller area than the panel 23 and adapted to nest inwardly of the upper horizontal frame bars 17. This panel 29 also has a central opening 30 receiving the conical speaker 26, and a suitable truncated conical gasket 31 preferably seals the loudspeaker within the opening 30 so that the sound waves emitted by the speaker cone 27 are largely blocked from direct passage downwardly into the interior of the enclosure below the panel 29.

Sandwiched between the panels 23 and 29 of assembly 22 are four substantially triangular baffle blocks 32 of uniform thickness, and suitably rigidly connected with the panels 23 and 29 to render the assembly 22 unitary. The baffle blocks 32 are spaced apart equidistantly and are disposed at the four sides of the assembly 22, FIGURE 9, so that their spaced inwardly converging edges 33 define therebetween four radial circumferentially equidistantly spaced sound passages 34 leading from the speaker cone 27 toward the four vertical corners of the cabinet or enclosure. The sound passages 34 are rectangular in cross section and their tops and bottoms are defined by the panels 23 and 29. Thus, sound waves emitted from the speaker cone 27 are able to travel horizontally and radially outwardly through the passages 34 only and are effectively blocked by the baffle blocks 32 which extend across substantially the four sides of the enclosure. The outer ends of the horizontal sound passages 34 are closed adjacent the corners of the lower panel 29 by solid baffle blocks or strips 35 and 36, rigid with the baffle blocks 32 and the panels 23 and 29. The inner edges 37 of the baffle blocks 35 are beveled as shown in FIGURE 7 to direct the sound waves downwardly at the outer ends of the passages 34 and into horns to be described.

Atop the panel 23 of assembly 22 are four additional radially inwardly tapering sound baffles 38 of uniform

thickness and being solid or plate-like in construction. The baffles 38 are rigid with the panel 23 and have their inner pointed ends arranged close to the periphery of the loudspeaker cone, the latter being substantially flush with the top of the horizontal panel 23. The baffles 38 have their outer broad ends 39 terminating near and inwardly of the corners of the panel 23 and extending diagonally thereof as shown in FIGURE 3. The tapered baffles 38 define between them at the four sides of the square panel 23 outwardly flaring horizontal vertically narrow sound passages 40 for the emission of relatively high frequency sound waves emitted from the top of the speaker 26, as will be further described. The high frequency sound passages 40 have their outer flared ends extending over the major portion of the width of the cubical enclosure at all four sides thereof and near the top thereof, as shown. The passages 40 are above the low frequency sound passages 34 previously described and between the same. That is to say, the passages 34 direct the low frequency sound waves from the speaker radially outwardly horizontally toward the four vertical corners of the enclosure, whereas the flared horizontal passages 40 direct the high frequency sound waves radially of the speaker 26 toward the vertical sides of the enclosure. The baffles 38 prevent the high frequency sound waves from passing toward the four vertical corners of the device, as should be obvious.

Atop the baffles 38 is mounted an uppermost square panel or baffle 41 which rests directly upon the baffles 38. The latter preferably have their top faces padded at 42 with felt or some other vibration dampening material. A downwardly tapering conical baffle 43 is dependingly secured centrally to the panel 41 and projects somewhat into the mouth of the speaker cone 27, whereby the upwardly emitted high frequency sound waves are deflected horizontally outwardly through the described passages 40. The tops of the passages 40 are closed by the uppermost panel 41 as well shown in FIGURES 2 and 7. Centering blocks 44 dependingly rigidly secured to the panel 41 near the corners of the same engage the outer diagonal ends 39 of baffles 38 to properly orient the conical baffle 43 and the loudspeaker cone.

It is desired to emphasize the extreme vertical shallowness and compactness of the assembly 22 carrying the loudspeaker and passages 34 and the uppermost panel 41 which coacts with the shallow baffles 38 to form the passages 40. This construction constitutes an important phase of the invention and the arrangement saves much space and produces highly desirable results as will become further apparent. The outer ends of the flared passages 40 are entirely open between adjacent baffles 38 and between the superposed panels 41 and 23, as should be obvious.

Directly below the beveled edges 37 of baffle blocks 35, the lower panel 29 of panel assembly 22 is provided with four diagonal corner slots 45, in direct communication with the outer ends of low frequency sound passages 34. In direct registration with these slots 45 are the upper ends of four vertically extending relatively narrow rectangular tubular sound conduits 46, arranged near and inwardly of the vertical corners of the enclosure and extending to points near and above the bottom of the same. The upper ends of the conduits 46 are anchored to diagonal horizontal braces 47 which span the corners of the enclosure and are rigidly secured to the bottoms of upper frame bars 17. Horizontal triangular gussets 48 are carried by the tops or mouths of the sound conduits 46 to seal the same against the bottom of the panel 29.

The four depending vertical conduits 46 constitute the entrance sections of a plurality of associated folded type gradually flaring low frequency sound amplifying horns, now to be described, and constituting another major feature of the invention. Each of the four conduits 46 is reversely directed upwardly along the inner side thereof to form an upwardly flaring conduit or horn section 49 integral therewith and joined thereto by a U-shaped conduit section 50 at the bottom of each conduit section 46. Each upwardly flaring horn section 49 terminates near and below the panel 29 in an inverted U-shaped horn section 51 of gradually increasing cross section, and centrally arranged downwardly inclined converging short horn sections 52 lead from the upper horn sections 51 and all communicate directly with a central vertical rectangular sleeve or horn section 53, terminating at its lower end in a large four sided rapidly flaring bottom horn outlet section 54, adapted to emit low frequency sound waves directly from the bottom of the enclosure over the entire rectangular area of the bottom, somewhat above the lower extremities of the legs 16.

In a like manner, upwardly directed inlet or entrance sections 55 of four side outwardly flaring low frequency sound amplifying horns 56 communicate directly with the downwardly opening converging horn sections 52, previously described, which also simultaneously communicate with the vertical sleeve 53 as well shown by the sound indicating arrows in FIGURE 7. The four side flaring horns 56 are similar to the bottom horn 54 and are adapted to simultaneously emit amplified low frequency sound waves from all four vertical sides of the enclosure while such sound waves are being emitted from the bottom thereof through the horn 54 and while high frequency sound waves are being emitted through the passages 40 from the four sides of the enclosure in overlapping or superposed relation with the low frequency sound. The mouths of the five flaring horns 54 and 56 are suitably anchored to the frame bars 17 and 18 and the legs 16 by nails or the like. The fabric panels 19 previously described cover the mouths of the four side horns 56 but are adapted to pass sound therethrough readily.

In view of the constructions detailed above, it should now be clear that substantially all of the sound waves produced by the vibrating speaker cone 27 must pass either through the horns 54 and 56 by way of the passages 34 and conduits 46 or through the high frequency sound passages 40 communicating directly with the top of the speaker and the conical deflector 43. As is well known, the high frequency sound waves emanate from the top of the speaker 26 while the low frequency sound emanates from the back or bottom of the speaker cone, and the sound passage design of the present invention makes use of this phenomenon. The electrical cable 57 leading from the voice coil of the loudspeaker may pass upwardly through an opening in the panel 23 and between a pair of the baffles 38 and between the panels 23 and 41 as shown in FIGURE 3.

In view of the foregoing description, it is believed that the operation of the speaker enclosure or amplifier should now be well understood. The superposed high and low frequency sound waves are simultaneously emitted from all four sides of the cubical enclosure through the passages 40 and the side horns 56. Simultaneously, low frequency sound is emitted from the bottom horn 54. As should now be apparent, an extremely large total length of flaring sound amplifying horn is embodied in the folded multiple horn construction shown in the drawings and above described. All of this horn length is compactly arranged in a cubical enclosure of minimum size, topped by a loudspeaker supporting and baffling panel assembly of extremely shallow depth and high compactness, adding very little to the overall height of the cubical enclosure.

The top panel 41 is also adapted to serve as a table top for a lamp or the like, and the finished article forms an attractive article of furniture as well as a highly efficient acoustic device of the character described.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred embodiment of the same and that various changes in the shape, size and arrangement of parts may be re-

sorted to, without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. An acoustical enclosure for a loudspeaker comprising a substantially cubical frame body portion having a top and vertical sides, a loudspeaker disposed at the top of the frame body portion substantially centrally thereof and having an upwardly flaring speaker cone, horizontal panel means secured to and supporting said loudspeaker at the top of the frame body portion and including baffle means forming a plurality of substantially horizontal shallow individual low frequency sound wave passages extending from the side wall of the speaker cone toward the vertical corners of said frame body portion, a substantially flat top panel disposed horizontally above said panel means and speaker and adapted to serve as a table-like support, a downwardly tapering conical sound deflector secured dependingly to the top panel and interfitting with the speaker cone centrally thereof, spacer baffle means between said top panel and panel means and supporting the top panel and forming between the top panel and panel means a plurality of horizontal shallow individual outwardly flaring high frequency sound wave passages between the top of the speaker cone and the vertical sides of the cubical body portion, substantially vertical sound wave conduits extending below said panel means and communicating directly with the outer ends of said low frequency sound wave passages, and folded flaring low frequency sound wave amplifying horns connected with the lower ends of said conduits and having open discharge ends disposed at the vertical sides of said cubical body portion for emitting amplified low frequency sound waves from all of said sides simultaneously with the emission of the high frequency sound waves from said high frequency sound passages.

2. An acoustical enclosure and amplifier for a loudspeaker comprising a loudspeaker having an upwardly flaring conical speaker cone, horizontal panel means supporting said loudspeaker and having a plurality of horizontal shallow individual circumferentially spaced substantially tubular low frequency sound passages leading from the side wall of the speaker cone radially thereof, a substantially cubical supporting framework having a bottom and vertical sides for said horizontal panel means and speaker and extending therebelow, outwardly flaring low frequency sound amplifying horns having discharge ends disposed at all of the vertical sides and at the bottom of said cubical framework, sound conduit means individual to each of said horns and communicating substantially centrally of said cubical framework, second sound conduit means leading from said communicating sound conduit means and leading to and communicating with the outer extremities of said low frequency sound passages and adapted to convey low frequency sound waves from said passages to said horns, and substantially horizontal baffle means above said loudspeaker and said panel means and forming a plurality of substantially horizontal shallow individual radially extending circumferentially spaced high frequency sound passages above the loudspeaker cone and panel means and above said low frequency sound passages and out of phase circumferentially therewith.

3. An acoustical enclosure and amplifier for a loudspeaker comprising a substantially cubical frame body portion having a top, bottom, and vertical sides, a horizontal panel covering the top of said frame body portion and having a substantially central opening, a loudspeaker having an upwardly flaring speaker cone dependingly secured within the opening of said panel, a second horizontal panel spaced somewhat below the first-named panel and near the lower end of the speaker cone and having a central opening receiving the lower portion of the loudspeaker snugly, generally triangular baffle blocks interposed between the first-named and second horizontal panels and tapering inwardly and being spaced equidistantly circumferentially around the speaker cone to form therebetween and between said panels a plurality of radial horizontal shallow individual low frequency sound passages extending from the side wall of the speaker cone toward and near the vertical corners of the cubical frame body portion, beveled baffle means closing the outer ends of said passages and serving to direct low frequency sound waves downwardly from the outer ends of said passages, depending vertical low frequency sound conduits communicating with the outer ends of said passages and below said baffle means and near and inwardly of the vertical corners of the frame body portion, upwardly extending flared conduit sections connected with the lower ends of said depending conduits and having reversely curved upper end portions which are directed inwardly in converging relation near the center of the cubical frame body portion and being downwardly open, flared low frequency sound amplifying horns having mouths extending over the vertical sides and the bottom of the cubical frame body portion, upwardly extending converging entrance sections carried by said horns centrally of the frame body portion and communicating directly with said reversely curved upper end portions of said flared conduit sections, whereby the low frequency sound waves emanating from the side wall of the speaker cone may travel directly to said horns simultaneously, and substantially horizontal baffle means above said first-named horizontal panel and loudspeaker for directing high frequency sound waves emanating from the top of said speaker horizontally outwardly toward the vertical sides of said cubical frame body portion intermediate said shallow individual low frequency sound passages.

4. An acoustical enclosure and amplifier for a loudspeaker according to claim 3, and vertical sound transmitting cover panels for the vertical sides of said cubical frame body portion and covering the mouths of the adjacent horns.

5. An acoustical enclosure and amplifier for a loudspeaker according to claim 3, and wherein said horizontal baffle means above the first-named horizontal panel and loudspeaker comprises a top horizontal panel spaced above said loudspeaker, a depending conical sound deflector secured centrally to the top horizontal panel and projecting into said speaker cone in spaced relation thereto, and a plurality of inwardly tapering plate-like spacer baffles interposed between said top horizontal panel and first-named horizontal panel and directly above said horizontal low frequency sound passages and forming between the top horizontal panel and first-named horizontal panel a plurality of outwardly flaring vertically shallow horizontal high frequency sound passages extending from said conical sound deflector to the vertical sides of said cubical frame body portion.

6. An acoustical enclosure and amplifier for a loudspeaker comprising a substantially cubical frame body portion having a top, bottom, and vertical sides, a single loudspeaker mounted upon the top of said frame body portion centrally thereof and having an upwardly flaring speaker cone adapted to emit high frequency sound waves upwardly and low frequency sound waves substantially radially, vertically shallow horizontal baffle means above said loudspeaker serving to direct the high frequency sound waves emitted from the top of the loudspeaker horizontally outwardly in a thin layer toward each of the four vertical sides of the cubical frame body portion, low frequency sound wave amplifying horns mounted upon each of the four vertical sides and bottom of the cubical frame body portion, the mouths of said horns spanning substantially the entire rectangular areas of the four vertical sides of said cubical body portion, and gradually expanding individual folded conduit and baffle means connected with all of said horns and leading from the side wall of the speaker cone for directly conveying low frequency sound waves from the speaker cone to said horns.

7. An acoustical device of the character described comprising an upwardly directed conical loudspeaker, a substantially cubical frame body portion having a top, bottom, and vertical sides and carrying said loudspeaker centrally upon the top thereof with said loudspeaker adapted to emit high frequency sound waves upwardly and low frequency sound waves radially horizontally, horizontal vertically shallow sound baffle means above said loudspeaker to direct the high frequency sound waves from the loudspeaker horizontally outwardly from the four vertical sides of the cubical frame body portion, flared low frequency sound wave amplifying horns mounted upon the four vertical sides and bottom of the cubical frame body portion, and folded low frequency sound wave conduit means within the cubical frame body portion leading from the side wall of the loudspeaker to said horns.

8. A substantially cubical enclosure and sound amplifier for a loudspeaker comprising a substantially cubical frame body portion having a top, bottom, and vertical sides and having low frequency sound amplifying outlet means at the four vertical sides and bottom thereof, horizontal vertically shallow high frequency sound outlet passage means at the top of the cubical frame body portion to emit high frequency sound waves at the four vertical sides of the body portion in superposed relation to the low frequency sound waves emitted simultaneously from the sides of the body portion, and loudspeaker means disposed near the top of the cubical body portion substantially centrally thereof and in communication with the low frequency sound amplifying outlet means and the high frequency sound outlet passage means.

9. An acoustical enclosure and sound amplifier for loudspeakers comprising a substantially cubical frame body portion having a top, bottom, and vertical sides, low frequency sound wave amplifying horns of the folded type disposed within the confines of said frame body portion and being arranged one each at the four vertical sides and the bottom of the frame body portion to emit low frequency sound waves simultaneously from substantially the entire areas of the vertical sides and bottom of the cubical body portion, a horizontal loudspeaker support and sound wave channeling panel assembly of vertically shallow construction covering the top of the cubical frame body portion and substantially flush with the top thereof and projecting for a slight distance only below the top, said assembly including an upwardly directed central loudspeaker and a pair of spaced superposed horizontal panels having baffle means therebetween forming horizontal diagonally extending low frequency sound wave passages leading to and communicating with said horns within the cubical frame body portion, and horizontal top panel means above said panel assembly in superposed relation thereto for directing relatively high frequency sound waves horizontally outwardly from the four vertical sides of the body portion adjacent the top thereof and intermediate said diagonally extending low frequency passages and for substantially the full width of each side and in superimposed relation to the lower frequency sound waves emitted from the horns at the vertical sides of the cubical body portion.

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