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EXTENSIBLE LOUDSPEAKER LOADING CHAMBER

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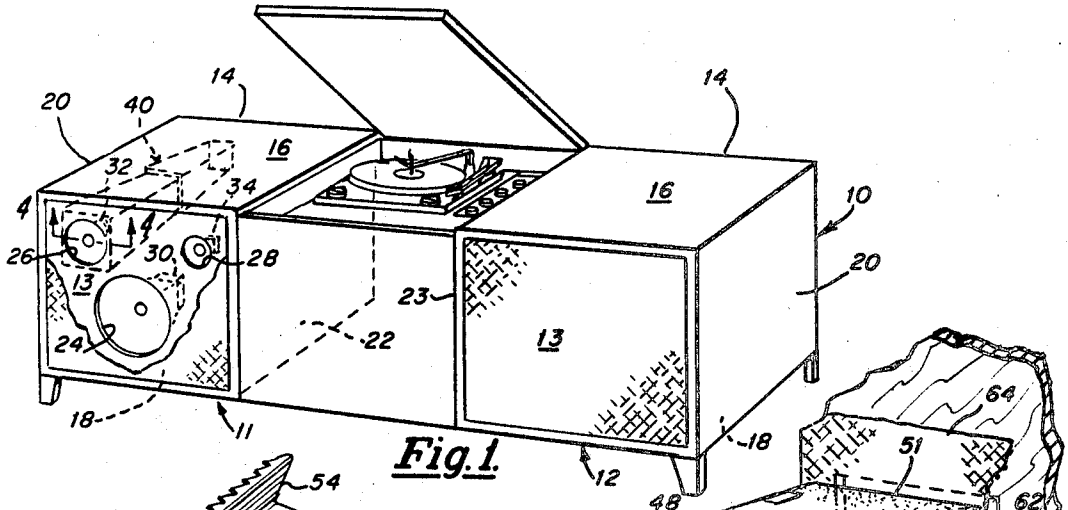


Fig. 1.

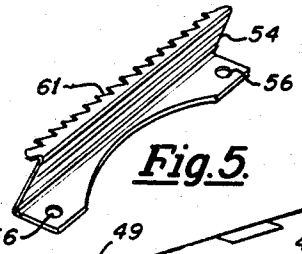


Fig. 5.

Fig. 2.

Fig. 4.

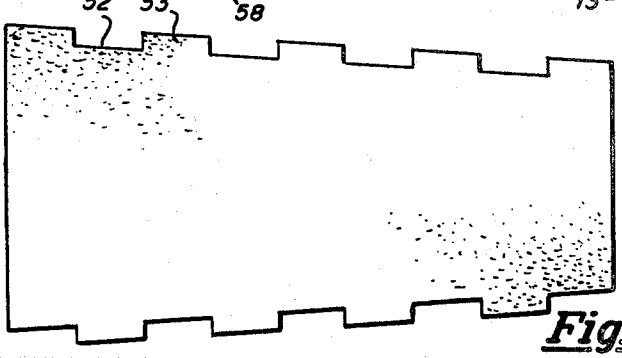


Fig. 3.

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EXTENSIBLE LOUDSPEAKER LOADING CHAMBER

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ABSTRACT OF THE DISCLOSURE

Economical apparatus for tube loading a loudspeaker, said apparatus being extendible for accommodation in cabinets having varying dimensions.

This invention relates in general to sound reproduction apparatus, and in particular to simplified means for altering and improving the tonal characteristics of cone type, direct radiator mid-range loudspeakers. More particularly, this invention relates to a universal, economical, and easily manufactured tube-like chamber for lowering the frequency operating range of a cone-type, mid-range loudspeaker, while maintaining isolation from low frequency pressures of the woofer to prevent cross-modulation of the two.

In sound reproduction systems, such as residential high-fidelity stereophonic radio-phonographs, wherein the components, including one or more loudspeaker enclosures, are housed in a console, it is generally desirable to obtain rich tonal reproduction with minimum cost and within the space limitations of each enclosure. This is typically accomplished by dividing the frequency range into three segments through the use of electronic cross-over devices and providing a separate loudspeaker for each, namely, a woofer for reproducing low frequencies, a tweeter for reproducing relatively high frequencies, and a middle-range loudspeaker for reproducing the middle range frequencies. A separate loudspeaker for reproducing each frequency segment affords maximum loudspeaker efficiency and reduces distortion from cross-modulation over the entire range it is desired to reproduce. The loudspeakers are typically mounted in an acoustically-designed loudspeaker enclosure, in a manner well known in the art.

One of the inherent problems of the sound reproduction system described above is to provide a low resonance woofer capable of operating efficiently at its upper range, for example, above 600 cycles. To compensate for the reproduction deficiencies of such woofers, and to eliminate the frequency response gap prevalent above 600 cycles, an attempt was made to utilize a direct radiator middle-range loudspeaker which was capable of efficiently operating at the upper frequency limit of the woofer, about 600–1,000 cycles.

To achieve this low frequency operating objective, a moderately priced, large diameter, direct radiator middle-range loudspeaker could be used, since such a speaker typically has a lower resonant frequency and operates efficiently at the lower mid-frequency ranges. The difficulty of using a large mid-range speaker is that the cabinet and front baffle wall dimensions impose rigid space limitations on the maximum size mid-range speaker which may be used, after allowing for the woofer which is inherently large. A second possibility of achieving low mid-frequency response from a mid-range loudspeaker is to use a mid-range having a horn-type construction. The horn type mid-range operates efficiently at its lower frequency range, but these speakers are relatively expensive and still require a large area on the front baffle wall. Consequently, due to their size and cost, they are unsuitable for incorporation in the above-described sound reproduction system.

The unsuitability of a large diameter direct radiator mid-range loudspeaker and of a mid-range utilizing a horn construction, dictates the incorporation of an average, inexpensive, standard cone type mid-range having a diameter of 4 to 5 inches. Ordinarily, a direct radiator mid-range of this small size and construction is incapable of efficiently operating at the lower mid-frequency ranges.

This invention obviates many of the difficulties inherent in utilizing inexpensive, small, mid-range loudspeakers in multispeaker enclosures by providing universal, economical means which cooperate with the loudspeaker for lowering its frequency operating range and maintaining isolation. The cooperating means comprise a two-piece, tube-like structure forming a hollow chamber which tube loads the rear of the cone type, mid-range loudspeaker by coupling it with an opening through the enclosure back wall. Each member of the tube-like structure is identical, and each is constructed of four identical sides preferably fabricated of a fibrous material. The members are longitudinally tapered and define two similarly shaped ends, having differing cross-sectional areas. The differing cross-sections allow one tube to nest inside the other, resulting in a chamber which may be extended or telescoped to fit several cabinets having differing distances between the front baffle wall and rear enclosure wall. In addition, the chamber acoustically isolates the mid-range loudspeaker from the enclosure environment, thereby allowing it to be housed within the loudspeaker enclosure.

Accordingly, it is the primary object of this invention to provide a universal tube-like structure for back loading a direct radiator mid-range loudspeaker.

Another object of this invention is to provide a universal housing for tube loading a loudspeaker, said housing being capable of easy assembly during production and adjustability to simplify its use in cabinets wherein the front baffle wall may be variably spaced from the rear wall.

An additional object of this invention is to provide an easily manufactured, economical, tube-like speaker housing which may be fabricated from multiple pieces of a single stamping, yet is rigid and adaptable for use in a speaker enclosure wherein the distance between the front baffle wall and the rear wall may vary.

A further object of this invention is to provide an adjustable chamber for tube loading the rear of a loudspeaker, wherein said chamber is fabricated of two identical tube-like members adapted for telescopic assembly, and is adjustable to span the distance between the front baffle wall and rear wall of a loudspeaker enclosure.

A feature of this invention resides in the use of a pair of tube-like members which are telescopically engageable and which may be easily extended to span the distance between two walls, wherein the distance may vary.

The primary advantage of this invention lies in its ease and economy of manufacture and its simplified assembly, since each member of the tube-like chamber is fabricated of four identical walls.

Other objects and advantages of this invention will become apparent upon an examination of the following description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a three-dimensional front view of a console phonograph cabinet in which the invention is incorporated, said cabinet having a pair of loudspeaker enclosures at its ends. The tube-like member incorporated in the enclosure at the left is illustrated by dotted lines.

FIG. 2 is a three-dimensional exploded view of the two-piece loudspeaker chamber showing its telescopic

relationship and its relation to the front baffle wall and rear wall of the enclosure.

FIG. 3 is a two-dimensional view of one side of a chamber member such as illustrated in FIG. 2.

FIG. 4 is an elevation view along the line 4—4 of FIG. 1, illustrating in detail the method of securing the loudspeaker and front portion of the chamber to the front baffle wall.

FIG. 5 is a three-dimensional view of a resilient clip used to secure the front chamber member to the front baffle wall.

Turning to consideration of the drawings, and in particular to FIG. 1, there is shown a console phonograph cabinet generally referred to by reference numeral **10**, which may be manufactured of wood or the like. The cabinet includes a pair of loudspeaker enclosures **11** and **12**, one located at each end, and each enclosure comprises a front baffle wall **13**, a back wall **14**, a top and a bottom **16** and **18**, outer sides **20**, and interior partitions **22** and **23**, which separate loudspeaker enclosures **11** and **12**, respectively, from the center of the cabinet.

For convenience, only enclosure **11** will be described. It includes apertures **24**, **26**, and **28**, through the front baffle wall which accommodates three loudspeakers, a woofer **30**, a mid-range **32**, and a tweeter **34**, respectively. The tweeter is a conventional loudspeaker suitable for use in any speaker system. Woofer **30**, while also of conventional design, is a relatively inexpensive low resonance loudspeaker and consequently its output efficiency is limited when operating at the upper portion of its capable range, for example, above 600 cycles. The mid-range loudspeaker is of cone type construction with an open back, and it is this speaker which the invention primarily concerns, namely, tube loading the rear thereof to lower its operating range, wherein the tube loading means consists of a universal, inexpensive, and easily manufactured chamber vented outside the enclosure.

Referring now to FIG. 2, the construction of a loudspeaker loading chamber which the invention concerns, and which is generally referred to by reference numeral **40**, is shown in detail. The chamber basically comprises two identical tube-like members, a forward member **42** and a rear member **44**. Each member is constructed of four sides **46**, **47**, **48**, and **49**, which preferably are identical. The sides are generally trapezoidal shaped, and when assembled they form a hollow structure resembling a truncated pyramid having one end **50** defining a large cross-sectional area and a second end **51** defining a smaller cross-sectional. The four sides are preferably fabricated of a thick, fibrous, sound-absorbing material such as Coresote, to prevent reverberation of the middle tones.

As more clearly shown in FIG. 3, each of the sides **46**, **47**, **48**, and **49** is provided with a plurality of adjacently spaced notches **52** and tabs **53** along two opposite edges. The notches and tabs of one edge are spaced to interlock and engage similar notches and tabs of an adjacent edge to provide a rigid tube-like structure. By constructing each chamber member of four identical sides, and the entire loading chamber of eight sides, it is quickly realized that only a single die or stamping is required for fabrication, thereby substantially reducing manufacturing costs. In addition, only a single item must be stored at the factory where the members are assembled, again resulting in a substantial savings.

Each chamber member is assembled by placing the edge of one side perpendicular to the edge of another side, and interfitting the notches and tabs. The entire length of the edge is then glued with a mucilage suitable for the material of which the sides are constructed. The third and fourth sides are assembled and secured in a similar manner, which results in a sturdy tube-like member shaped like a truncated pyramid. Although each member is preferably fabricated of sound absorbing material, additional sound absorption can be achieved by lining the interior walls with a material such as fiberglas wool **60**, thereby further reducing vibrations.

After each chamber member has been assembled, one, designated the forward member **42**, is fastened to the interior side of front wall **13** by a pair of resilient spring clips **54**. Each spring clip has a length approximately equal to the width of one chamber member side, and has a Z-shaped cross section. One leg of the Z is provided with apertures **56**, which are guided over studs **58**, normally securing the loudspeaker to the front baffle. The loudspeaker is then placed over studs **58** and is bolted securely to the front; thus the clip is sandwiched between the loudspeaker and front baffle wall. The remaining leg of each spring clip has a sharp serrated edge **61** extending outwardly of the speaker and positioned to engage two interior parallel sides of the forward chamber member adjacent the large end **50**. This chamber member is urged over the serrated edges during assembly, and is retained in position by the sharp edge biting into the fibrous side walls.

Back wall **14** is provided with an opening **62**, coaxial with the mid-range loudspeaker. This opening is the same shape and of sufficient size to admit the small end **51** of rear chamber member **44**. As member **44** is inserted into the opening, it secures a pliable grille cloth **64** between the opening periphery and the member wall. After the forward chamber member is secured over its clips and is extending toward the back wall, the large end of the rear chamber member, which has previously been inserted into the opening **62** with grille **64** and the enclosure back, is guided over the narrow end of the forward chamber member. The relative sizes of the mating chamber openings simplifies the assembly procedure by eliminating the problem of accurately guiding one member over another.

In different varieties of enclosures corresponding to different phonograph cabinet designs, the distance between the front and rear walls may vary. To compensate for this distance while using the same chamber members, a strip of caulking **66**, such as Mortite, is extruded around the outside of the forward chamber member near its small end. This caulking is of sufficient thicknes to effectively seal the gap betwen the chambers upon assembly of the forward and rear members, thus compensating for the wall distance variations.

What has been described is a loudspeaker enclosure incorporating an inexpensive, relatively small, cone type mid-range speaker, the operating frequency range of which has been lowered by means of an extendable loading chamber adapted to span the distance between a front and rear wall, said distance being variable in different enclosures. In addition, what has been described is a chamber which is constructed of two identical members, each fabricated of four identical sides, thereby decreasing manufacturing costs.

It is obvious that upon study by those skilled in the art, the disclosed invention may be altered or modified both in physical appearance and construction without departing from its inventive concept. Therefore, the scope of protection to be given this invention should not be limited by the embodiment described above, but should be determined by the essential descriptions thereof which appear in the appended claims.

What is claimed is:

1. A housing for a loudspeaker comprising; a first wall; a second wall spaced a distance from said first wall; said second wall defining an opening therethrough; a loudspeaker secured to said first wall substantially coaxial with said opening; extensible chamber means coupling said opening and said loudspeaker for baffling the latter; said extensible chamber means including a pair of identical tube like members each having a first end of large cross sectional area and a second end of slightly smaller cross sectional area, said smaller end being adapted for telescopic engagement with said large end to facilitate assembly and adjustability thereof to span the

distance between said walls; and means sealing any gap between said members.

2. A housing for a loudspeaker as set forth in claim 1 wherein said tube like members are each constructed of four identical trapezoidal shaped sides fabricated of sound absorbent material and assembled to form a truncated pyramid.

3. A housing for a loudspeaker as set forth in claim 2 further including a pair of elongated resilient clips of generally Z shape secured to said front wall adjacent said loudspeaker, each of said clips having a serrated edge extending outwardly of said loudspeaker for gripping a corresponding side of said tube like member; and wherein said tube like members are constructed of sound absorbent material of fibrous character.

4. In combination: a loudspeaker enclosure comprising a front wall, a rear wall spaced away from said front wall and side walls extending from said front to said rear walls, said front wall defining a plurality of openings; loudspeakers, secured to said front wall adjacent each opening, including a middle range loudspeaker having an effective frequency operating range higher than desired; said rear wall defining an opening substantially coaxial with said middle range loudspeaker; a pair of identical longitudinally tapering tube like members having a square

cross section surrounding said middle range loudspeaker and defining an acoustically impervious passageway extending to said opening in said rear wall for lowering the effective frequency operating range of said middle range loudspeaker; each of said members being fabricated of four identical sides assembled to form a hollow truncated pyramid and being arranged for telescopic assembly and extendible to span the distance between said front and rear walls; a pair of resilient clips of generally Z shape secured to said front wall adjacent said middle range loudspeaker for securing one of said tube like means thereto; and means sealing any gap between said tube like members.

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