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J. PRESTON

2,206,427

SOUND REPRODUCING APPARATUS

Filed March 31, 1937

Fig. 1.

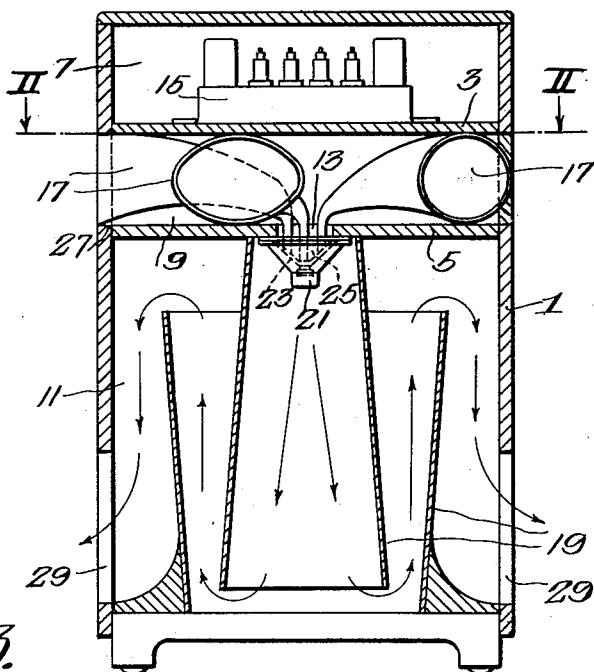


Fig. 3.

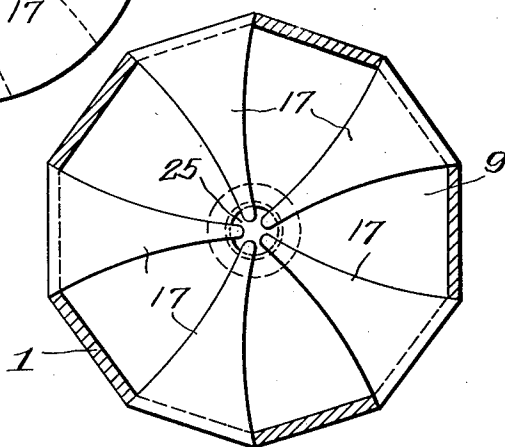
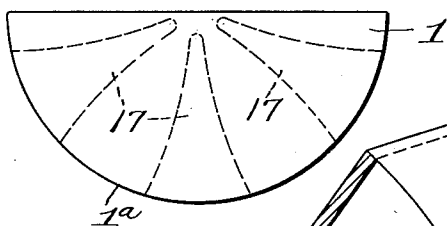


Fig. 2.

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SOUND REPRODUCING APPARATUS

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3 Claims. (Cl. 181—31)

This invention relates to sound reproducing apparatus, and more particularly to an arrangement of horn loudspeakers within a radio or similar cabinet.

It has been well recognized that the horn type loudspeakers have, in general, many advantages over the direct radiator, flat baffle type speakers, and various arrangements have been employed heretofore incorporating a pair of horns with a suitable driver, one of the horns being particularly adapted to transmit high frequency vibrations and the other horn low frequency vibrations. All such construction with which I am familiar, however, are arranged to have a relatively small angle of spread and they are, therefore, more or less directional.

It is also well known that the higher frequency vibrations are especially directional and that they are normally subject to attenuation by reason of absorption and reflection. Under certain circumstances, it is desirable to distribute reproduced sound over a wide angle, even as much as 360°. So far as I am aware, the prior art constructions fail to meet this requirement adequately, and particularly in view of the limitations heretofore noted.

The primary object of my invention is to provide an improved loudspeaker construction which will efficiently transmit and distribute vibrations within the audible range to all parts of a room.

More specifically, it is an object of my invention to provide an improved loudspeaker arrangement which will distribute sound over 360° and in substantially uniform manner throughout all parts of a room.

Another object of my invention is to provide an improved loudspeaker construction as aforesaid which will distribute sound in a manner to minimize wall and other reflections.

Still another object of my invention is to provide a loudspeaker construction and cabinet therefor which can be placed in the center or any other suitable part of a room and which will reproduce the high frequencies without the necessity of employing special high frequency spreaders.

It is also an object of my invention to provide an improved loudspeaker and cabinet construction as aforesaid which is simple in construction, which may be easily assembled, and which is inexpensive of manufacture.

In accordance with my invention, I provide a cabinet with upper and lower compartments and place in the upper compartment a plurality of short, substantially straight axis horns having

their respective axes disposed angularly with respect to each other in a horizontal plane and facing in different directions over 360°. In the lower compartment of the cabinet, I arrange a long, preferably folded horn with its axis running vertically and with its mouth constituted by a plurality of openings in the walls of the cabinet adjacent the bottom thereof, the openings being spaced around the cabinet 360°. Thus, the sounds reproduced through all of the horns cover an angle of 360°. The long horn is particularly adapted to transmit low frequencies and the short horns are designed to particularly transmit high frequencies, and by placing the short, high frequency horns at substantially the level of the listeners' ears, the attenuation of the high frequencies by reason of absorption and reflection is minimized. A single driver of any suitable type may be employed to drive all of the horns and is preferably mounted on the partition which divides the cabinet into the two compartments.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, together with additional objects and advantages thereof, will best be understood from the following description of two embodiments thereof, when read in connection with the accompanying drawing, in which

Figure 1 is a view partly in section and partly in elevation of one form of my invention,

Figure 2 is a view taken on the line II—II of Fig. 1, and

Figure 3 is a plan view of a modified form of cabinet according to my invention.

Referring more specifically to the drawing, wherein similar reference characters designate corresponding parts throughout, there is shown, in Figs. 1 and 2, a cabinet 1 which may be cylindrical in shape or which may be formed of such a large number of sides as to very closely approximate a cylinder. In the drawing, I have shown a cabinet with ten sides, but it is to be understood that this is merely illustrative and that the cabinet may be of any desired shape in cross section, such as square, triangular or otherwise. A pair of horizontal partitions 3 and 5 divide the cabinet 1 into a top compartment 7, a middle compartment 9 and a bottom compartment 11, the partition 5 having an opening 13 therein for establishing communication between the compartments 9 and 11.

Within the compartment 7 may be placed a radio receiver chassis 15, a phonograph or any

other suitable device for supplying electrical signal energy to the loudspeaker apparatus of my invention. This apparatus consists of a plurality of short horns 17 mounted in the compartment 9 and a single, long horn 19 of the folded type mounted in the compartment 11. A suitable electro-acoustical driver 21, such as an electro-dynamic loudspeaker including a conical diaphragm 23, and supplied with signal energy by the radio receiver or the like 15, is mounted on the partition 5 within the chamber 11 behind the opening 13 and drives all of the horns 17 and 19.

The short horns 17 are preferably all straight axis horns adapted to particularly transmit only the higher frequencies, and they have only a short bend therein at the throat end in order to be accommodated to a member 25 which is mounted in proximity to the front side of the cone 23 and which couples each of the horns 17 to the cone 23 by providing throats for each of them. The bell ends of the respective horns 17 may be supported in openings 27 formed in the walls of the cabinet 1, and the axes of the respective horns 17 are angularly related to each other in a horizontal plane, preferably on about the level of listeners' ears. By this arrangement, each of the horns 17 is pointed in a different direction, the mouths of these horns being so distributed as to cover an angle of 360°.

The long horn 19 has its axis extending in a vertical direction, as shown, and is preferably one designed to particularly transmit only the lower frequencies within the audio range. This horn may be arranged substantially centrally of the cabinet 1 to load the rear side of the cone 23, the vibrations produced by the rear surface of the cone 23 traveling in the direction of the arrows shown in Fig. 1 and passing into the room in a horizontal direction through the mouth of the horn 19 constituted by a plurality of closely spaced, large openings 29 formed in the walls of the cabinet 1 adjacent the bottom thereof. The openings 29 are preferably distributed entirely around the base of the cabinet and provide an effective mouth for the horn 19 of substantially 360°.

When a horn loudspeaker arrangement such as that described is embodied in a cabinet, the cabinet may be placed in the center of a room and the sound will be distributed uniformly in all directions throughout the room. The lower frequency sounds do not appreciably suffer from attenuation caused by absorption and reflection, and therefore substantially no loss of low frequencies will result. At the same time, since the high frequencies are transmitted by the horns 17 at an elevated level from the floor, the loss of high frequencies will also be reduced to a minimum.

In the modification of my invention shown in Fig. 3, the cabinet 1 is made substantially semi-circular in cross-section instead of circular, as in the modification previously described. The cabinet with a plane back may be readily placed against the wall, as is customary with conventional cabinets now on the market. However, by placing a plurality of short, straight-axis horns 17 therein, the high frequencies will be readily distributed over an angle of approximately 180°. Similarly, by making the effective mouth of the horn 19 extend over substantially the entire, curved front surface 1a of the cabinet 1, a wide distribution of the low frequencies over a similar angle will be obtained.

Although I have shown and described but two

embodiments of my invention, I am fully aware that many other modifications are possible, as are also changes in the particular modifications described. For example, in place of a single driver for all of the horns, separate drivers may be used for each of them, or a driver embodying a single field supply and two voice coils and associated cones of the type disclosed in the copending application of Frank Massa, Serial No. 113,475, and assigned to the Radio Corporation of America, may be employed, one of the cones driving the high frequency horns and the other cone driving the low frequency horn. Also, if desired, two or more low frequency horns 19 may be provided in the chamber 11, each one coupled to the rear side of the cone 23 in any suitable manner. Where separate drivers are used for each of the horns, a suitable switching arrangement may be provided for cutting out any one or more of the horns, depending, perhaps, upon the location of the cabinet in the room. Many other changes will, no doubt, readily suggest themselves to those skilled in the art. I therefore desire that my invention shall not be limited except insofar as is made necessary by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. Sound reproducing apparatus comprising, in combination, a hollow cabinet, a partition in said cabinet dividing it into upper and lower compartments, a plurality of horns in said upper compartment having their respective mouths facing in different directions and being particularly adapted to radiate high frequency acoustical vibrations simultaneously in all said directions, a single horn in said lower compartment particularly adapted to transmit low frequency acoustical vibrations, said last named horn opening in the same general direction and having an effective mouth embracing substantially the same angle as is embraced by the combined mouths of said short horns, and sound translating means in said cabinet communicating with said horns for supplying acoustical vibrations to said horns.

2. Sound reproducing apparatus according to claim 1 characterized in that said short horns are substantially straight axis horns and are so arranged within said upper compartment that their respective axes are angularly related to each other in a horizontal plane whereby their respective mouths face in different directions, said horns being so distributed that their combined mouths embrace an angle of 360°, and characterized further in that said long horn is of the folded type and has its axis in a vertical direction, said cabinet having a plurality of openings in the walls thereof adjacent its bottom constituting a mouth for said long horn, and said openings being distributed around said cabinet over an angle of 360°.

3. Sound reproducing apparatus according to claim 1 characterized in that said sound translating means is mounted on said partition within said lower compartment, said means including a conical diaphragm so arranged that its rear side is loaded by said long horn, and characterized still further by the addition of means providing a throat for each of said small horns, said last named means being disposed in proximity to the front side of said diaphragm and serving to couple said small horns to said diaphragm whereby said short horns load the front side of said diaphragm.

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