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SOUND REPRODUCING APPARATUS
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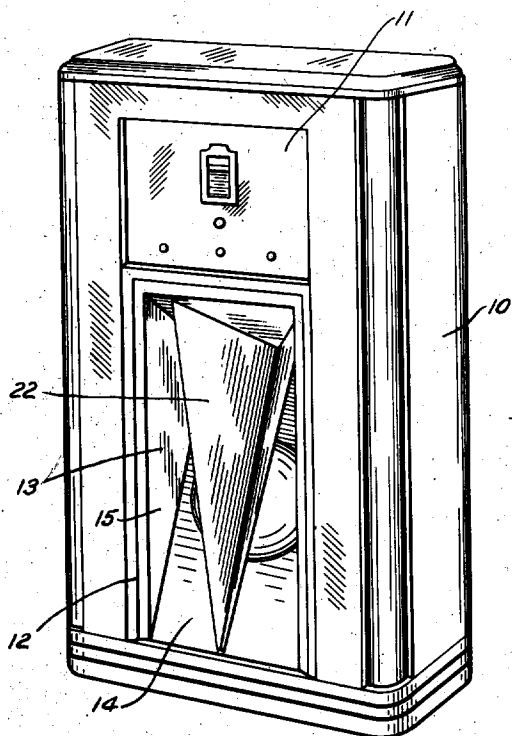


Fig. 1.

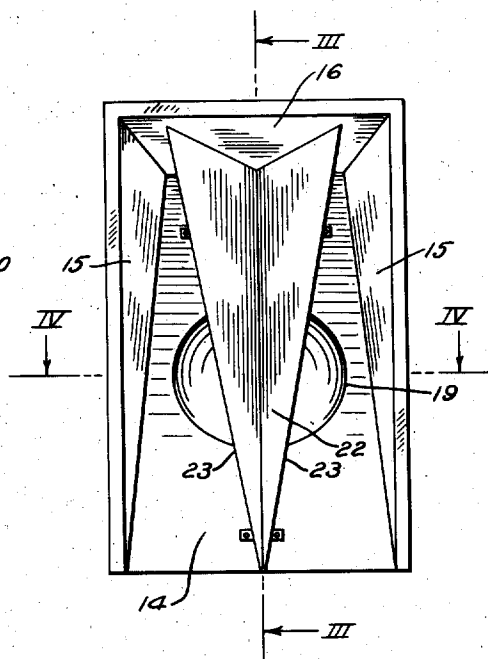


Fig. 2.

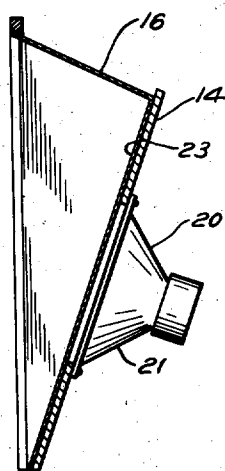


Fig. 3.

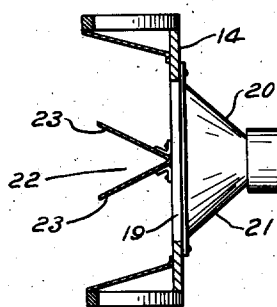


Fig. 4.

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SOUND REPRODUCING APPARATUS

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10 Claims. (Cl. 181—31)

This invention relates to an improved high-fidelity sound reproducing apparatus and is particularly concerned with sound reproducing apparatus of the type used in connection with radio broadcast receivers and the like.

For the most satisfactory reproduction of sound there must be a high degree of fidelity of reproduction and uniformity of distribution, that is to say, the sound waves of the various frequencies must be uniformly reproduced and propagated with a uniform distribution throughout the room or auditorium into which such waves are radiated, and there should be a uniformity of effectiveness of the various sound waves throughout the audible frequency range, without distortion.

In order to obtain such satisfactory reproduction, certain problems are involved due to certain peculiarities in the behavior of the sound waves which are radiated by reproducers of the type now generally used, and to effects which result from the physical nature of certain parts of the reproducing apparatus employed.

It is a well-known phenomenon of acoustics that sounds of relatively high pitch, that is, sound waves of relatively short wave lengths and high frequencies, which are radiated from a relatively large area cone or diaphragm type of reproducer or loudspeaker (such as is now generally used in radio broadcast reception), as well as in some instances from loudspeakers of the horn type (such as were formerly in general use), tend to be propagated substantially as a beam, in a head-on direction from the diaphragm, whereas sounds of relatively low pitch, that is, of relatively great wave lengths and low frequencies, are propagated substantially spherically. The consequence of these phenomena has been a non-uniform distribution of the sound waves throughout the response area, or reception room, characterized by a predomination of the sounds of higher pitch in locations directly in front of the reproducing apparatus and a predomination of the sounds of lower pitch in the adjacent locations.

It is also well known that where a sound cavity or recess is employed, through which sound waves are radiated from the reproducer, parallel surfaces and opposing parallel edges provided by such cavity, in the path of the sound waves, will result, respectively, in reflections and refractions of such sound waves, which in turn result in the setting up of interference patterns and in non-uniformity of effectiveness of the various waves throughout the audible range of

frequencies. One explanation of these results is the tendency of two or more waves, which are either so reflected or so refracted as to arrive simultaneously at the same location, to either neutralize or reinforce each other, according to whether they are so related as to add or subtract at the location under consideration. The fidelity of the reproduction of the various sound waves at different locations is thus affected by the inherent structural characteristics of the sound cavity of the reproducing apparatus employed.

It is the object of this invention to provide an improved high-fidelity sound reproducing apparatus, whereby sound may be reproduced and propagated with uniformity of distribution of the waves of various frequencies throughout the area into which such waves are radiated.

A further object is to provide an apparatus of the character aforedescribed whereby the various sound waves reproduced throughout the audible frequency range will be free from distortion and the fidelity of the reproduction thereof will be uniform at all locations for which the apparatus is designed to provide reception.

Various other and further objects of and advantages achieved by the present invention will be apparent from the following description taken in connection with the accompanying drawing, wherein there is illustrated, by way of an example, an apparatus embodying the invention.

In accordance with this invention there is provided a sound reproducing apparatus which includes a sound cavity, through which cavity a reproducing device, such as a loudspeaker of the relatively large area cone or diaphragm type, is adapted to radiate sound waves, in combination with a sound wave deflector. This deflector is disposed within the cavity and extends transversely across the path of the sound waves there-through, and thereby serves to diffuse the sound waves of relatively higher frequencies which would otherwise tend to be propagated substantially as a beam in a head-on direction. The deflector thus effects a substantially even distribution of the waves of the various frequencies throughout the response area.

Further in accordance with this invention, the walls of the sound cavity and the configuration of the deflector are so related as to avoid parallel surfaces or opposed parallel edges within the sound cavity, thus substantially eliminating the undesirable interference from reflections and refractions described above.

In the accompanying drawing, Fig. 1 is a per-

spective view of a radio receiver embodying the sound reproduction apparatus of this invention; Fig. 2 is an enlarged front elevation showing the apparatus of this invention separately; Fig. 3 is a vertical section on the line III—III of Fig. 2; and Fig. 4 is a transverse section on the line IV—IV of Fig. 2.

The cabinet indicated generally by the numeral 10 of the receiver illustrated is provided with radio receiving apparatus (not shown) housed in its upper portion 11 in a suitable well-known manner. Below this apparatus a rectangular opening 12 is provided in the front wall of the cabinet, from which wall extends a sound cavity, as indicated generally by the numeral 13.

The cavity 13 is defined by a rear wall such as a baffle 14, which slants in an upward and rearward direction from the lower edge of the opening, at an angle of approximately 10 to 20 degrees from the vertical, triangular side walls 15—16 which converge rearwardly from the vertical side edges of the opening, and a top wall 16 which slants in a rearward and downward direction from the upper edge of the opening. The rear edges of the walls 15 and 16 engage the baffle 14 and are suitably secured thereto, by brackets (not shown) or in any other desirable manner.

An opening 18 is formed in the baffle 14 at the central portion thereof and a sound reproducer or loudspeaker 20 is disposed behind the baffle opposite the opening. The reproducer is preferably of the type having a moving coil which drives a conical diaphragm of relatively large area, its diaphragm 21 suitably engaging the baffle around the margin of the opening, with its axis perpendicular to the plane of the baffle so that sound waves radiated by the reproducer will be propagated through the opening and through the sound recess.

Among other useful purposes, the sound cavity serves to provide an additional desirable amount of load on the diaphragm and to amplify the sound waves in accordance with well known principles. While the sound cavity 13 has been illustrated and described as being open only at the front, it is to be understood that, in certain instances, certain other walls, such as the side walls 15, may be omitted, it only being necessary that there shall be formed a recess or confined or semi-confined space effective to load the sound reproducing device, and the term "sound cavity" as used herein is to be so construed. The angle of the baffle is not critical but is preferably of such degree that the axis of the cone will be directed toward approximately where the head of a listener in the center of a room of average size will be.

A deflector, indicated generally by the numeral 22, is provided within the sound recess. The deflector comprises a pair of plate-like members 23—23 cooperating to form a dihedral angle with the vertex thereof extending across the opening 18. The deflector is substantially coextensive with the sound cavity. The side members of the deflector may be cut to conform to the walls of the sound cavity and so that their front edges lie in the plane of the front wall of the cabinet.

The dihedral angle of the deflector, while in the approved embodiment illustrated being approximately 75 degrees, is not critical but in practice may be varied within limits of approximately 60 to 120 degrees, according to the requirements of the particular embodiment, considering the position of the loudspeaker in the room where the same is to be used. It is within the contemplation of the invention to so construct the baffle

that its members may be adjusted to vary the degree of their angularity, and for such a construction any suitable hinge or pivoting arrangement may be employed.

By virtue of the tapered effect of the deflector, it will be apparent that pathways are provided at the sides thereof within the cavity which are of varying width from top to bottom. Further, the shape and position of the deflector, together with the shapes and relative angular positions of the walls of the cavity, including the baffle, provide a passageway, through which the sound waves are propagated, wherein there are no parallel surfaces and no opposing parallel edges.

In the operation of the apparatus, the audio-frequency or sound waves will be radiated from the diaphragm through the sound cavity, and the waves of relatively high frequencies, which naturally would tend to travel substantially as a beam from the diaphragm, will be deflected by the walls of the deflector members and so diffused throughout the receiving room as to provide a substantially even distribution thereof. By virtue of the shapes and relative positions of the various surfaces and edges of the sound cavity and baffle, there will be substantially no interference from reflections or refractions of the waves. The slanting position of the baffle and the axis of the diaphragm will serve to effect a propagation of the sound waves in an upwardly slanting direction so as to provide the maximum effectiveness at the most desirable location, that is, in a region elevated from the relatively low position of the reproducer or in a region approximately at the heads of listeners in the receiving room.

In the completed apparatus a loosely woven screen or tapestry may, if desired, be provided over the opening 12, to protect the deflector and cavity.

While there has been hereinbefore described an improved method of reproducing sound and an improved apparatus embodying the present invention, it will be apparent that many and various changes and modifications may be resorted to, as to the manner of utilization of the method and as to the form, structure and arrangement of the parts of the apparatus, without departing from the spirit of this invention, and it will be understood that all and any such changes and modifications are contemplated as a part of this invention, as defined in the appended claims.

What is claimed is:

1. A sound reproducing apparatus comprising a sound cavity of non-uniform depth having an open front in a vertical plane, side walls and a rear wall slanting relative to said vertical plane, said rear wall being provided with an opening centrally therein, a sound radiating device mounted behind said rear wall so as to radiate a beam of sound through said opening, and a sound deflector comprising tapered surfaces having their rear edges extending across said opening and their front edges substantially in said front plane, said surfaces being angularly disposed so as to disperse horizontally a beam of sound radiated from said device through said opening.

2. A sound reproducing apparatus comprising a sound cavity of non-uniform depth having an open front in a vertical plane and a rear wall provided with an opening centrally therein, a sound radiating device mounted behind said rear wall so as to radiate a beam of sound through said opening, and a sound deflector comprising tapered surfaces shaped to conform to the non-

uniform depth of said cavity and having their rear edges extending across said opening and their front edges substantially in said front plane, said surfaces being angularly disposed so as to disperse horizontally a beam of sound radiated from said device through said opening.

3. A sound reproducing apparatus comprising a sound cavity having an open front in a vertical plane, side walls and a rear wall slanting relative to said vertical plane, said rear wall being provided with an opening centrally therein, said cavity thereby being of varied depth, a sound radiating device mounted behind said rear wall so as to radiate a beam of sound through said opening, and a deflector fitted into said cavity, said deflector conforming to said varied depth of said cavity and providing surfaces of tapered angular shape having longitudinal rear edges extending across said opening and front edges substantially in said front plane and said surfaces being angularly arranged so as to disperse horizontally a beam of sound radiated from said device through said opening.

4. A sound reproducing apparatus comprising a sound cavity having an open front in a vertical plane, rearwardly converging side walls and a rear wall slanting relative to said vertical plane and provided with an opening centrally therein, said cavity thereby being of varied depth diminishing from top to bottom, a sound radiating device mounted behind said rear wall so as to radiate a beam of sound through said opening, and a deflector fitted into said cavity, said deflector conforming to said varied depth of said cavity and providing surfaces of tapered angular shape having longitudinal rear adjoining edges extending across said opening and front edges converging from top to bottom and disposed substantially in said front plane, said surfaces being thereby angularly arranged so as to disperse horizontally a beam of sound radiated from said device through said opening.

5. A sound reproducing apparatus comprising a sound cavity symmetrical with respect to a vertical plane, having an open front in a vertical plane normal to the plane of symmetry, side walls disposed in non-parallel planes, a rear wall in a non-vertical plane normal to the plane of symmetry and provided with an opening centrally therein, a sound radiating device disposed behind said rear wall and adapted to radiate a beam of sound through said opening, and a sound deflector disposed within said cavity and providing surfaces arranged in a dihedral angle having its vertex provided by longitudinal edges of said surfaces extending transversely across said opening, the other longitudinal edges of said surfaces being substantially in said front plane and said angle being on the order of from 60 to 120 degrees

whereby a beam of sound radiated from said device through said opening will be dispersed horizontally by said deflector.

6. A high-fidelity sound reproducing apparatus comprising a sound cavity including as the rear wall thereof a baffle slanting at an angle to the vertical and having an opening formed therein, a sound reproducing device including a conical diaphragm disposed at the rear of said cavity with its axis perpendicular to the plane of said baffle and coincident with the center of said opening and adapted to radiate sound waves through said opening and through said cavity; and deflector means disposed within said cavity extending transversely of said opening.

7. A high-fidelity sound reproducing apparatus comprising a sound cavity having a flat rear wall provided with an opening; a sound reproducing device disposed behind said rear wall and arranged to radiate sound waves through said opening and through said cavity; and a deflector within said cavity having a pair of substantially flat surfaces angularly arranged with adjoining edges thereof extending transversely of said opening.

8. A high-fidelity sound reproducing apparatus comprising a sound cavity having a flat rear wall provided with an opening; a sound reproducing device disposed behind said rear wall and adapted to radiate sound waves through said opening and through said cavity; and a deflector having a pair of substantially flat surfaces, an edge of one of said surfaces adjoining an edge of the other of said surfaces to provide a tapered deflector, and said surfaces being angularly arranged with their adjoining edges extending transversely of said opening.

9. A high-fidelity sound reproducing apparatus comprising a sound cavity having slanting upper, side, and rear walls, said rear wall providing a sound baffle and having an orifice formed therein; a sound reproducing device adapted to radiate sound waves through said opening and through said cavity; and a plurality of sound wave deflecting members angularly arranged within said cavity and providing no parallel surfaces within said cavity.

10. A high-fidelity sound reproducing apparatus comprising a sound cavity having slanting upper, side, and rear walls, said rear wall providing a sound baffle and having an orifice formed therein; a sound reproducing device adapted to radiate sound waves through said opening and through said cavity; and a plurality of sound wave deflecting members angularly arranged within said cavity, with no opposing parallel edges formed by the walls of said cavity and said deflector.

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