May 26, 1936. B. OLNEY ET AL 2,041,777

SOUND REPRODUCING SYSTEM

Filed July 10, 1935 2 Sheets-Sheet 1

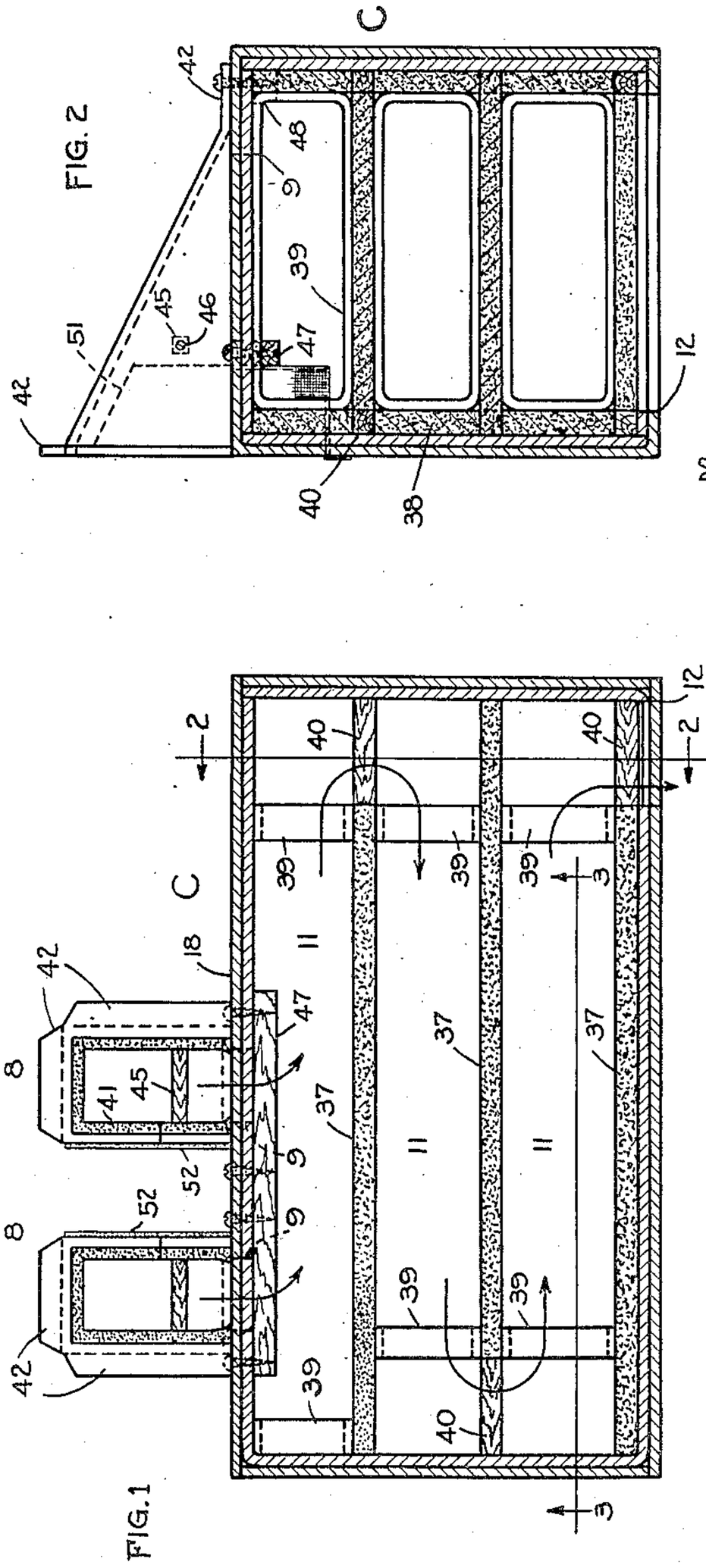

FIG. 2

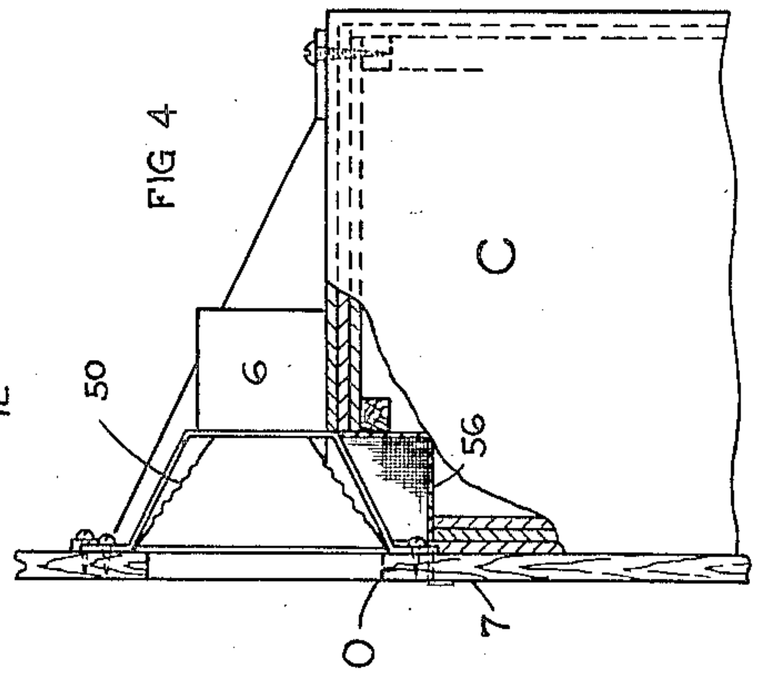

FIG 4

FIG. 1

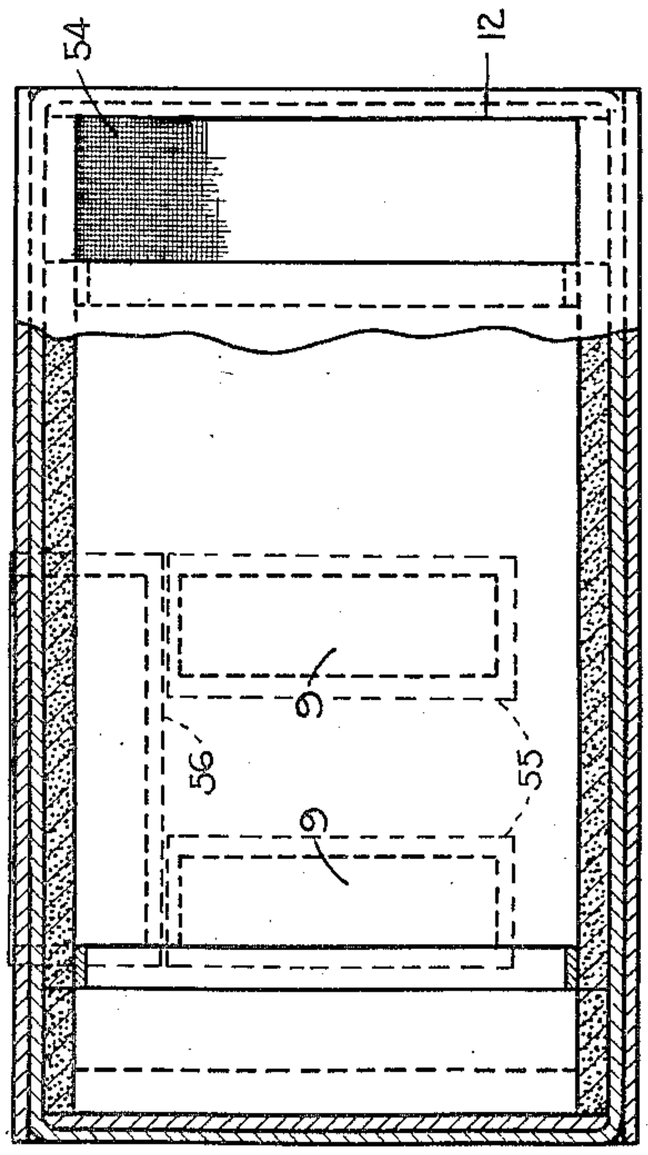

FIG 3

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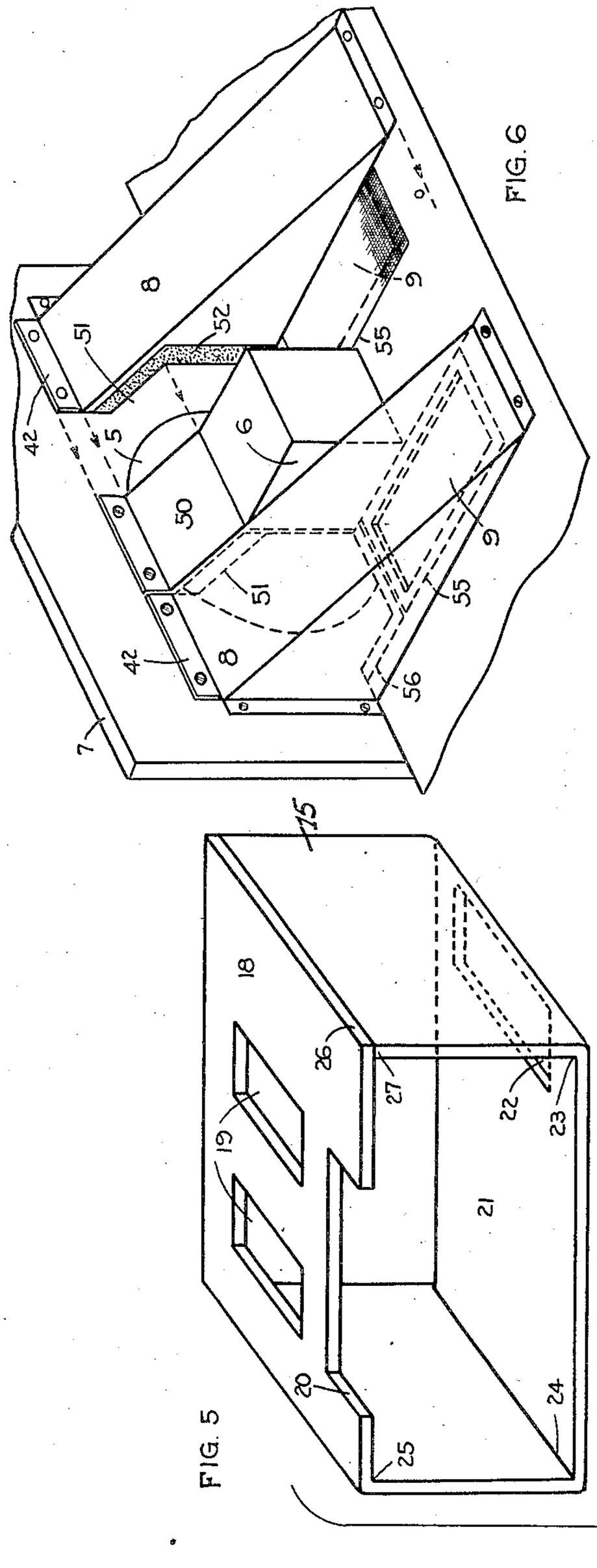

FIG. 6

FIG. 5

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SOUND REPRODUCING SYSTEM

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Application July 10, 1935, Serial No. 30,660

9 Claims. (Cl. 181—31)

This invention relates to a sound absorbing system.

In the copending application of Benjamin Olney, Serial No. 744,382, filed September 17, 1934, there is disclosed a sound reproducing system wherein the major portion of the sound transmitted from one surface of the loud speaker diaphragm is absorbed, while the remaining portion of said sound from this surface in the lower or bass audio frequency range, is resonated so that the response of the system is uniform throughout a large extent of the audio frequency range.

The present invention has for its purpose a construction, and arrangement of parts which permit the manufacture of such a system at greatly reduced cost and without materially decreasing the efficiency of the same.

The various features and advantages of the invention will appear from the detailed description and the claims when taken with the drawings in which Fig. 1 is a front elevation of the sound system of the present invention with the loud speaker, the cabinet or baffle and the front of the casing omitted; Fig. 2 is a vertical section of the same taken substantially on the line 2—2 of Fig. 1 but with the front of the casing replaced; Fig. 3 is a bottom view of a casing with a portion thereof broken away substantially on the line 3—3 of Fig. 1; Fig. 4 is a fragmentary end view of the present invention with one of the cone housings omitted and with a portion of the casing broken away to illustrate the construction and mounting of the loud speaker; Fig. 5 is an exploded view of the several sections comprising the composite casing and indicating by the dotted lines and arrows the manner in which these sections can be nested together; and Fig. 6 is a perspective view of the top portion of the casing with the cone housings and the loud speaker associated therewith the right hand cone housing being displaced from its normal position to indicate its construction.

Referring to the drawings, 5 generally designates the diaphragm or radiator of a cone type loud speaker, the actuating element of which is enclosed within a generally rectangular shell 6. This loud speaker is supported at the rear of a baffle 7 having an opening O therein through which sound is transmitted from one surface of its diaphragm. It has been found that where such a loud speaker is enclosed in a cabinet, the sound generated at the rear surface of the diaphragm 5 is resonated in the cavity defined by the cabinet causing a hollow or boomy sound effect and peak resonances in the response curve which render the tone of speech and music generated by the loud speaker of inferior quality. In the mentioned copending application the major portion of the sound generated at the rear surface of the diaphragm is absorbed in a circuitous passageway or folded conduit lined with sound absorbing material and opening at a point remote with respect to the front surface of the diaphragm, the remaining portion of the sound in the bass range generated at the rear of the diaphragm being resonated in the folded conduit to amplify the low frequency response of the system. The effective length of the folded conduit is approximately equal to one quarter of the wave length of the sound which it is desired to resonate.

In the present arrangement, sound generated at the rear surface of the loud speaker diaphragm or cone 5 is similarly discharged into two cone housings 8, 8 which lead through openings 9 in a composite casing C, into a folded conduit or circuitous channel 11 therein, the sound path being indicated by arrows in Fig. 1 and discharging into free air through the opening 12 in the bottom of the casing. The composite casing comprises an inner section 15 open at its sides, an intermediate section 16 open at its top and bottom, and an outer section 17 open at its ends. These sections which are preferably made of inexpensive material such as corrugated pasteboard, are of such size that the inner section nests within the intermediate which in turn nests within the outer section 17 in the manner indicated by the dotted lines and arrow heads in Fig. 5. The top flap 18 of the inner section is provided with two rectangular openings 19 and with a rectangular cutout portion 20 while the bottom 21 thereof is also provided with a rectangular opening 22, the purpose of which will be set forth. In practice, this inner section is cut from a sheet of stock with openings and cutout portions therein, and thereafter folded along the lines 23, 24 and 25 to bring its edges 26 and 27 together. The intermediate section 16 which is provided with a cutout portion 28 in one side, is likewise formed from a piece of corrugated pasteboard stock folded on the lines 29, 30 and 31 until its edges 32 and 33 are brought together and fastened by adhesive. The outer section 17, likewise formed of corrugated pasteboard, is provided with two top openings 34 which are so spaced as to be brought into registry with the openings 19 in the section 15 to form the top openings 9 in the casing when the several sections are nested. The top and one side of this section are provided with a cutout portion 35 adapted to register with the cutout portion 20 in the section 15 and with the cutout portion 28 in the section 16 when the several parts are nested. The bottom of the section 17 is provided with a rectangular cutout portion 36 adapted to register with the opening 22 in the section 15 when the parts are nested.

The sound damped passageway or folded conduit 11 is formed by certain of the walls of the casing and by a series of sheets of sound absorb-

ing material 37, in staggered endwise relation, defining the top and bottom of the conduit and by narrower strips or sheets 38 of sound absorbing material of the same length as the interior of the casing defining the sides of the same. Suitable spacers 39 in the form of loops of pasteboard or like material together with suitable rectangular strips 40 of wood or the like, position the sheets of sound absorbing material within the casing.

The cone housings 8, 8 are formed from pasteboard or like inexpensive sheet material folded into the general shape of a wedge, the bottom and end of which are left open. These housings are lined with relatively thick felt 41 fastened to the inner surfaces thereof and are provided with suitable edge flaps 42 by which the housings can be fastened to the casing and to the baffle to provide sound proof joints therewith as will be set forth. Each housing, when folded into the shape illustrated, is retained in erected condition by rectangular spacer strips 45 of wood, the ends of which are fastened by screws 46 in the opposing sides of the housing.

It is believed that the construction of the sound system will best be understood by describing the manner in which it is assembled. The inner section 15 is inserted in the intermediate section 16 as indicated in Fig. 5 and while the top flap 18 of the inner section is raised, first a sheet of rock wool 37 or the like, of less length than casing, is placed on the bottom of the inner section with the left end of the sheet engaging the left end of the section, being held in this position by the rectangular strips of wood 40 so that the rock wool sheet does not cover the opening 22. Two side sheets 38 of rock wool or the like are then placed against the sides of the inner section 16 while rectangular loops of pasteboard 39, which serve as spacers, are then placed between these two side sheets to hold them in upright position. Thereafter, a second sheet 37 of rock wool of less length than that of the casing, is placed horizontally on the top edges of the sheets 38 and the upper surfaces of the spacers 39, the sheet being positioned with its right end against the right end wall of the inner section 15 where it is held by the other rectangular wood strips 40 engaging the left end of the sheet and the left end of this section. Two other sheets 38 of rock wool are stood on edge on the last-mentioned sheet of rock wool engaging the respective sides of the intermediate section in which position these sheets are held by a second pair of spacers 39 in the form of rectangular loops of pasteboard. A third sheet 37 of rock wool, also of less length than the casing, is then placed on the top edges of the last-mentioned sheets 38 and on the top surfaces of the last-mentioned pair of spacers 39, the left end of this sheet engaging the left end of the inner section where its is held by a pair of rectangular wooden strips 40. Additional side sheets 38 of rock wool are stood on edge on this last-mentioned sheet and against the sides of the intermediate section, being held in this position by other rectangular loops or spacers 40. The top flap 18 of the inner section is then folded down into position shown in Fig. 5 and the intermediate section and the inner section therein is inserted into the outer section 17. This operation positions the openings 19 and 34 as well as the cutout portions 20, 28 and 35 in registry. A strip of wood 47 for reinforcing the top of the casing is attached to the inner section 15 in any suitable manner, this strip being inserted through the opening defined by the cutout portions 20, 28 and 35 now in registry. The cone housings 8, 8 are now mounted in spaced relation as shown (Fig. 6) on the composite casing, certain end flaps 42 on the housings being fastened to the casing by screws passing through the top of the casing into the wood strips 48 which is crowded into the edge of the uppermost righthand side strip as illustrated in Fig. 2. The other end flaps 42 on the housings are screwed to the baffle 7.

The unit thus far defined, is to be used with a loud speaker of the open radiator type, preferably a cone type loud speaker, mounted on the rear surface of a baffle board 7, which may be the front of a radio receiver cabinet, by means of screws passing through the ends of the frame of the speaker into the baffle board. It will be understood that the opening in the composite casing developed by the cutout portions 20, 28, and 35 provides a recess to receive the lower part of the frame and the lower part of the diaphragm or cone of the loud speaker with the shell 6 of the driving unit of the speaker resting on the top of the composite casing. It will be noted in Fig. 6 that the adjacent sides of each of the cone housings 8 are cut away as indicated at 51 to provide clearance for portions of the diaphragm. In the present invention, the frame 50 of the loud speaker is in the form of a bent-up strip of such width that when both of the housings are positioned tightly in engagement with the side edges of the frame, a sound tight joint is made therebetween so that all the sound generated at the rear surface of the diaphragm 5 will enter the housings. The mentioned joint is preferably sealed by a thin piece of felt lining 52 fastened to the adjacent side of the housing. The edges of the felt lining project slightly beyond the walls of each housing so that when the housings are assembled on the casing, these felt edges are compressed against the top of the casing, thereby forming substantially an acoustic seal at the joint.

The bottom opening 12 in the casing is preferably covered with a sound transmitting screen 54, such as a loosely woven fabric, to prevent entrance of vermin. There are also provided sound transmitting screens likewise of loosely woven fabric 55 and 56 over the openings 9 and 35 in the casing to prevent loose material such as dust within the casing, from escaping into the loud speaker mechanism.

From the foregoing description it will be seen that sound generated at the rear surface of the diaphragm enters the cone housings 8, 8 and from there is transmitted through the folded conduit 11 formed by the sheets of rock wool and certain walls of casing to the discharge opening in the bottom of the casing, the path of sound through this folded conduit being indicated by the arrows.

What we claim is:

1. A sound damping structure for use in a sound reproducing system, said structure comprising a casing having openings therein, spaced partitions within said casing made of sound absorbing material of less length than said casing defining a circuitous passageway leading from one of said openings to another, and spacing means retaining said partitions in the desired position.

2. A sound damping structure for use in a sound reproducing system, said structure comprising a casing having openings therein, spaced partitions within said casing made of sound ab-

sorbing material of a less length than said casing defining with the inner walls of said casing a circuitous passageway leading from one of said openings to another, and rectangular loops of sheet material for spacing and retaining said partitions in the desired relation.

3. A sound damping structure for use in a sound reproducing system, said structure comprising a casing having openings therein, said casing being formed of sections of sheet material nested one within another, spaced staggered partitions within said casing of sound absorbing material defining with the inner walls of said casing a circuitous passageway leading from one of said openings to another, and spacing means for retaining said partitions in the desired spaced relation.

4. A sound damping structure for use in a sound reproducing system, said structure comprising a casing having openings therein, spaced partitions within the casing of sound absorbing material in staggered relation with respect to the ends of said casing to define a circuitous passageway extending from one opening in said casing to another, and spacers and loops for retaining said partitions in the desired relation.

5. A sound damping structure for use in a sound reproducing system, said structure comprising a casing having openings therein, spaced partitions of sound absorbing material in staggered relation with respect to the ends of said casing, strips of sound absorbing material lining the sides of said casing and defining with said partitions, a circuitous passageway extending from one opening in said casing to another, and spacing means for retaining said partions and strips in desired relation.

6. A sound damping structure for use in a sound reproducing system, said structure comprising a casing formed of sections nesting one within another, said casing having a pair of spaced openings in its top and an opening in its bottom, partitions of sound damping sheet material in spaced relation from one another, said partitions being of less length than the length of said casing and being staggered so that adjacent partitions engage opposite ends of said casing to define a circuitous passageway therethrough from said top opening to said bottom opening, and a cone housing folded from sheet material and communicating with each top opening.

7. In a sound reproducing system, a loud speaker including a cone shaped diaphragm and means including a flat bracket supporting the same, a casing formed of sections of folded sheet material nesting one within another, said casing having a pair of spaced openings in its top and a cutout portion in a corner thereof adjacent said openings, said casing also having an opening in its lower portion, partitions of sound damping sheet material in spaced relation from one another, said partitions being of less length than the length of said casing and being staggered so that adjacent partitions engage opposite ends of said casing to define a circuitous passageway therethrough from said top openings to said bottom opening, and a cone housing folded from sheet material and communicating with each top opening, the opposing surfaces of said cone housings having cut away portions, the cut away portions of said housings and the cut away corner of said casing being adapted to receive said diaphragm, said bracket having its edges engaging the opposing surfaces of said cone housings whereby sound generated at the rear surface of said diaphragm is transmitted into said casing through said housings.

8. A sound damping structure for use in a sound reproducing system, said structure comprising a casing having a pair of openings near its top and an opening adjacent its bottom, cone housings of sheet material, one of which communicates with each opening of the pair, a sheet of sound absorbing material covering a substantial portion of the bottom of the casing and having its edges substantially engaging the sides of the casing while leaving the bottom opening uncovered, strips of sound absorbing material engaging the sides of said casing and resting on said sheet, rectangular loops of sheet material retaining said strips in position, a second sheet of sound absorbing material resting on said loops and the edges of said strips, other strips of sound absorbing material engaging the sides of said casing and resting in part at least on said last-mentioned sheet, other loops retaining said last-mentioned side strips in position, a third sheet of sound absorbing material resting on said last-mentioned loops and the edges of said last-mentioned strips, still other strips of sound absorbing material resting in part at least on said last-mentioned sheet and extending substantially to the top of the casing and still other loops for retaining said last-mentioned strips in position, said sheets being of less length than said casing and being arranged in staggered endwise relation to define a circuitous passageway from said pair of openings in said casing to the other opening therein.

9. A sound damping structure for use in a sound reproducing system, said structure comprising a casing formed of folded sections of sheet material, nested one within another, said casing having a pair of openings near its top and an opening adjacent its bottom, cone housings of sheet material, one of which communicates with each opening of the pair, a sheet of sound absorbing material covering a substantial portion of the bottom of the casing and having its edges substantially engaging the sides of the casing while leaving the bottom opening uncovered, strips of sound absorbing material engaging the sides of said casing and resting on said sheet, rectangular loops of sheet material retaining said strips in position, a second sheet of sound absorbing material resting on said loops and the edges of said strips, other strips of sound absorbing material engaging the sides of said casing and resting in part at least on said last-mentioned sheet, other loops retaining said last-mentioned side strips in position, a third sheet of sound absorbing material resting on said last-mentioned loops and the edges of said last-mentioned strips, still other strips of sound absorbing material resting in part at least on said last-mentioned sheet and extending substantially to the top of the casing, and still other loops for retaining said last-mentioned strips in position, said sheets being of less length than said casing and being arranged in staggered endwise relation to define a circuitous passageway from said pair of openings in said casing to the other opening therein.

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