April 22, 1930. H. C. MUELLER 1,755,931

SOUND AMPLIFYING HORN

Filed April 8, 1929

FIG. 1.

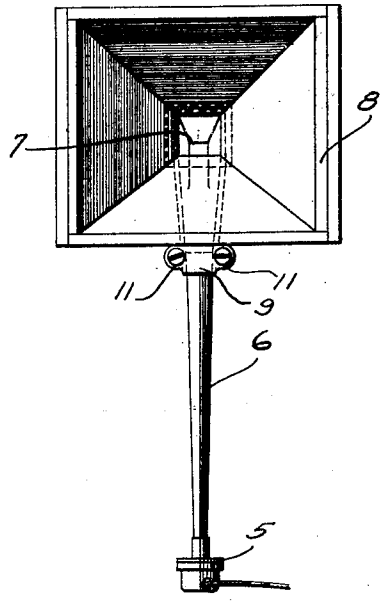


FIG. 2.

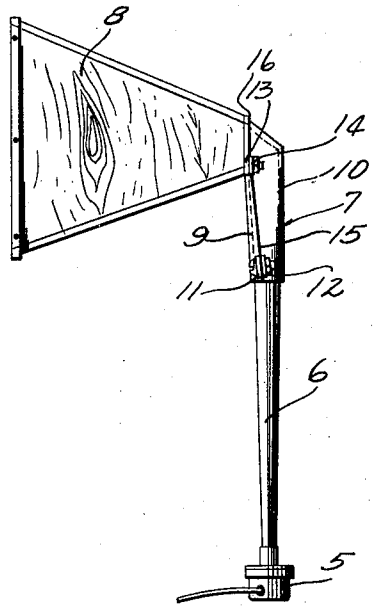


FIG. 4.

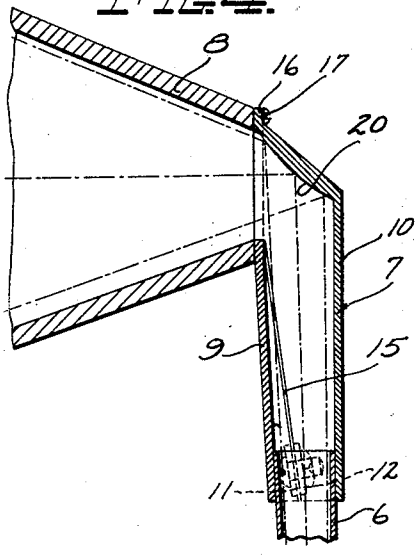
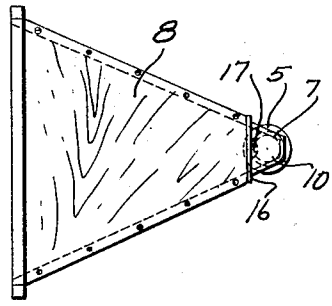


FIG. 3.



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UNITED STATES PATENT OFFICE

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SOUND-AMPLIFYING HORN

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This invention relates to improvements in sound amplifying horns.

It is the object of the invention to improve the tone quality of sound projected through a horn and particularly through a horn having angularly related portions.

It is a further object of the invention to provide a novel and improved mechanical construction for an amplifying horn adapted to facilitate its assembly while avoiding vibration or rattle such as might influence the sound output thereof.

In the drawings—

Figure 1 is a front elevation of a horn embodying this invention;

Figure 2 is a side elevation thereof;

Figure 3 is a plan view of the horn;

Figure 4 is an enlarged fragmentary detail in axial section.

Like parts are identified by the same reference characters throughout the several views.

The component parts of the horn comprise a sound reproducing unit 5 to which is connected an elongated tube 6 of gradually increasing diameter. An extension 7 of similarly increasing diameter serves as a means of connecting the tube 6 to the discharge bell 8 of the horn and also provides a special sound reflector hereinafter to be described.

The tube 6 may be of any desired construction but is preferably made to conform in an approximate way to the well known proportions of an exponential horn.

The output bell 8 is preferably made of wood and may be rectangular in cross-section as illustrated. It also may be of any desired construction.

The present invention is concerned primarily with the connecting device 7 which is designed for detachable connection with the tube 6 and the output bell 8 of the horn and must be constructed to avoid vibration and rattle, while at the same time providing for the effective and undistorted transmission of sound waves notwithstanding a change of direction which, in the present device, approaches a right angle.

In order to fulfill these requirements, the connecting device 7 comprises two parts 9 and 10 which are desirably so designed as to be divided approximately at the median line of the fitting at the end thereof which clamps about tube 6 but which are of such unequal size that the portion 10 thereof alone provides an anchorage to the output bell 8. The plane of union between the two parts 9 and 10 of the fittings runs out at the side thereof immediately adjacent the connection of fitting 10 with the output bell, as clearly shown in the drawings.

The component parts 9 and 10 of the fitting are provided with complementary bosses at 11 and 12 and at 13 and 14, such bosses being bolted together to clamp the parts 9 and 10 of the fitting upon a suitable gasket 15 which may comprise a cord or a strip of rubber or any other well known yieldable gasket material for maintaining the parts 9 and 10 out of contact while permitting them to be clamped comparatively firmly together.

A flange 16 extending peripherally about the top and sides of the part 10 of the fitting is apertured to receive screws 17 whereby part 10 is screwed to the wooden bell 8 of the horn.

One of the principal features of the invention consists in the formation of the fitting 7 to provide for proper reflection of sound waves from tube 6 into the bell 8. It is well known that irregularities or recesses out of the path of the sound waves traversing a horn tend to produce abnormalities and distortions in the tone thereof both by reason of their possible resonance and also by reason of their interference with the proper development of the sound waves in traversing the horn. Notwithstanding this knowledge, however, it has been customary heretofore to provide either a plane or a concave surface for the reflection of sound waves at an angle in a horn in which such waves are propagated.

The present invention seeks to eliminate distortion resulting from the practices referred to by providing a convex reflecting surface which is preferably so designed as to offer very little interruption to the uniform propagation of sound waves. In attaining this objective, the convexity and position of the reflecting surface 20 in the angle between the portions 6 and 8 of the horn are pref-

erably so chosen that waves incident upon the reflecting surface 20 along lines approximately parallel and adjacent to the divergent side margins of tube 6 will be reflected along lines immediately adjacent to and parallel with the sides of the bell 8. In other words, the convexity of surface 20 is determined with reference to the divergence of the opposite sides of tube 6 and also with reference to the divergence of the walls of the mouth-piece 8. The position of the reflecting surface 20 at the angle between the component parts of the horn is preferably such that a line normal to the center of the reflecting surface will substantially bisect the angle between the axes of the angularly related portions of the horn.

The fitting 7 and reflecting surface 20 thereof may be made of any desired materials but it has been found perfectly satisfactory to make these parts of cast metal, such as aluminum or the like, the weight of the metal preferably being such that its natural period of vibration, if any, will not reinforce any audible frequencies.

In the drawings I have shown diagrammatically by means of three lines traversing the component portions 6 and 8 of the horn how sound waves traveling along such lines will be reflected at an angle equal to their angle of incidence upon surface 20 and will thereby be delivered from the horn without material interference or obstruction tending to produce distortion.

It will be obvious that due to the increased angularity between the walls of horn portion 8 as compared with the elongated portion 6 thereof, sound waves would not be uniformly propagated in the bell portion but for the convex reflecting surface at 20. If the reflecting surface were concave, as is customarily the case in horns of this general type, the result would be the crossing of the lines representing the reflected sound waves with a resultant series of oblique reflections from the wall of the bell 8 destroying uniformly of propagation and resulting in a confused and distorted emission of sound from the bell.

I claim:

1. In a horn having angularly related portions, the combination with said portions of a sound reflector positioned in the angle at the juncture of said portions, the area of said reflector being greater than that of a cross section of one of the portions and angularly disposed to intercept substantially all portions of a sound wave propagated through said portion and to reflect said sound wave into the other of said portions substantially symmetrically with reference to the axis thereof.

2. In a horn, the combination of a plurality of angularly related portions and a reflector angularly positioned in the junction between two said portions whereby the axes of said portions intersect substantially at the surface of said reflector and at substantially equal angles with respect to a line normal to the surface of said reflector at the point of intersection of said axes.

3. In a horn, the combination of two angularly related portions and a reflector positioned in the angle between said portions and provided with a surface contour such that divergent lines paralleling the sides of one of said portions and corresponding divergent lines paralleling the sides of the other of said portions will respectively intersect substantially at the surface of said reflector and at substantially equal angles to a line drawn normal to said surface at each point of intersection.

4. In a horn, the combination with two angularly related portions, of a convex reflector disposed in the angle between said portions.

5. In a horn, the combination with two angularly related portions, of a convex reflector disposed in the angle between said portions, the sides of one of said portions being more widely divergent than the sides of the other and the convexity of said reflector being angularly disposed to reflect sound waves propagated in said last mentioned portion into the portion having more widely divergent sides for substantially uniform and undistorted propagation therein.

6. In a horn, the combination with two angularly related portions, of a convex reflector disposed in the angle between said portions, the position and form of the convex reflecting surface of said reflector being such that lines corresponding approximately to the sides of one of said horn portions are reflections from said surface of lines approximating the corresponding sides of the other of said horn portions.

7. In a horn, the combination with two angularly related portions, of a convex reflector disposed in the angle between said portions in a position to reflect axially of one of said portions a sound wave propagated axially of the other, one of said horn portions being provided with sides more rapidly divergent than the other of said horn portions and the convexity of the reflecting surface therebetween reflecting the sound waves between said portions for propagation substantially uniform in accordance with the divergence of the sides of the horn portion into which sound waves are reflected.

8. In a device of the character described, the combination with a horn portion having sides of relatively low divergence, and a second horn portion substantially at right angles to the first and having sides of relatively greater divergence, of a convex reflector disposed in the angle between said horn portions, having an extent substantially adequate to receive all portions of the sound wave propagated in either of said portions and to

reflect said sound wave into the other of said portions, the convexity of said reflector being so determined that lines representing the included angle between the sides of one of said horn portions and lines representing the included angle between the sides of the other of said horn portions approximately intersect at the surface of said reflector and at like angles to imaginary lines drawn normal to said surface at the point of intersection.

9. In a device of the character described, the combination with a horn passage member and a bell angularly related to each other, of a connecting fitting rigidly anchored to said bell and provided with an adjustable portion in clamping engagement with said horn member.

10. In a device of the character described, the combination with a horn passage member and a bell angularly related to each other, of a connecting fitting rigidly anchored to said bell and provided with an adjustable portion in clamping engagement with said horn member, said fitting including a convex reflector in the angle between said horn member and bell and substantially symmetrical with reference to the axes thereof.

11. In a device of the character described, the combination with a horn member and bell, of a fitting uniting said member and bell substantially at right angles and comprising a casing anchored at its margin to said bell and having an angularly related arm divided on an obliquely disposed plane and provided with clamping means for pressing its component parts upon said member, said plane intersecting the axis of said arm substantially at its point of clamping engagement with said member and running thence laterally toward the point of engagement of said fitting with said bell.

12. In a device of the character described, the combination with a horn member and a bell, of a fitting angularly connecting said horn member and bell and comprising a first part extending approximately 180° about said member and secured to said bell, and a second part extending approximately 180° about said member and abutting said first part upon a plane oblique to the axis thereof and terminating adjacent the point of connection of the first part with said bell, said first part providing a convex reflector symmetrically disposed about a point substantially at the intersection of the axes of said member and bell.

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