

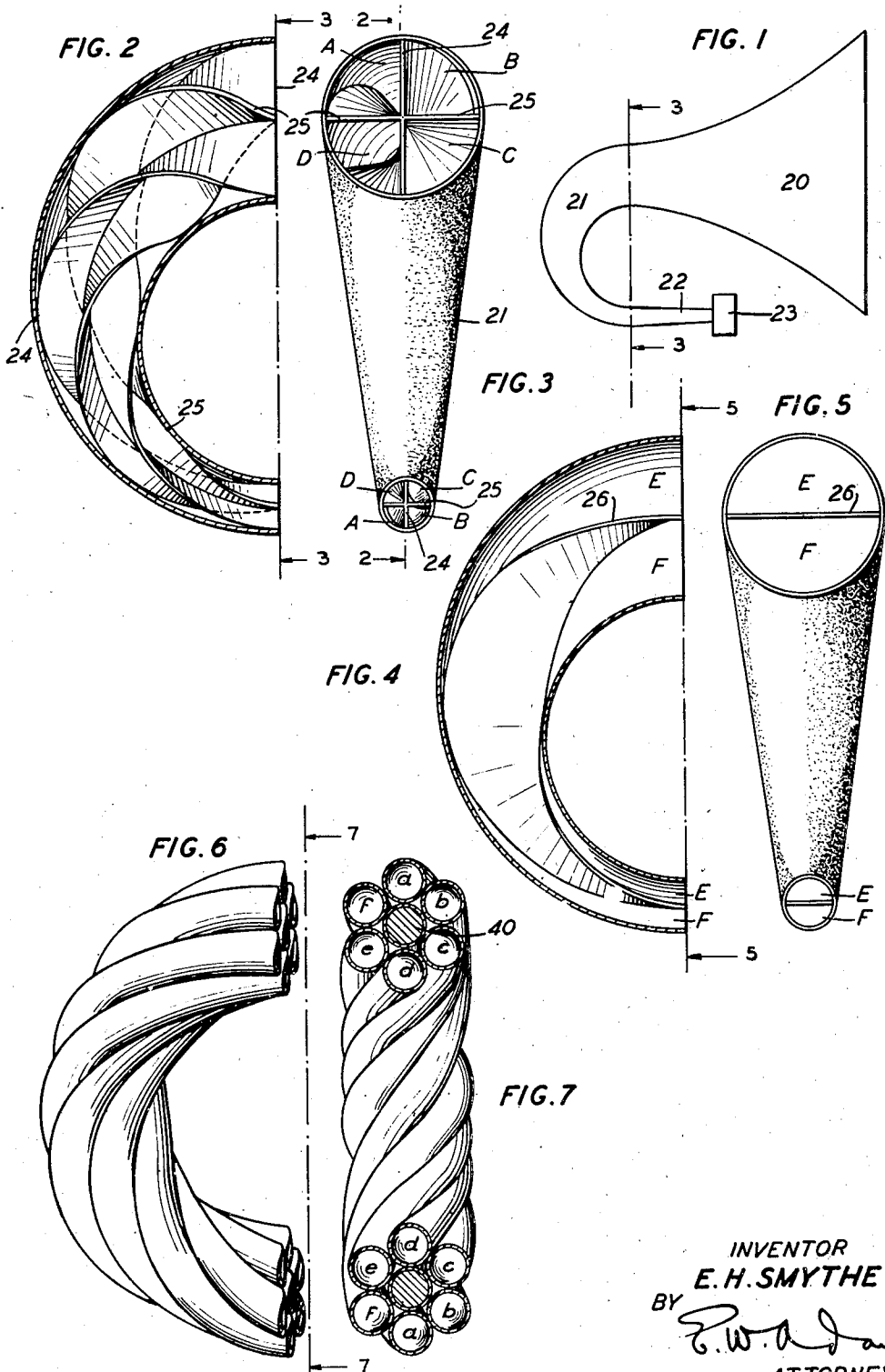
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ACOUSTIC DEVICE

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ACOUSTIC DEVICE

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This invention relates to improvements in acoustic devices and particularly to sound conduits such as used in horns and sound transmitting apparatus.

The object of the invention is to improve the transmission of sound waves in acoustic lines.

Heretofore the sound waves were conducted around the bends in horns or from one chamber to another of substantially different cross-sectional area by one channel with the result that the component parts of the sound wave front travelled in different times from one section to another because of the difference in the length of the paths in different parts of the conduit. Conduits having large dimensions in the plane of a bend also cause distortion at high frequencies due to reflection.

In accordance with one feature of the invention the sound waves are transmitted from one chamber or portion of a conduit to another of larger cross-section without distorting the wave front, the sound waves entering the larger portion being substantially plane and perpendicular to the longitudinal axis thereof, thereby eliminating phase displacement of the wave front and cross-resonances in the conduit.

In accordance with another feature the invention provides a plurality of paths of substantially equal mean lengths to conduct the sound waves around a bend and thereby control the wave front so that after it has passed the bend it will be substantially parallel to the plane of the exit opening. In one embodiment the invention provides a plurality of passages arranged spirally around the axis of the bend.

Referring to the drawing:

Fig. 1 is an elevation of a curved horn embodying the invention and shows the general type of horn to which the invention is applicable;

Fig. 2 is a side view of an acoustic conduit of circular cross-section having a 180° curvature and four passageways embodying the invention, the portion of the conduit on one side of the plane through 2—2 of Fig. 3 being removed to show the shape of these passages;

Fig. 3 is an end view of the conduit along the line 3—3 of Figs. 1 and 2;

Figs. 4 and 5 are a modification of the structure shown in Figs. 2 and 3 with two passageways.

Fig. 6 is a side view of a modification embodying the invention in which a plurality of tubes twisted together form the passages in an acoustic conduit;

Fig. 7 is a front view along the line 7—7 of Fig. 6.

Fig. 1 shows a curved horn of the general type to which the invention is applicable comprising in order a straight bell portion 20, a 180° bend 21, and a throat portion 22 to which a suitable sound reproducer 23 may be attached. The curved portion 21 is divided into a plurality of spiral-shaped passages which may take the form of any of the modifications hereinafter described.

Referring to Figs. 1, 2 and 3, the portion 21 of the horn is divided into four small passages A, B, C and D, of substantially equal length by two helical partitions 24 and 25 extending longitudinally of the portion 21 and intersecting along the axis thereof. The partitions 24 and 25 turn gradually through 360° about their intersection between the inlet and the outlet of portion 21 thereby displacing the inlets with respect to the outlets of the passages A, B, C and D 360° to equalize the paths of the sound waves.

Figs. 4 and 5 show a modification in which a single partition 26 the center line of which coincides with the axis of the section 21 and is gradually turned thereabout to reverse the inlet and outlet of passages E and F 180° as shown in Fig. 5.

Referring to Figs. 6 and 7, this modification shows the bend made up of a plurality of similar tubes spirally arranged around a core 40 which may be solid. Although not shown for the sake of clearness the spaces between the tubes at their ends should be closed by any suitable material, solder or a cement for example, to make the structure air-tight where it joins the straight portions of the horn.

Although the horn illustrated in Fig. 1 discloses only one bend of 180°, and all por-

tions having their axes lying in the same plane, obviously the invention may be applied to a horn or acoustic conduit having any number of bends of any degree of curvature lying in different planes.

The structures shown in the drawing represent in a general way the application of the invention. It will be noted that when the bend is divided into only two passages, and this applies to any degree of bend, a 180° twist is all that is necessary to equalize their mean lengths as long as the axes of the two passages at their inlet and outlet ends lie in the plane of the bend. For bends having more than two passages, the angle of twist should be 360° for any degree of bend. Obviously, the greater the number of passages the more nearly plane will be the wave front at the outlet. Reducing the area of the passages to increase their number too greatly may introduce friction losses and decrease the volume output unnecessarily. The number and size of the passages will depend upon the size and requirements of the horn.

Acoustic conduits in accordance with the invention have the advantages that they correct to a large degree the phase displacement of the wave front in curved horns, and the cross-resonances due to this displacement. The invention also permits the use of bends in horns which are sharper and larger in the dimension in the plane of the bend resulting in a more compact structure. Heretofore it has been necessary in order to transmit the high frequencies efficiently to make such bends substantially flat in the direction of the bend which required a section to be made comparatively wide at this point. For this reason the construction of large horns was limited to those of rectangular cross-section. The present invention permits the use of those of circular cross-section as the high frequencies are faithfully transmitted around the bends having a plurality of passages.

What is claimed is:

1. A sound conduit comprising two sound chambers having different cross-sectional areas, a plurality of uniformly distributed sound outlet openings in one chamber and an equal number of uniformly distributed inlet openings in another chamber, and a plurality of channels of equal length connecting said outlets to said inlets, the longitudinal axes of said channels being oblique to the longitudinal axes of said chambers.

2. A sound conduit comprising a primary portion having diverging walls, a secondary portion having diverging walls, and a third portion connecting said primary and said secondary portions, said third portion comprising a plurality of twisted channels of equal length.

3. A sound conduit having a bend therein comprising a plurality of channels of the

same length having inlets in a transverse plane and outlets in a transverse plane, said inlets and said outlets as viewed from their ends being substantially in reverse order.

4. A sound conduit having a curved section comprising a plurality of similar passages, said passages being disposed in helical fashion around the axis of said curved section.

5. A sound conduit having a curved section comprising a plurality of substantially equal length ducts disposed symmetrically and in helical fashion around the axis of said curved section.

6. A sound conduit having a curved section comprising a plurality of substantially equal length ducts, each of said ducts being so disposed about the axis of the curved section that equal portions of its length lie on the short side and on the long side of the curve.

In witness whereof, I hereunto subscribe my name, this 21st day of July 1931.

EDWIN H. SMYTHE.