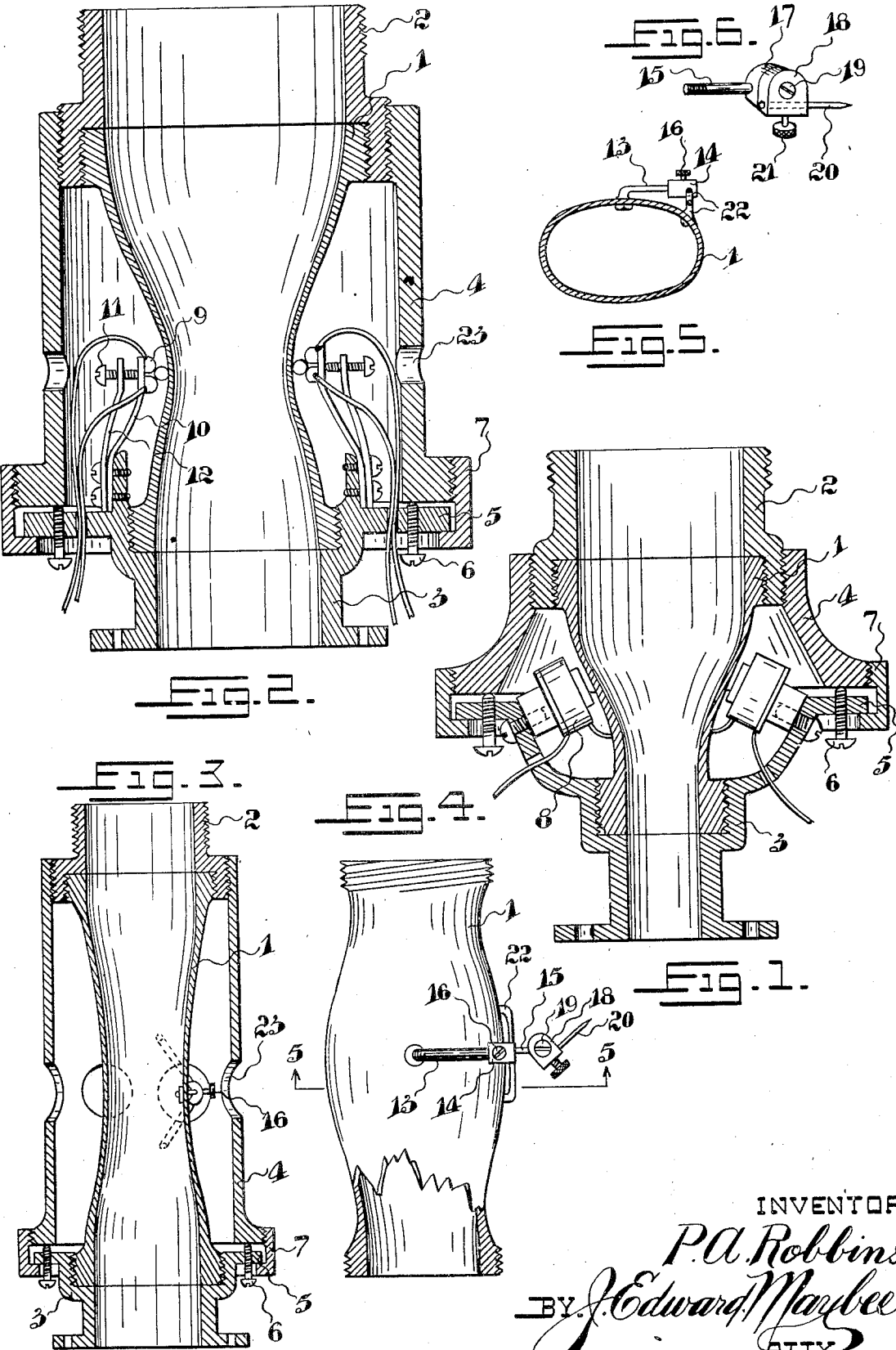


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P. A. ROBBINS
ACOUSTIC TRANSFORMER

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ACOUSTIC TRANSFORMER.

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In the art of converting sound waves into mechanical movements, and vice versa, it is usual to employ either a small diaphragm with a horn or a large diaphragm without a horn, but neither form is equally efficient for sounds varying widely in pitch, or amplitude, or both. Nor if such diaphragms be employed, is it usually possible to effect adjustments to better adapt the device employing them to meet conditions found in actual operation.

My aim therefore is to devise an acoustic transformer employing a form of diaphragm which will vibrate to emit or receive sounds of any pitch or amplitude within wider limits than is usually possible, and in which adjustment may be made to vary the responsiveness of the diaphragm to different qualities of sound as may be required.

I attain my object by means of a construction which may be briefly described as follows. The diaphragm is formed as a tube, and means are provided for stressing the diaphragm longitudinally to put it into tension or compression as desired. To render such stressing more effective, the walls of the diaphragm intermediate of the ends are longitudinally curved. The sensitiveness of the diaphragm to sounds of high pitch is increased by making part of the wall at the middle of the diaphragm thinner than the remainder. The sensitiveness of the diaphragm to sounds of low pitch is increased by giving the middle of the tube of the diaphragm an elliptical form.

In a preferred form the wall of the diaphragm converges from one or both ends to the point at which vibrations are applied to or received from the diaphragm.

The device is constructed in detail substantially as hereinafter described and as illustrated in the accompanying drawings in which

Fig. 1 is a longitudinal section of one embodiment of my invention;

Fig. 2 a similar view of a modification used as a transmitter;

Fig. 3 a longitudinal section of a further modification arranged as a phonographic recorder or reproducer;

Fig. 4 a side elevation, partly broken away, of the diaphragm shown in Fig. 3.

Fig. 5 a cross section on the line 5-5 in Fig. 4; and

Fig. 6 a perspective detail of the stylus holder.

In the drawings like numerals of reference indicate corresponding parts in the different figures.

1 is the tubular diaphragm, which may be made of metal, bakelite or other suitable elastic material. The tubular diaphragm is provided at opposite ends with the end members 2 and 3, preferably threaded on the ends of the diaphragm. A sleeve 4 is suitably connected with one end member, in the drawings being shown as threaded on the member 2. The end member 3 has an annular flange 5 formed thereon, through which are threaded a plurality of adjusting screws 6. It is evident that, by screwing in these screws 6, a compressional stress can be imparted to the sleeve 4, and thus a longitudinal tensional stress imparted to the tubular diaphragm.

Means are also provided whereby a compressional stress may be applied to the tubular diaphragm. I show for this purpose the flanged ring 7, which is threaded on the end of the sleeve and engages the outer side of the flange 5. By loosening the screws 6 and screwing up the flange ring 7, a compressional stress may be imparted to the tubular diaphragm.

The effect of longitudinally stressing the diaphragm is increased if the wall of the tube be formed otherwise than as a right cylinder. For instance, in Fig. 1 it is shown as funnel shaped; in Fig. 2 a similar form is adopted, save that there is an increase in the diameter of the tube beyond the point of least diameter; in Figs. 3 and 4 the wall is inwardly curved and flattened on two sides.

Sensitiveness to sounds of widely different pitch is increased by varying the thickness of the wall of the tubular diaphragm from one or both ends towards the point at which vibrations are applied to or received from the diaphragm. While in many cases satisfactory results may be obtained by employing a uniform thickness of wall in any cross section of the tubular diaphragm, I may for the purpose of giving increased sensitiveness of sounds of high pitch make one part of the wall adjacent the point at which vibrations are applied to or received from the diaphragm of less thickness than the other parts of the wall in the same cross section.

To give increased sensitiveness to sound waves of great amplitude, an oval or flattened form of cross section may be employed

for the tubular diaphragm at or about the point where vibrations are applied to or received from the diaphragm (see Fig. 5).

An acoustic transformer constructed in accordance with my invention may be employed with any known form of apparatus for applying vibrations to or receiving them from the diaphragm. For instance, in Fig. 1 I show electro-magnets 8 secured to the end member 3 and positioned with their poles adjacent the thinnest part of the wall of the diaphragm, and, so arranged, the device is operative as a receiver and may form part of a loud speaker unit.

In Fig. 2 the device is shown as arranged as a transmitter. Carbon contacts connected in a suitable circuit are suitably held in contact with the wall of the diaphragm at its thinnest point. In this view, 9 are the carbon pellets, 10 the holders for the carbon pellets, 11 adjusting screws threaded through the arms 12 for applying pressure to the carbon pellets. Two of these carbon contact devices may be employed at opposite sides of the tubular diaphragm.

Any other known form of electrical device for converting the vibrations of the diaphragm into undulatory current may be employed.

In Figs. 3 to 6 I show the device as arranged for use as a phonographic recorder or reproducer. Secured at one end of the diaphragm is the transmission rod 13, to the end of which is attached the block 14, which is provided with a threaded hole to receive the threaded end of a rod 15, which may be screwed into the block to any desired position and there held by means of the set screw 16. To the outer end of the rod 15 is secured a block 17, against the side of which may be clamped the block 18, by means of a screw 19. The block 19 is adapted to receive the stylus 20, which may be clamped therein by means of the set-screw 21. The block 14 is braced from the wall of the diaphragm by means of the braces 22. The end of the transmission rod 13 is preferably secured to the diaphragm at its thinnest point, and the braces 22 secured to the diaphragm at a point remote therefrom. The sleeve 4 is provided with openings 23 through which access may be had to the stylus and the stylus carrying parts.

What I claim is:

1. An acoustic transformer including a tubular diaphragm; and means for imparting at will either a longitudinal tensional stress or a compression stress to said tubular diaphragm.

2. An acoustic transformer including a tubular diaphragm having a zone of its wall thinner than the remainder to render it more sensitive to sounds of high pitch.

3. An acoustic transformer including a tubular diaphragm having the middle zone of its wall thinner than the remainder to render it more sensitive to sounds of high pitch.

4. An acoustic transformer including a tubular diaphragm having cylindrical ends, and a middle part of elliptical cross section.

5. An acoustic transformer including a tubular diaphragm having cylindrical ends, and a middle part of elliptical cross section, the wall being thinner at one part of the circumference of the middle section than at other parts of the middle section.

6. An acoustic transformer including a tubular diaphragm having cylindrical ends, and a middle part curved longitudinally and of elliptical cross section.

7. An acoustic transformer including a tubular diaphragm having cylindrical ends, and a middle part curved longitudinally and of elliptical cross section, the wall being thinner at one part of the middle section than at other parts of the middle section.

8. An acoustic transformer including a tubular diaphragm; end members connected to the ends of the diaphragm; a sleeve connected at one end to one of the end members; and means engaging the other end of the sleeve and the other end member for imparting a longitudinal stress to the sleeve and thus to the diaphragm.

9. An acoustic transformer including a tubular diaphragm having its walls converging towards the point at which vibrations are applied to or are received from the diaphragm, the wall also decreasing in thickness, as well as diameter, towards said point.

10. An acoustic transformer including a tubular diaphragm having its walls converging from one end towards a point intermediate of the ends at which vibrations are applied to or received from the diaphragm, the wall also decreasing in thickness from said end towards said point.

11. An acoustic transformer including a tubular diaphragm having its walls converging from each end towards a point intermediate of the ends at which vibrations are applied to or received from the diaphragm.

12. An acoustic transformer including a tubular diaphragm having its walls converging from each end towards a point intermediate of the ends at which vibrations are applied to or received from the diaphragm, the wall also decreasing in thickness from one end towards said point.

13. An acoustic transformer including a tubular diaphragm having its walls converging from each end towards a point intermediate of the ends at which vibrations are applied to or received from the diaphragm, the wall also decreasing in thickness from each end towards said point.

14. An acoustic transformer including a tubular diaphragm, end members connected to the ends of the diaphragm; a sleeve connected at one end to one of the end members; and means engaging the other end of the sleeve and the other end member for imparting a longitudinal stress to the sleeve and thus to the diaphragm, the sleeve having openings therein through which access may be had to the parts of the diaphragm at which vibrations are applied or received. 10

Signed at Highland Park, Ill., this third day of March, 1927.

PERCY A. ROBBINS.