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SOUND REPRODUCING APPARATUS

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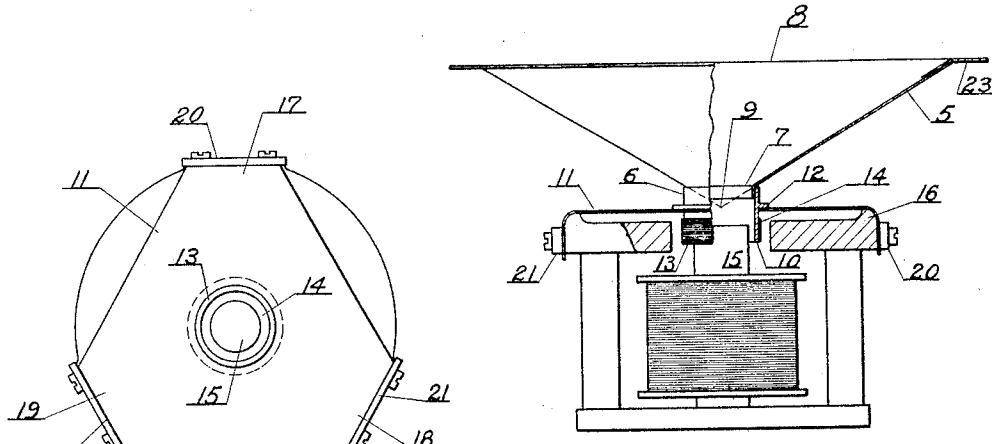


Fig. 1

Fig. 2

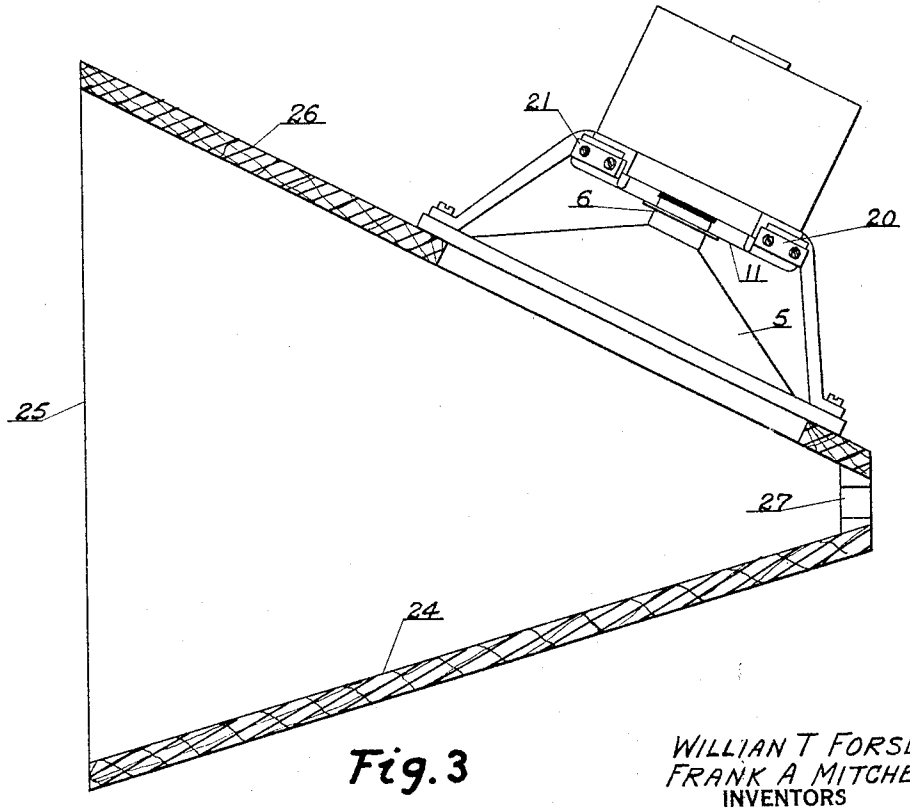


Fig. 3

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UNITED STATES PATENT OFFICE

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SOUND REPRODUCING APPARATUS

Application filed July 15, 1929, Serial No. 378,297, and in Great Britain July 23, 1928.

This invention relates to sound reproducing devices or loud speakers of the type in which a relatively large cone or diaphragm is employed, and while applicable more particularly to sound reproducing apparatus of this type in which the cone is vibrated at acoustic frequencies by a coil located in a magnetic air gap, the invention is in some respects applicable also to apparatus of the above character provided with other forms of magnetic armature.

It is known that with coil-driven diaphragms of the usual paper cone type, there is a pronounced tendency for the diaphragm to rattle or blast when music of a defined power limit has been reached and this fault has usually been attributed to the overloading of the power valves in the amplifier used in connection with the apparatus. We have found, however, that the fault also lies in the cone itself and particularly in the method used for suspending the same, it being usual either to leave the small end of the cone unsuspended or else to attach the cone direct to a flexible support.

One of the principal objects of this invention is to provide a sound reproducing device of the character referred to which shall give substantially even response throughout the essential musical frequencies and which shall be free from distortion when reproducing sounds having a large power value (that is frequency multiplied by amplitude).

The invention consists in an electromagnetic sound reproducing device of the type comprising a coil-driven conical diaphragm characterized by the feature that the cone is attached to a relatively rigid projection which in turn is attached to a flexible support.

The invention also consits in an electromagnetic sound reproducing device of the type comprising a coil-driven conical diaphragm characterized by the feature that the diaphragm is supported at its smaller end by a flexible member located in a plane intersecting the axis of the cone at a point beyond the apex of the cone.

A further feature of the invention lies in the means adopted for amplifying the sounds emitted by the conical diaphragm and in accordance with this feature of the invention, we arrange the conical diaphragm of an electromagnetic sound reproducing device to operate in conjunction with a sound reflector located in a plane intersecting the axis of the cone.

Further features of the invention will be apparent from the description given hereafter.

In the accompanying drawing:—

Fig. 1 is a sectional view showing a method of flexibly mounting the loud speaker cone and operating coil in accordance with the invention;

Fig. 2 shows a convenient form of centering device for the above;

Fig. 3 shows a cone speaker mounted to operate in combination with a reflector in accordance with the invention.

In carrying our invention into effect in one convenient manner as shown in Fig. 1, we provide a diaphragm or cone 5 of suitable form with a relatively rigid projection 6 made of cardboard, vulcanized fibre or the like attached to the cone at a position 7 located between its base 8 and its apex 9, the said projection 6 extending in the direction of the axis of the cone so that its end 10 remote from the cone lies in a plane intersecting the axis of the cone at a point beyond the apex 9 shown in dotted lines, Fig. 1. To this relatively rigid projection 6 we attach a flexible support 11 (if necessary with the aid of a flange 12 upon the tube) which may conveniently be in the form of a sheet of oiled silk, leather or like material or in the form of cords or the like so arranged that the flexible support lies in a plane which intersects the axis of the cone at a point beyond the apex of the cone, the flexible support 11, permitting relatively free but limited movement of the cone 5 in the direction of its axis.

A small operating coil 13 of wire is also attached to the relatively rigid projection 6 conveniently in such a position that the flexible support 11 lies between the cone 5 and the operating coil 13, the coil being either wound upon the rigid tube or formed sep-

arately and attached to the tube in any suitable manner, the coil being located in a magnetic air gap 14 between the poles 15 and 16 of a permanent magnet or of an electromagnet and being caused to vibrate and operate the cone to reproduce sounds by any suitable or known means such as by the use of an amplifier.

The supporting sheets of leather or the like may be of any suitable shape in plan. One convenient shape is shown in Fig. 2 having three projecting strips 17, 18 and 19 located at 120° from one another by means of which and suitable clamping strips 20, 21 and 22, the flexible support 11 may be adjustably secured to the frame of the sound reproducing device in such a manner as to locate the movable coil of wire 13 in its correct central position in the magnetic air gap 14, and to tension the flexible support. The large end 8 of the cone may be free, or it may be supported by means of oiled silk, leather, cloth or other suitable material 23 attached to its edge as shown in Fig. 1. If desired, the cone diaphragm 5 may be mounted in combination with an acoustic amplifying device such as a horn or baffle but as both these forms of amplifiers have faults which are very noticeable when loud passages of music are reproduced, we prefer to employ a reflector device so that a more even response can be obtained throughout the essential musical scale. Thus, in one construction shown in Fig. 3, we may mount the complete conical loud speaker so that it projects a parallel beam of sound waves against one or more reflectors 24 placed at an angle to the axis of the cone 5, such an arrangement tending to diffuse the higher frequencies and conserving the lower frequencies so that there is a better diffusion of sound at both ends of the musical scale as compared with that which is obtainable when either a horn or a baffle is employed.

The reflector 24 may conveniently be arranged at about 45 degrees to the axis of the cone, and may sometimes form one side of an amplifying chamber 25 to the other side 26 of which the cone speaker is attached by suitable means.

In this case, the small end 27 of the amplifying chamber may also be left open or such small end may be perforated so as to break up any resonance tendency.

Such a reflector device may be employed with other types of loud speaker, and it may also be applied to mechanically operated sound-reproducing devices since the principles involved are applicable to mechanical as well as to electromagnetic apparatus.

It is to be understood that the invention is not to be limited to the foregoing details of construction which are given by way of illustration only, and we may vary the mode of construction and material employed for the conical diaphragm, the form and material of the relatively rigid projection and the means adopted for securing the same to the cone as also the number and shape of the projecting strips upon the flexible support or other means adopted for securing the flexible support to the frame of the apparatus or the material or shape of the reflector or amplifying chamber depending upon the particular purpose for which the device is to be employed or any practical requirements that may have to be fulfilled.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. In a sound reproducing device including a conical diaphragm, a relatively rigid tubular projection secured at one of its ends to the convex side of the diaphragm and enclosing the apex thereof, flexible supporting means for said tubular projection, and said supporting means secured to said projection in spaced relation to said diaphragm.

2. In a sound reproducing device including a diaphragm, a relatively rigid projection secured to said diaphragm, a flexible supporting member for said projection, and means whereby said flexible supporting member may be adjusted.

3. In a sound reproducing device comprising a conical diaphragm, flexible means supporting the diaphragm at its smaller end, said flexible means located in a plane intersecting the axis of the diaphragm at a point beyond the apex thereof, and means whereby said flexible supporting means may be adjusted.

4. In a sound reproducing device, a dished diaphragm, a relatively rigid member secured to the diaphragm, a supporting member comprising a sheet of flexible material secured to the rigid member, and means whereby said flexible supporting member may be adjusted.

5. In a sound reproducing device comprising a conical diaphragm, a member supporting the diaphragm at its smaller end, said member comprising a sheet of flexible material, and means whereby said supporting member may be adjusted.

6. A sound reproducing device comprising a cone-like diaphragm, an operating coil for said diaphragm, a member supporting said diaphragm at its smaller end, said member comprising a sheet of flexible material, said member located in a plane between the operating coil and the apex of the diaphragm, and means whereby said flexible supporting member may be adjusted.

7. In a sound reproducing device, a dished diaphragm, a relatively rigid member secured to the diaphragm, a supporting member comprising a sheet of flexible material secured to the rigid member, means mounting said flexible supporting member, said mounting means comprising clamping pieces adapted

to grip the edge portion of the flexible supporting member, and said pieces independently releasable whereby said supporting member may be adjusted.

8. In a sound reproducing device comprising a conical diaphragm, a member supporting the diaphragm at its smaller end, said member comprising a sheet of flexible material, means mounting said flexible supporting member, said mounting means comprising clamping pieces adapted to grip the edge portion of the flexible supporting member, and said pieces independently releasable whereby said supporting member may be adjusted.

9. A sound reproducing device comprising a cone-like diaphragm, an operating coil for said diaphragm, a member supporting said diaphragm at its smaller end, said member comprising a sheet of flexible material, said member located in a plane between the operating coil and the apex of the diaphragm, means mounting said flexible supporting member, said mounting means comprising clamping pieces adapted to grip the edge portion of the flexible supporting member, and said clamping pieces adapted to be independently released and tightened to permit of adjustments of said supporting member.

10. In combination, a sound reproducer including a diaphragm of the direct acting type, a sound amplifier including a discharge opening and spaced oppositely arranged walls, one of said walls inwardly of the discharge end of the amplifier and having an opening therethrough of substantially the diameter of said diaphragm, said reproducer positioned to have said diaphragm direct sound through the opening in the one wall of the amplifier and in the direction of the other wall of the amplifier, and said other wall of the amplifier arranged at an angle to the wall having the opening and inclining toward the discharge opening.

11. The combination as in claim 10 said other wall comprising a relatively rigid reflecting wall arranged at an angle of approximately 45° to the axis of the diaphragm.

12. The combination as in claim 10 said amplifier having a relatively large open discharge end and with an opening in its small end, said small opening serving to break up resonance.

13. In a sound reproducing device including a conical diaphragm, a relatively rigid tubular projection secured at one of its ends to the convex side of the diaphragm, a flexible supporting member for said tubular projection, said flexible supporting member secured to said projection in spaced relation to said diaphragm and said flexible supporting member comprising a sheet of flexible material.

14. A sound reproducing device comprising a cone-like diaphragm, a relatively rigid tubular projection secured at one end to the convex side of said diaphragm and enclosing the apex thereof, a coil on said tubular projection beyond the apex of the diaphragm, flexible supporting means for said tubular projection, and said flexible supporting means connected with the projection at a point and located in a plane between the coil and the apex of said diaphragm.

Signed at London, England, this first day of July, A. D. 1929.

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