Nov. 6, 1928.

1,690,726

E. F. HOLINGER

SOUND REPRODUCING DEVICE

Filed June 17, 1927

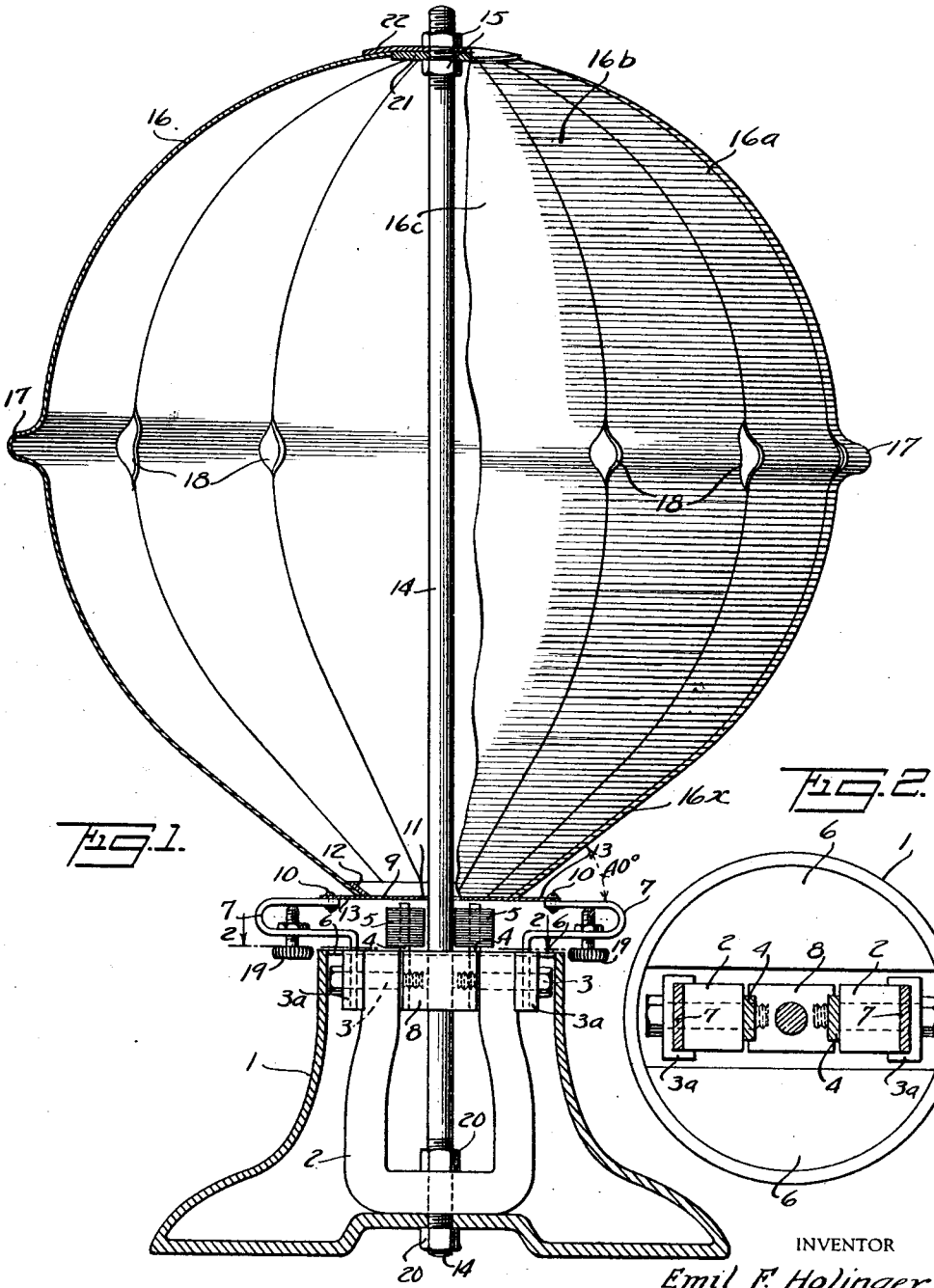


FIG. 1.

FIG. 2.

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Patented Nov. 6, 1928. 1,690,726

UNITED STATES PATENT OFFICE.

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SOUND-REPRODUCING DEVICE.

Application filed June 17, 1927. Serial No. 199,504.

This invention is designed to provide means for the clear and accurate reproduction of sound waves in general, but is more particularly designed, so far as the present embodiment thereof is concerned, for use in radio receiving sets. The present invention comprises certain improvements on constructions of the general type disclosed in my pending application Serial No. 133.581, filed Sept. 24, 1926, allowed May 19, 1927, and in my pending application Serial No. 185,994, filed April 23, 1927. In this type of my invention, as in those disclosed in my said prior applications, the resonant member consists of a hollow body of thin, stiff, but slightly elastic material, such as wood or fibrous composition, to which the armature of an electromagnetic receiving element is attached, but I have found that the quality, accuracy and volume of the tone reproductions are considerably further increased if said member is given a generally obovoid shape, such as may be produced by joining the base of a cone to a portion of a sphere, and then attaching the vibration producing means to the smaller end of such member.

The best form of apparatus now known to me embodying my invention is illustrated in the accompanying sheet of drawings in which—

Fig. 1 is a side elevation and a partial vertical section of the apparatus with parts broken away, and

Fig. 2 is a cross section taken on the line 2—2 of Fig. 1.

Throughout the drawings like reference characters indicate like parts. 1 is the base of the apparatus, which may be made of any non-magnetic material such as bronze, and 2 is a permanent magnet mounted in said base. Soft iron pole pieces 4, 4 are fastened to the poles of magnet 2 and provided with magnetic coils 5, 5, adapted to be connected in the receiving circuit. The permanent magnet is fastened to the base 1 in any convenient manner as by means of the nuts 20, 20 mounted on the threaded lower end of the rod or tube 14 which passes through the magnet and the base. Cover plates 6, 6, mounted in the upper portion of the base serve to enclose the permanent magnet therein.

Screw bolts 3, 3 pass through horizontal perforations in the permanent magnet and in the pole pieces 4, 4, and engage threaded recesses in a spacing block 8 of non-magnetic material located between the poles of the permanent magnet. These bolts also pass through perforations in the lower ends of a pair of goose-neck springs 7, 7, located outside of the permanent magnet poles, and through grooved clamp shoes 3^a, 3^a. When said screw bolts are set up tightly the parts are thereby firmly assembled in accurate alignment and spaced relation, as well shown in Fig. 2. The spacer block 8 may be grooved to receive the pole pieces 4, 4 as shown in Fig. 2.

The armature 9 for the electromagnet thus formed is preferably made by stamping out a thin, soft iron plate having a central opening 11, the exterior, upwardly bent semi-circular flanges 12 and the laterally projecting ears 13, 13 arranged diametrically opposite one another, as described and shown more in detail in my said pending application Serial No. 185,944. This armature is preferably supported upon the upper ends of the goose neck springs 7, 7 which are formed of non-magnetic materials, such as brass, being fastened to said ears 13, 13 at 10, 10, by welded or soldered joints, or by screws, as shown in Fig. 1. 19, 19 represent adjusting screws threaded into one section of each of the goose-necks of each spring 7, 7 and bearing upon the other section of said goose-neck, by which said supporting springs 7, 7 may be flexed to raise or lower the armature 9 with reference to the pole pieces 4, 4.

The resonant member, in the preferred form of my invention, is composed of a portion 16 in the general shape of a portion of a sphere, and a lower portion 16^x in the shape of a truncated cone, the elements of which cone are tangent to the surface of the spherical portion at the junction point of the two portions. Preferably the angle of flare of the truncated conical portion 16^x is about 50 degrees, which causes the walls of the lower portion of this member to be inclined at an angle of about 40 degrees to the plane of the armature plate 9. The armature 9 is fastened to the resonant member by cementing or otherwise attaching the walls of the resonant member to the flanges 12 on said armature.

The pear-shaped resonant member thus produced is supported at its larger end by

the upper end of the rod or tube 14 which extends through its interior and is clamped to it by means of the nuts 15, 15 engaging the threaded upper end of said rod or tube.

The pear-shaped resonant member may be formed in a variety of ways but I prefer to make it of a series of strips 16^a, 16^b, 16^c of resonant material, such as wood, or paper, which are joined together at the upper end by being cemented to a ring-shaped piece of wood or cardboard 21 and to an overlapping cap plate 22 of similar material. 17 represents an annular fold of wave-like cross section in the wall of the resonant member extending around the same approximately midway between its ends, and 18, 18 are perforations through the wall of said member preferably located in said crease.

In operating my invention, the magnet coils 5, 5, are connected in the electrical circuit of the radio receiving unit and the armature 9 is adjusted toward or from the pole pieces 4, 4, by means of the screws 19, 19 until the best results in sound reproduction are obtained.

I find that making that portion of the resonant member to which the armature is attached in the shape of the truncated cone, as shown, very greatly increases the volume and sensitiveness of the sound reproduction. By means of this apparatus I am able to bring out fully the lower or bass notes of any musical composition being reproduced without impairing the reproduction of the higher notes, clearly developing even the lowest notes of a great organ.

The volume and quality of the sound reproduction vary according to the size of the resonant member, the loudness increasing with the size of the member, at least within certain limits. Excellent results are obtained with an apparatus in which the diameter of the globular portion of the resonant member is sixteen inches.

So far as I can at present determine, the main portions of the sound waves are generated by the vibration of that portion of the resonant member below the crease 17, while the upper portion of said member serves as a sounding board, mainly useful in reflecting and concentrating the sound waves, and forcing them to escape through the openings 18, 18. The crease 17 in the walls of the resonant member practically acts as a hinge, permitting a freer vibration of the remaining portions of the walls, and very greatly increasing the sensitiveness and volume of sound reproduction.

Various changes could be made in the relative arrangement and construction of the constituent elements herein described and illustrated without departing from the principle of construction here disclosed, or entirely destroying the improved results above outlined.

Having described my invention, I claim:

1. A sound reproducing device comprising, in combination, a hollow member of substantially pear shape having one portion in the form of a segment of a sphere, and the rest substantially cone shaped, both made of thin, resonant material, and means for imparting sound vibrations to said member attached to the smaller end thereof.

2. A sound reproducing device comprising, in combination, a hollow member of substantially pear shape having one portion in the form of a segment of a sphere, and the rest substantially cone shaped, both made of thin, resonant material, and means for imparting sound vibrations to said member attached to the smaller end thereof, together with a support for said member attached to its larger end.

3. As an element in a sound reproducing device, a hollow, thin-walled oboviod resonant member having a large closed end of globular shape, and a smaller open end in the shape of a truncated cone tangent to the adjacent globular portion.

4. A structure such as defined in claim 3 in which the angle of flare of said conical portion is about fifty degrees.

5. A sound reproducing device comprising, in combination, a hollow, thin-walled pear-shaped member having its larger portion of a generally spheroidal shape and the rest substantially cone shape, and having an opening at its smaller end, means for imparting sound vibrations to said member attached to its walls near said opening, and a support extending through said opening and attached to said member at its opposite and larger end.

6. A combination such as defined in claim 5 in which there is a circumferential crease in the walls of said pear-shaped member extending around the same.

7. A combination such as defined in claim 5 in which there is a crease in the walls of said pear-shaped member extending circumferentially around the larger end thereof.

8. A combination such as defined in claim 5 in which there is a crease in the walls of said pear-shaped member extending circumferentially around the larger end thereof and perforations through the walls of said crease.

9. A sound reproducing device comprising, in combination, a hollow, thin-walled, pear-shaped resonant member closed at its larger end, having an opening in its side, and being open at its smaller end, a support for said member attached to its larger end, and means for imparting sound vibrations attached to its smaller end.

10. In a sound reproducing device suitable for use in radio apparatus having an electromagnet, the coils of which are adapted to be included in a reproducing circuit, the combination, with the above recited apparatus, of a hollow, substantially pear-shaped member made of thin, resonant material, hav-

ing an opening in its side, and an armature for said electromagnet fastened to said member at its smaller end.

11. A structure such as defined in claim 10 combined with a support for said pear-shaped member attached to it at its larger end.

12. A combination such as defined in claim 10 in which said pear-shaped member has a circumferential crease in its wall, in which crease said side opening is located.

13. A combination such as defined in claim 10 in which said pear-shaped member has a circumferential crease in its walls producing a wave-like cross section thereof.

14. In a sound reproducing device suitable for use in a radio receiving set having an electromagnet, the coils of which are adapted to be included in a reproducing circuit, the combination, with the above defined apparatus, of a hollow, substantially pear-shaped member made of resonant material having a circumferential crease located substantially midway between the ends of said member and having a series of openings therethrough, a support attached to said member at a point remote from said crease, and an armature for an electromagnet attached to the smaller end of said pear-shaped member at a point in the field of force of said magnet.

15. In a sound reproducing device suitable for use in a radio receiving set having an electromagnet, the coils of which are adapted to be included in a reproducing circuit, the combination with the above defined apparatus of a vertical support extending upward from said magnet, a hollow, substantially pear-shaped member formed of resonant material surrounding said support with its larger end uppermost and fastened thereto and having a circumferential crease in its walls of curved cross section extending around its medial portion, and an armature for said magnet located in the field of force thereof and fastened to the smaller and lower end of said pear-shaped element.

16. A combination such as defined in claim 15 in which said pear-shaped member is provided with a series of openings through its walls located in said crease.

17. In a sound reproducing device suitable for use in a radio receiving set comprising, in combination, a horseshoe magnet, a hollow, substantially pear-shaped resonant member made of thin, stiff material and having an opening at its smaller end, a support for said member extending upward through said opening to the upper and larger end of said pear-shaped member, an annular armature for said magnet surrounding said support and fastened to the wall of said resonant member at its smaller and lower end, two curved springs rigidly mounted with reference to said magnet and supporting said armature at diametrically opposite points thereof, and adjusting screws mounted in, and bearing upon, said spring and adapted to flex the same, whereby on the flexing of said springs any desired adjustment of said armature with reference to said magnet may be secured.

18. A combination such as defined in claim 17 in which said pear-shaped member has an annular crease in its walls at a point substantially midway between its ends.

19. A combination such as defined in claim 17 in which said pear-shaped member has an annular crease in its walls at a point substantially midway between its ends, and a series of perforations in its walls located in said crease.

20. A sound reproducing device comprising, in combination, a hollow obovoid member with its larger end of approximately spheroidal shape and its smaller end of generally conical shape, both formed of walls of thin, stiff, but elastic material, with an opening therein, and means for imparting sound vibrations attached to one portion of said member.

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