Oct. 1, 1929. P. S. O'DONNELL 1,730,286

SOUND PRODUCING APPARATUS

Filed March 19, 1926 3 Sheets-Sheet 1

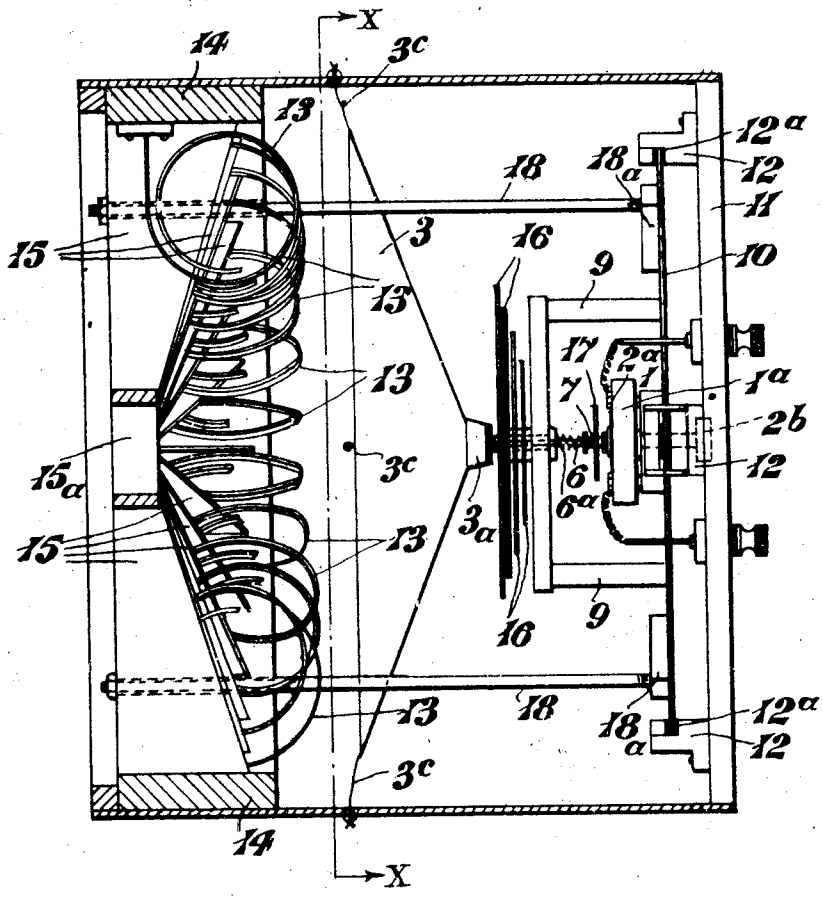

Fig. 1.

Inventor
Patrick S. O'Donnell
by
F. D. Singer, Atty.

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Filed March 19, 1926 3 Sheets-Sheet 2

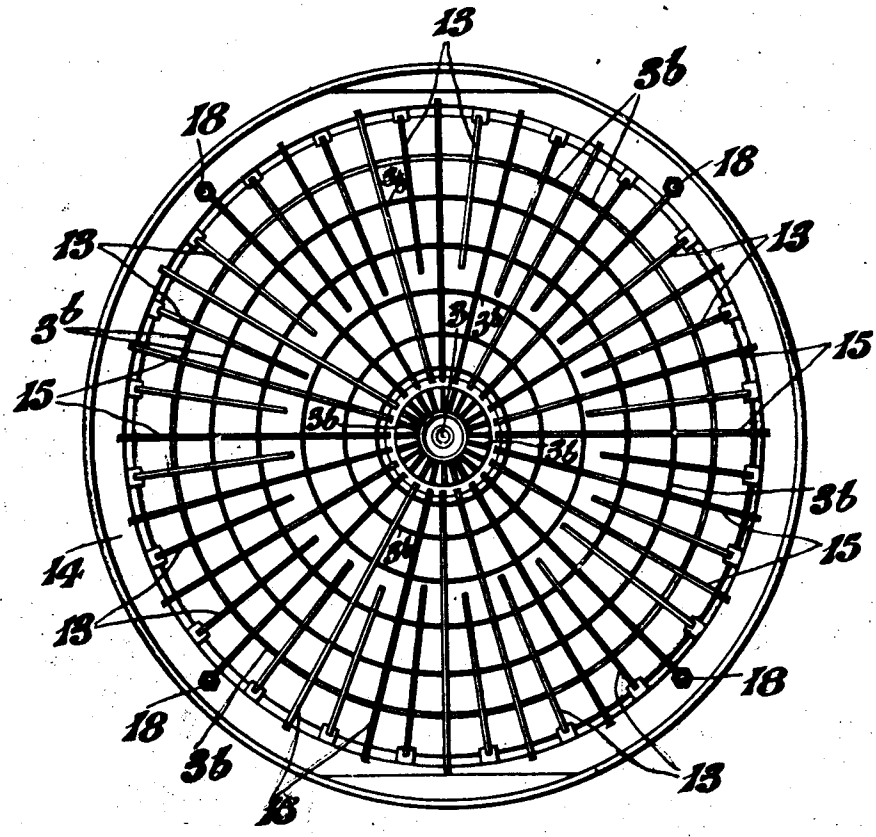

Fig. 2.

Inventor
Patrick S. O'Donnell
By
J. B. Linger, Atty.

Oct. 1, 1929. P. S. O'DONNELL 1,730,286

SOUND PRODUCING APPARATUS

Filed March 19, 1926 3 Sheets-Sheet 3

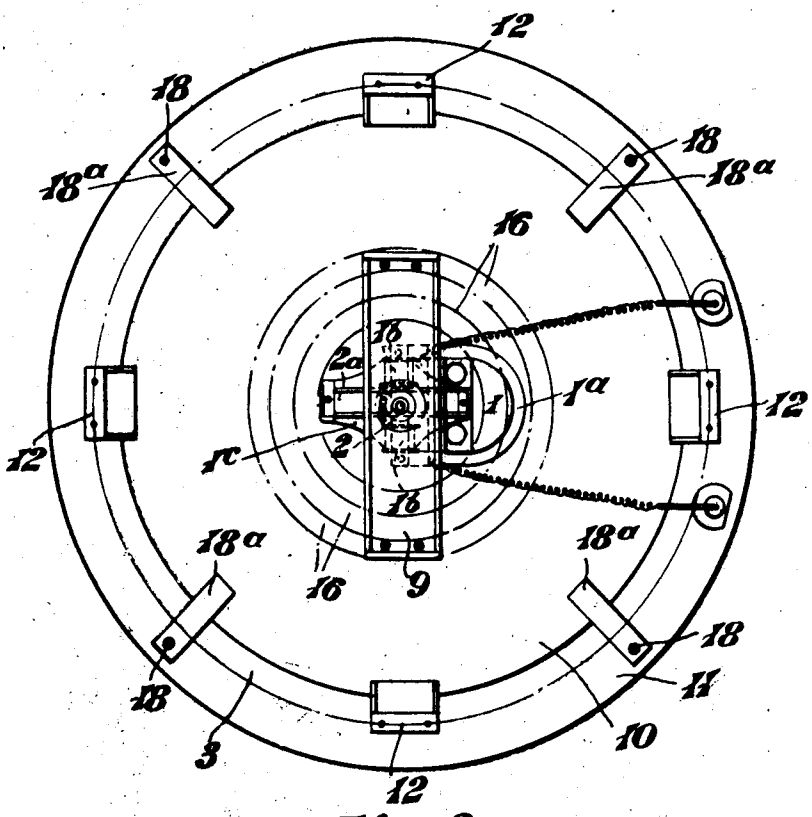

Fig. 3.

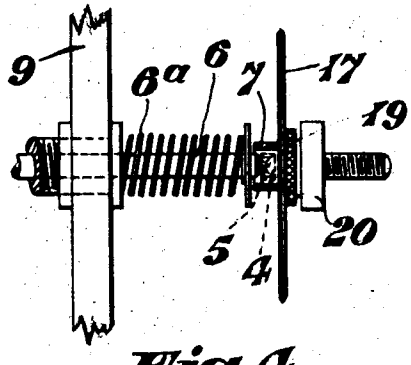

Fig. 4.

Inventor
Patrick S. O'Donnell
By
B. Singer, Atty.

Patented Oct. 1, 1929

1,730,286

UNITED STATES PATENT OFFICE

PATRICK SHAUGHNESSY O'DONNELL, OF LONDON, ENGLAND

SOUND-PRODUCING APPARATUS

Application filed March 19, 1926, Serial No. 96,010, and in Great Britain September 30, 1925.

This invention relates to, and has for its object the provision of improvements in, sound reproducing apparatus.

The invention consists broadly in the arrangement according to which vibrations are transmitted from a primary vibrator to a secondary vibrator through the medium of a simple or free contact between two hard substances such as diamond.

One embodiment of the invention is illustrated in the accompanying drawings and the same will now be described, it being understood that the particular construction and arrangement illustrated are susceptible of various modifications without departing from the scope of the invention as defined in the appended claims.

In these drawings:—

Figure 1 is a side elevation of a loud speaker (particularly for use in connection with wireless apparatus) in accordance with the invention, the casing thereof and certain other parts being shown in section.

Figure 2 is an end elevation of the same looking from the left of Figure 1.

Figure 3 is a similar end elevation of all those parts to the right of line X—X of Figure 1, certain of the parts being shown in chain dotted lines.

Figure 4 is a side elevation of a detail.

Referring to the drawings the loud speaker therein illustrated comprises an electromagnet 1 the armature 2 of which is adapted to vibrate in accordance with the vibrations of the sound to be reproduced. The vibrations of this electromagnet are adapted to be transmitted to a diaphragm 3 of conical shell formation through the medium of a transmission device which comprises two diamonds 4 and 5 which are in simple contact with one another and which are in rigid relationship respectively with said armature 2 and said diaphragm 3.

Thus the diaphragm 3 is rigidly and coaxially mounted to a rod 6 extending outwardly from its apex, and this rod carries at its remote extremity the diamond 5. The armature 2 carries a cup 7 which contains the other diamond 4. The rod 6 is reciprocably mounted in a sleeve 8 carried by a bracket 9 so that the axis of said rod passes through the diamond 4 and the middle of the armature 2. A spring 6^a is provided for biasing said rod with respect to said sleeve in such a way that the diamond 5 is pressed down upon the diamond 4.

The vibrations of the armature 2 are adapted to take place in a sense at right angles to the rod 6 and thus the diamonds 4 and 5 tend to rub one another in a sense at right angles to the direction of the pressure between them. In practice the irregularity of form of the two diamonds results in an engagement between them such that the rod 6 together with the diaphragm 3 is vibrated transversely of its axis. Sound waves are therefore emitted from said diaphragm.

The bracket 9 and the electromagnet 1 are both supported from a common base 10 which consists of a glass disc and is supported in spaced relation from the back 11 of the loud speaker casing by means of four supporting feet 12 spaced around its circumferential periphery. The electromagnet is mounted to this case in the neighborhood of its centre and the bracket 9 is made in the form of a bridge which straddles said electromagnet with its columns mounted to said base and its bridging member carrying the aforesaid sleeve 8.

The loud speaker casing is of cylindrical formation the back 11 thereof thus being disc shape. The front thereof is open and has mounted therewithin at spaced intervals around the circumferential wall of said casing a number of tuned gongs 13 each of which represents a definite musical note. These gongs are of the spiral type and are located as shown in radial planes with respect to the cylindrical casing and with their mounting points nearest the open end of the casing. They are mounted to an annular base 14 extending around the inner periphery of the casing as shown. The gongs are partly isolated from one another by means of baffle plates 15 also arranged in radial planes. These baffle plates come between the outer halves only of each pair of the gongs (i. e. the halves nearest the open end of the casing) and are formed so that they become narrower as

they approach the centre of the casing near to which they terminate. They also are mounted to said base 15 and at their inner ends carry an annulus 15^a.

Rigidly and coaxially mounted upon an extension of the sleeve 8 and between the diaphragm 3 and the bracket 9 are a number of, say four, auxiliary diaphragms 16. These auxiliary diaphragms are of progressively varying diameters and are arranged in spaced relation to one another with the largest nearest the diaphragm 3 and the smallest nearest the bracket 9.

Between the cup 7 and the armature 2 and in rigid relation with both is a glass disc 17.

Extending between the disc shape base 10 and the annular base 14 are four wooden rods 18. These rods are mounted to said base 10 by means of blocks 18^a cemented to, and overhanging the circumferential periphery of, said base, and are bolted to the base 14 as shown.

In operation the vibrations are transmitted as described by means of the diamond contact transmission device from the armature 2 to the diaphragm 3. Sound waves are thus emitted from said diaphragm and pass out through the open end of the casing past the gongs 13. The purity of the sound thus produced is enhanced on account of the said transmission device and also as a result of the gongs 13. The transmission through the contacting diamonds probably has the effect of making the vibrations of the diaphragm 3 more nearly simple harmonic vibrations than are the vibrations of the armature 2 but this is not certain. The gongs operate to break down echoes and false vibrations and to enhance the true notes. Each gong responds to its own proper note and tends to swamp false notes. The auxiliary diaphragms 16 and the disc 17 have the effect of further increasing the mellowness and purity of the tone produced. The scientific explanation of this is not however quite clear. The connection between the base 10 and the base 14 by means of the rods 18 has the effect of increasing the sensitiveness of the gongs. Very slight vibrations are transmitted from said base 10 to said base 14 and thus the gongs themselves are maintained in a slightly tremulous state in which they are more readily susceptible of sympathetic response to their proper notes than they are in a state of rest.

Describing now certain constructional details of the device, the electromagnet 1 consists of a core 1^a having energizable pole pieces 1^b arranged one each side of the armature 2 and adapted alternately to attract and repel the same. The armature 2 is mounted to a somewhat resilient bridging piece 2^a one end of which is rigidly mounted to the base 1^c to which the core 1^a is mounted and the other end of which is mounted to said base in such a way as to be adjustable with respect thereto in a vertical sense. Such adjustment is adapted to be effected by means of an adjusting knob 2^b underneath the glass base 10, the adjusting column passing through a hole in said base 10. The base 1^c is secured to the base 10 by means of a suitable cement.

The cup 7 is made in one unit with the disc 17 and with a suitable screw 19 by which said unit is screwed to said armature 2. A washer 20 say of ebonite is interposed between said screw 19 and the armature 2.

The diaphragm 3 and also the auxiliary diaphragms 16 are made of silk. The silk may be mounted on a light framework and coated with a very thin solution of celluloid followed by a thin coating of spirit mastic varnish, or it may be self supporting being stiffened by means of a suitably stiffening solution. In the latter case the diaphragm 3 is stamped into a pleated form. In the particular construction illustrated the former method is adopted and the frame members of the diaphragm 3 are shown in Fig. 2 at 3^b. In this figure the baffle plates 15 are shown superimposed over the radial frame members 3^b. This is purely fortuitous and should not cause confusion. The diaphragm 3 is provided with a boss 3^a by which it is screwed onto the end of the rod 6 and said diaphragm is also supported from the periphery by means of strings 3^c secured to the inner periphery of the casing. The diaphragms 16 are formed with bosses 18^a whereby they are spaced apart.

The four supporting feet 12 are provided with grooves as shown in which the edge of the base 10 fits.

These grooves are provided with rubber or like pads 12^a above and below the edge of said base.

No claim is made in this specification to a loud speaker comprising a casing having a sound wave exit, a separate sound wave producing diaphragm located within said casing and a plurality of tuned gongs rigidly mounted within said casing adjacent said sound wave exit and between said diaphragm and said wave exit, as such construction is described and claimed in my copending application for Letters Patent of the United States for sound amplifying devices for sound reproducing and recording instruments, filed March 19, 1926, Serial Number 96,008.

No claim is made in this specification to a loud speaker comprising a sound emitting diaphragm having an unclamped edge and a damping diaphragm also having an unclamped edge located behind said sound emitting diaphragm, as this is described and claimed in my copending application for Letters Patent of the United States for sound reproducing apparatus, filed March 19, 1926, Serial Number 96,009.

What I claim and desire to secure by Letters Patent is:—

1. A connection between a loud speaker

diaphragm and an actuating member therefor, comprising two hard jewels respectively connected to said diaphragm and said member and arranged in simple contact with one another whereby the vibrations of said member are adapted to be transmitted to said diaphragm.

2. A connection between a loud speaker diaphragm and an actuating member therefor, comprising a hard jewel adapted to vibrate with said member, a second hard jewel biased into contact with said former hard jewel, said diaphragm being adapted to vibrate with said second hard jewel.

3. A connection between a loud speaker diaphragm having an unclamped edge and an actuating member for said diaphragm, comprising two hard jewels respectively connected to said member and the center of said diaphragm and arranged in simple contact with one another whereby the vibrations of said member are adapted to be transmitted to said diaphragm.

4. A connection between a loud speaker diaphragm and an actuating member therefor, comprising a hard jewel rigidly secured to said member, an axial rod rigidly supporting said diaphragm, a hard jewel mounted on the extremity of said rod and means for yieldably biasing said latter jewel into engagement with said former jewel.

5. A connection according to claim 4 and comprising a glass disc from which both said member and said rod are supported.

6. A connection according to claim 4 and comprising a glass disc mounted rigidly between said member and said former jewel.

In witness whereof I affix my signature.

PATRICK SHAUGHNESSY O'DONNEL.