Jan. 13, 1931. C. H. DUFFY 1,788,385

SOUND AMPLIFIER

Filed April 8, 1929

FIG. 1.

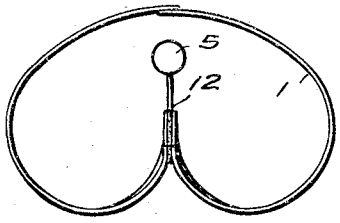


FIG. 3

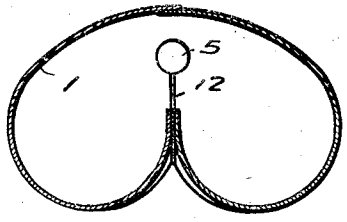


FIG. 2.

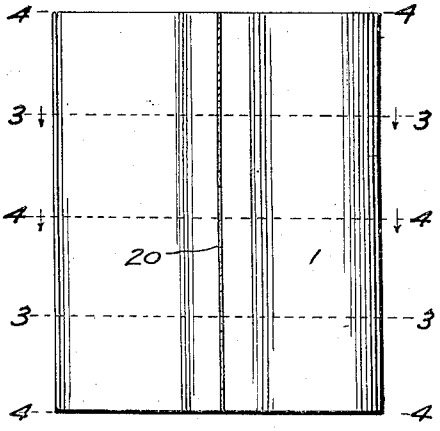


FIG. 8.

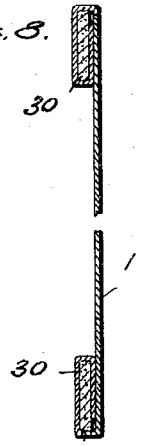


FIG. 7.

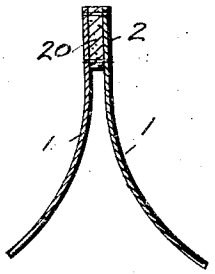


FIG. 6.

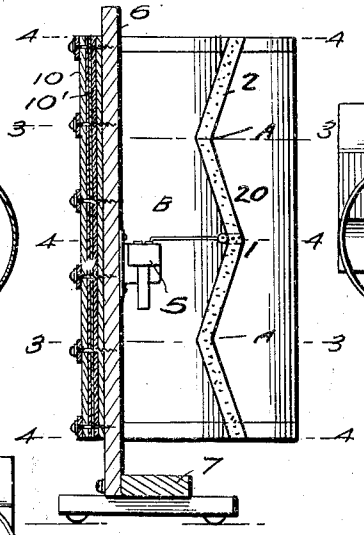


FIG. 4.

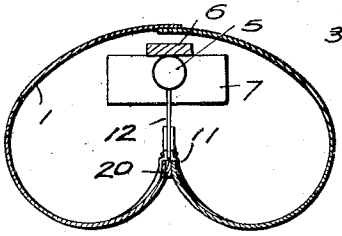


FIG. 5.

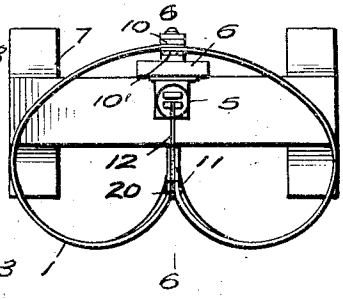
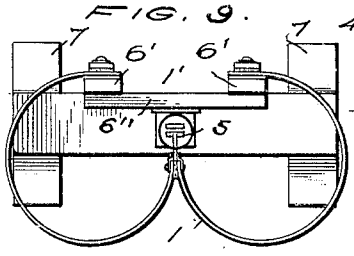


FIG. 9.



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UNITED STATES PATENT OFFICE

CHARLES HUGH DUFFY, OF MIAMI, FLORIDA

SOUND AMPLIFIER

Application filed April 8, 1929. Serial No. 353,472.

(GRANTED UNDER THE ACT OF MARCH 3, 1883, AS AMENDED APRIL 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to devices for reproducing sound, but more particularly to radio speakers and the like.

The invention consists in the construction of the diaphragm, and in the arrangement of the component parts, whereby the same is capable of producing the full range of audible sounds from the highest to the lowest without rattling, rippling or creating the disturbing parasitic vibrations which destroy the purity of the reproduction and produce distortion.

Referring to the accompanying drawings:

Figure 1 is a diagrammatic view of the modified cylindrical diaphragm and its actuating motor in top plan;

Figure 2 is a diagrammatic front elevation of the same;

Figure 3 is a horizontal sectional view through the diaphragm taken on lines 3—3 of Fig. 2;

Figure 4 is a horizontal sectional view through the diaphragm taken on lines 4—4 of Figure 2;

Figure 5 is a top plan view of a practical embodiment of the invention;

Figure 6 is a vertical longitudinal sectional view through the speaker taken on line 6—6 of Figure 5;

Figure 7 is an enlarged fragmentary horizontal sectional view through a portion of the diaphragm, and

Figure 8 is an enlarged, fragmentary, vertical sectional view through the top and bottom edge portions of the diaphragm; and

Figure 9 is a top plan view illustrating the rear of the modified cylindrical diaphragm open.

Like numerals of reference indicate the same parts throughout the several figures.

It appears that the ideal diaphragm of this modified cylindrical formation would be one in which the diaphragm has no support nor connection with any extraneous member or element other than its connection with the driving pin of the actuating motor.

A practical application of this theory whereby the acoustical results obtained very closely approach the ideal, comprises the modified cylindrical diaphragm 1 formed of two sheets of suitable material which are flexed into the shape shown in Figure 5. The front vertical lateral edges 2 of these sheets are directed inwardly of the structure and are suitably secured together as will be hereinafter described.

These vertical lateral edges 2 are first shaped preferably but not necessarily as shown in Figure 6, so that when they are secured together, as in Figure 5, and Figure 7, modified cylinder so formed is of two distinct shapes in cross section. Two of these cross sections which are taken on lines 3—3 of Figures 2 and 6, pass through the two exterior angles A of the meeting edges 2 of the two sheets forming the diaphragm, and the shape of the modified cylinder at these points is illustrated in Figure 3.

The other cross section which is taken on line 4—4 of Figures 2 and 6, passes through the interior angle B of the meeting edges 2 of the two sheets of the diaphragm, and the shape of the diaphragm at this central point is illustrated in Figure 4. This shape at this central point is preferably the same as the shape of the diaphragm at the top and bottom edges of the diaphragm at the lines 4—4 in Figures 2 and 6. The purpose and function of this construction will presently appear.

Referring to the drawings by reference numeral, the actuating motor 5 is suitably mounted on a vertical support 6 which passes through the modified cylinder, and which is suitably mounted on a supporting base 7. The diaphragm 1 has its rear meeting edges clamped between the vertical support 6 and a suitable vertical clamping strip 10, between which clamping surfaces I prefer to apply a strip of suitable soft sound damping material 10′ such as felt, rubber or the like. While the rear edges of the diaphragm may meet as shown in the drawing and thus form a closed modified cylinder, I may where conditions

warrant, leave a considerable open space 1′ between the rear edges of the diaphragm, so that the modified cylinder will not be entirely closed, as shown in Fig. 9. Where this form of diaphragm is employed, the single vertical support 6 is displaced by two vertical supports 6′, each of which has one rear edge of the diaphragm 1 clamped thereto. A horizontal cross member 6″ which connects the two vertical supports 6′ provides the mounting for the actuating motor 5, and stiffens the structure.

A suitable connecting clip 11 is employed to connect the diaphragm with the driving pin 12 of the actuating motor 5.

While the driving pin 12 of the actuating unit 5 lies tangential to the meeting edges 2 of the diaphragm 1 at the exterior angles A thereof, as will appear from the cross section illustrated in Figure 3, I prefer to connect the said driving pin 12 to the diaphragm 1 at the point or apex of the interior angle B, at which point the driving pin 12 does not lie tangentially to the meeting edges 2 of the diaphragm, as will appear from Figure 4, which shows a cross section through the diaphragm on a line with said interior angle B. By this construction, when the diaphragm is flexed into its modified cylindrical formation, it is retained in such formation at three points along the meeting edges 2 of the diaphragm. These three points are located at the interior angle B and at the juncture of the sheets of the diaphragm at their upper and lower edges. These three points resist the natural tendency of the flexed diaphragm to assume a simple cylindrical formation. Therefore, the greatest tension on the diaphragm is on the line of the interior angle B and on the lines of the upper and lower edges of the diaphragm, while areas of less tension exist on the lines of the exterior angles A. I therefore prefer to connect the driving pin at the interior angle B which is at the central area of the greatest tension on the diaphragm so that the impulses from the actuating motor are imparted to the diaphragm at this central area of greatest tension to cause the diaphragm to respond more perfectly to the impulses imparted to it through the driving pin. While this shaping of the meeting edges 2 as shown in Fig. 6, produces a very satisfactory diaphragm, the same may be otherwise shaped so that the point of connection with the driving pin may be tangential to the two curves formed by the diaphragm.

With particular reference now to Figures 7 and 8, it will be seen that between the forward meeting edges 2 of the diaphragm, I interpose a layer 20 of sound damping material such as felt or the like, and prefer to stitch or otherwise secure, the said edges and felt together so that the two sections forming the diaphragm are incapable of touching each other and thus create a rattle when the diaphragm is in a state of vibration.

When a diaphragm is made of two pieces of material which are connected together at their meeting edges, there is a tendency for the portions of the diaphragm at the meeting edges to strike against each other and produce a rattle which ruins the reproduction. This is because when in operation both sections of the diaphragm are vibrating, and when the amplitude of the vibrations are sufficient to cause the meeting edge portions to strike each other, a rattling results.

In order to overcome this disadvantage the meeting edges of the diaphragm sections are spaced apart and preferably a soft material such as a layer of felt or the like is interposed as shown in Fig. 7. This insures that the two sections of the diaphragm vibrate independently in the sense that the vibrations of one section are not imparted to the other section and no rattling results.

It is likewise to be seen from Figure 8 that at the top and bottom edges of the diaphragm, I prefer to encase a strip 30 of sound damping material such as elastic webbing, felt or the like and to stitch, or otherwise secure, the same in position as shown. An additional purpose served by this latter construction is to stiffen the edges of the diaphragm. The result is a complete damping out of any rattling at the edges of the diaphragm and a more perfect reproduction of low frequencies which usually create the harsh and unpleasing rattling in speakers of usual design and construction.

I claim:

1. A device for reproducing sound including a modified cylindrical diaphragm having two front meeting edges, means for supporting the diaphragm, means for actuating the diaphragm, connecting means between the actuating means and the two front meeting edges of the diaphragm, and a layer of suitable sound damping material disposed between the two front meeting edges of the diaphragm to prevent the meeting edge portions of the diaphragm from striking each other when the diaphragm is in a state of vibration.

2. A device for reproducing sound including a curved diaphragm having two front meeting edges, means connected to the two front meeting edges of the diaphragm for actuating the same, and means for damping the vibrations at the two front meeting edges of the diaphragm to prevent the meeting edge portions of the diaphragm from striking each other when the diaphragm is in a state of vibration.

3. A device for reproducing sound including a curved diaphragm having two front meeting edges, means connected to the two front meeting edges of the diaphragm for actuating the same, and means between the

two front meeting edges of the diaphragm for damping the vibrations at the said meeting edges to prevent the meeting edge portions of the diaphragm from striking each other when the diaphragm is in a state of vibration.

4. A device for reproducing sound including a flexed diaphragm having two front meeting edges, means connected to the two front meeting edges for actuating the diaphragm and means interposed between the two front meeting edges of the diaphragm to space the same apart to prevent the meeting edge portions of the diaphragm from striking each other when the diaphragm is in a state of vibration.

In testimony whereof I affix my signature.

CHARLES HUGH DUFFY.