April 20, 1943. C. R. LA MAR 2,317,069

TONE EQUALIZING MECHANISM

Filed Aug. 27, 1941

Fig. 1

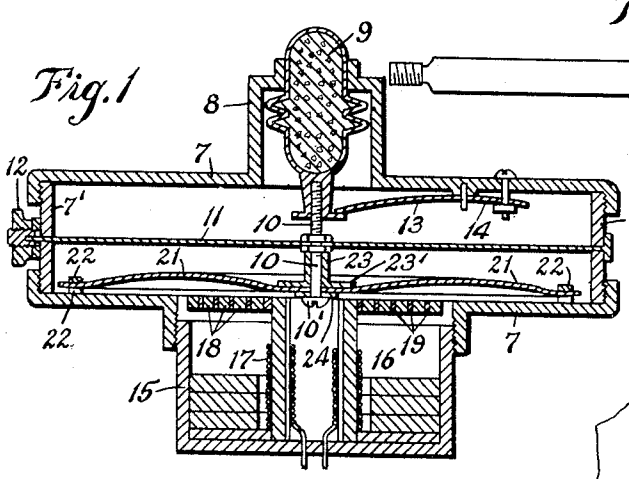


Fig. 6



Fig. 2

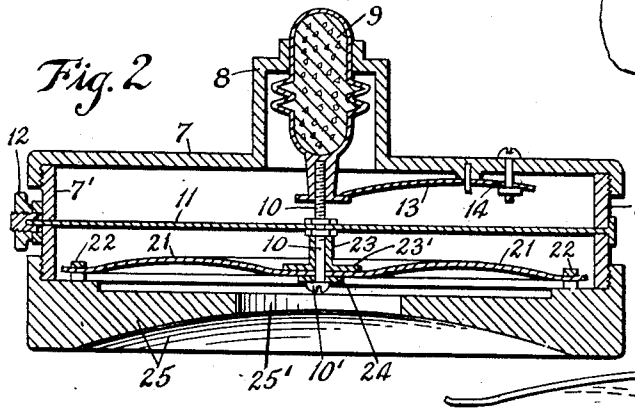


Fig. 4

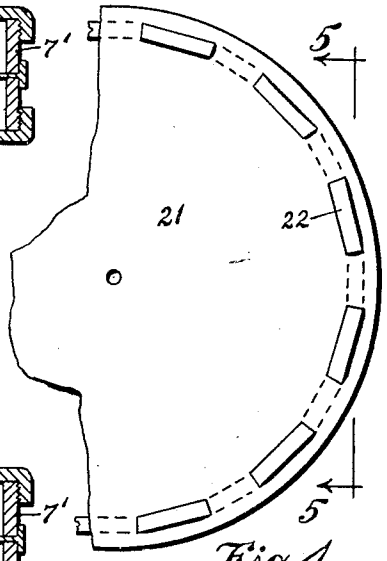


Fig. 7

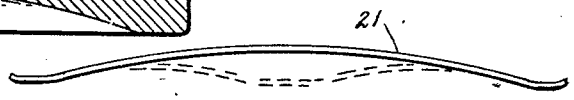


Fig. 3

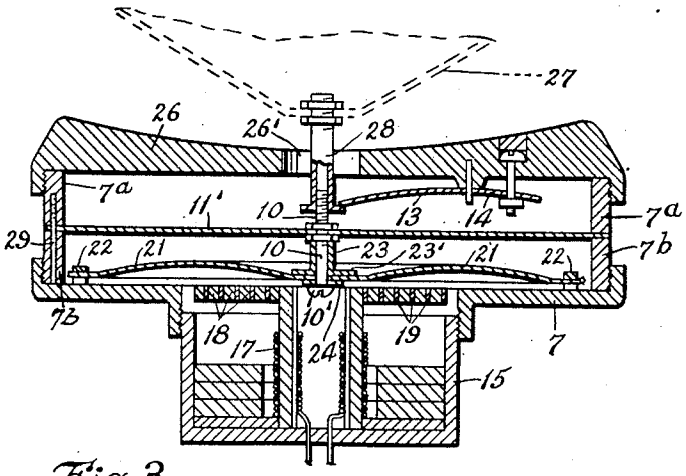
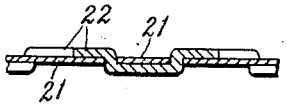


Fig. 5



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TONE EQUALIZING MECHANISM

Charles R. La Mar, Long Beach, Calif.

Application August 27, 1941, Serial No. 408,462

5 Claims. (Cl. 181—31)

My invention relates to tone equalizing mechanism, and more particularly to a mechanism which can be embodied in and applied to a microphone, an earphone, or a loud speaker, and perhaps to other sound equipment, wherever there is a vibrating diaphragm or element to be vibrated by the vibrations of the air produced by the voice, or other sounds or by electric impulses produced and conveyed to said diaphragm through magnetic or other means.

The mechanisms above referred to are standard and well known in the general art.

My invention contemplates the use of an auxiliary diaphragm or member, connected at its center to the regular diaphragm or band, at a space therefrom, and having its outer edge free or floating and adapted to move relative to the central part of said auxiliary diaphragm, whereby vibrations of the air against said auxiliary diaphragm, or the transmission of electric impulses against said auxiliary diaphragm, in addition to transmitting said vibrations or impulses to the regular diaphragm or member, if said vibrations or impulses are at all excessive, will cause said auxiliary diaphragm to move or yield at its outer floating edge, and thus serve as an absorbing medium for excessive vibrations or impulses, or as a cushioning means to prevent too high or too low sounds being reproduced by the regular diaphragm.

In other words, this invention as thus referred to will accomplish a selection of qualities of extreme high and low sounds, reducing them to a point of clarification. It constitutes means for bringing low sounds, which are ordinarily too faint for the human ear to get, to a point of clearness, and likewise, to reduce high or loud sounds to a point better within the normal range of human hearing.

It is an object of my invention to so equalize the high and low sounds or tones so that they will reach the hearer in a clear and modulated condition, and will have the same volume regardless of whether emanating close to, or from a great distance from, the instrument.

In order to better explain my invention, I have illustrated the same on the accompanying sheet of drawings, which I will now describe.

Figure 1 is a sectional view through an amplifier assembly, embodying my invention;

Figure 2 is a sectional view through a microphone assembly, embodying my invention;

Figure 3 is a sectional view through an earphone, or speaker assembly, with my invention embodied therein;

Figure 4 is a fragmentary plan view of my auxiliary diaphragm, showing one method of applying a ribbon-like pad to the outer edge thereof;

Figure 5 is a sectional view taken on the line 5—5 of Fig. 4;

Figure 6 is a plan view of a ribbon or band element to which my auxiliary diaphragm is connected at their centers, at a space apart; and

Figure 7 is an edge view of my auxiliary diaphragm, showing in solid lines how it is first formed in the making before its central portion is pressed inwardly.

Referring now in detail to the drawing, it will be understood that any suitable box or case or housing can be used and may be of standard equipment.

In the drawing, the body or housing is designated 7, in the upper part of which is an extension 8, in which is located the usual carbon button or crystal 9, connected by means of a screw bolt 10 with a ribbon or band 11, held at its opposite ends in the outer wall 7' of said housing, and provided at one end with a thumb nut 12 for regulating the tension of said ribbon or band. A leaf spring 13 is adjustably held within the chamber of the body, as at 14, with its free end resting on a part of the connection with the carbon button 9, as illustrated.

Supported in a suitable extension 15 at the opposite side of said body or housing is a magnet assembly, designated as a whole 16. This magnet assembly is provided at the upper end of the tubular core or member 17, with a plurality of concentric iron rings, 18, 18, separated by fiber rings, or other suitable material, designated 19, 19, said concentric rings being presed together and frictionally held.

The mechanisms thus far described are mostly standard and well known in the art.

My invention resides in the provision of an auxiliary diaphragm, 21, being in the form of a thin metal disc formed in convexed form, as indicated in full lines in Fig. 7, with its outer edge provided with a form of pad or cushion, here shown in the form of a ribbon 22, woven back and forth through holes made in the disc, as indicated in Figs. 4 and 5, said cushioned edge being positioned to rest freely upon the lower side or floor of the case or housing 7, as seen in Fig. 1.

The central portion of this auxiliary disc or diaphragm is connected by means of a sleeve 23, having a flange 23', with the screw bolt 10, the head 10' of which, with washer 24, serves to

clamp said auxiliary diaphragm 21 and said sleeve 23 together and to connect them with the ribbon or band 11 and with the carbon button 9, as clearly shown in said Figure 1.

The same parts are designated by the same numerals in all three figures, additional parts making the difference in the different embodiments of the invention in said three figures.

The mechanism as illustrated in Fig. 1, shows the invention embodied in an amplifier assembly, while in Fig. 2, the mechanism shows the invention embodied in a microphone assembly; and in Fig. 3, the mechanism shows the invention as embodied in an ear phone, in full lines, and as a speaker assembly in light broken lines by the connection of a conical speaker to the connecting bolt 10, as indicated.

In Fig. 2, which is the microphone assembly, in place of the magnetic assembly 16, in the extension 15, of the housing, there is connected a cap member 25, having an open center 25' through which the voice reaches the diaphragm mechanism.

In Fig. 3, which is the ear phone assembly, in full lines, in place of the carbon button mechanism, this is replaced by an earphone cap 26, with an open center 26', and if it is desired to convert the ear phone into a speaker, this is accomplished by connecting a cone member, as 27, with the diaphragm mechanism, as indicated in light broken lines, by means of a sleeve connection, as 28, screwed to the upper end of the bolt 10.

In Fig. 3, instead of using the ribbon or band form of diaphragm 11, I have shown the diaphragm 11' in the form of a disc, with its edges held between the upper and lower ring portions 7^a and 7^b of the outer wall, as shown, said ring portions being secured together by through screw bolts, 29, 29, said main diaphragm 11' being connected in its center with the auxiliary diaphragm 21 in the same manner as in Figs. 1 and 2.

The use and operation of my invention may be briefly described as follows:

In the amplifier form or embodiment of my invention, the impulses from the magnet are transmitted through the core or tubular portion 17 to the central part of the diaphragm assembly, that is: to the sleeve 23 and its flange portion 23' and the bolt 10 to the main diaphragm, in the usual manner. In case of excessive impulses, they are transmitted also through the concentric ring elements 18, 18, and to the auxiliary diaphragm 21, which is free to yield relative to its central connected portion, whereby any excessive vibrations set up by excessive impulses are absorbed or cushioned or equalized by the yielding or vibrating of the outer portion of said auxiliary diaphragm. The stronger the impulses or the vibrations the further out in the concentric iron rings 18 will said impulses be imparted to the auxiliary diaphragm 21 and further out on the same toward its free outer edge.

This function is the same, whether the impulses are impulses transmitted from a magnet, as in the amplifier assembly, shown in Fig. 1, and in the earphone or speaker embodiment of the invention shown in Fig. 3, or whether the vibrations are set up by the human voice or other sounds transmitted into the microphone assembly directly against the auxiliary diaphragm, as shown in Fig. 2. The impulses or vibrations striking the auxiliary diaphragm 21, according to their strength or speed, cause the auxiliary diaphragm in its free and floating outer edge or area to yield and thus equalize or take up the excessive vibrations or impulses while transmitting to the regular diaphragm the normal impulses or vibrations.

The auxiliary diaphragm 21 is formed of metal in a convexed form, as indicated in Fig. 7 in full lines, and then, when the pressure is placed upon the central part thereof, the central portion is depressed, as indicated in light broken lines, to a point where the tension of the body of said diaphragm is reduced to the desired strength or resistance, as may be required by the force of the magnetic impulses used. The small leaf spring 13 is intended to balance or offset the tension of said auxiliary diaphragm so that the main diaphragm 11 or 11' and the auxiliary diaphragm will be equalized or balanced, the outer area of the auxiliary diaphragm being free to yield under any excessive impulses or vibration producing force directed thereagainst.

I do not limit my invention to the details of construction and arrangement here shown for purposes of explanation, except as I may be limited by the hereto appended claims.

I claim:

1. In a sound reproducing mechanism of the character referred to, a body having a chamber therein, a diaphragm element supported across said chamber at opposite sides thereof and adapted to be vibrated in its middle area, a second diaphragm connected in its middle to the middle of said first diaphragm element at a space therefrom to vibrate therewith, said second diaphragm having its outer edge resting on a part of said body but free to move in one direction relative to its middle area under increased volume, whereby said auxiliary diaphragm functions to cushion or reduce excessive vibrations transmitted to said first diaphragm.

2. In an instrument of the character referred to, a body having a chamber therein, a diaphragm element supported around its edge across said chamber, and adapted to be vibrated in its central area, an auxiliary diaphragm connected in its central area to said first diaphragm element, at a space therefrom, said auxiliary diaphragm being of slightly convexed form with its middle connected area depressed in reverse of said convexity and having its outer circular edge resting on a part of said body but free to move relative to said central area in one direction under increased volume, said auxiliary diaphragm being positioned in said body to receive impulses or vibrations entering said chamber before they are transmitted to said first diaphragm element for reproducing purposes.

3. In a sound reproducing device including a body with a chamber therein and a diaphragm element thereacross to be vibrated in reproducing sound, a second diaphragm connected in its central portion to said first diaphragm element, at a space therefrom and having its outer edge resting on a part of said body but free to move therefrom, by increased volume, relative to its central area, whereby to yield in a cushioning function in transmitting excessive impulses or vibrations to said first diaphragm.

4. A sound reproducing instrument having a body with chamber therein, a diaphragm stretched across said chamber to vibrate in its middle portion in reproducing sound, a second diaphragm connected at its middle to the middle of said first diaphragm at a space therefrom to vibrate therewith, said second diaphragm having its outer edge free to move relative to its central area, said outer edge being provided with a pad and resting upon a part of said body within said

chamber, whereby it can be moved by excessive impulses off of said part of said body, said second diaphragm being of convex form with its central area depressed in reverse to the convexity of said diaphragm and being positioned to receive sounds and transmit them to said first diaphragm.

5. In a sound reproducing instrument, a body having a chamber therein, a diaphragm across said chamber to vibrate in its central area in reproducing sound, a second diaphragm connected in its center to said first diaphragm at a space therefrom to vibrate therewith in its central area, the outer area of said second diaphragm being free to move relative to its central area and having thereon pad means to rest freely upon a part of said body within said chamber, and an adjustable spring element having a part bearing upon a part of said first diaphragm and its connections, substantially as shown.

CHARLES R. LA MAR.