Oct. 25, 1932. A. C. KELLER 1,884,724

SOUND BOX FOR PHONIC DIAPHRAGMS

Filed June 19, 1923

Fig. 1

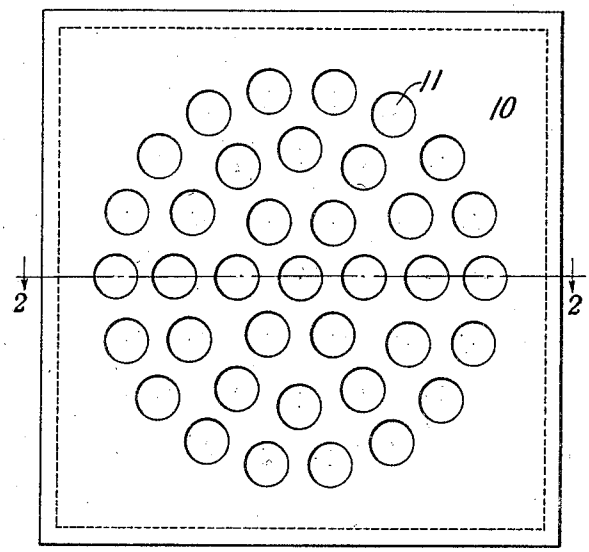


Fig. 2

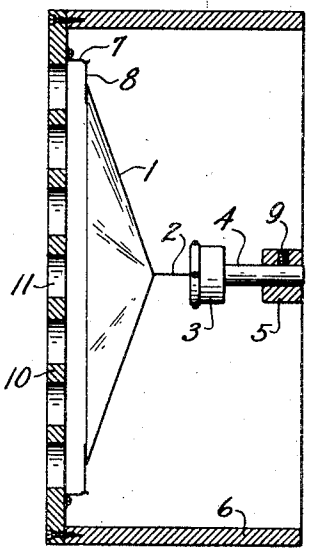


Fig. 3

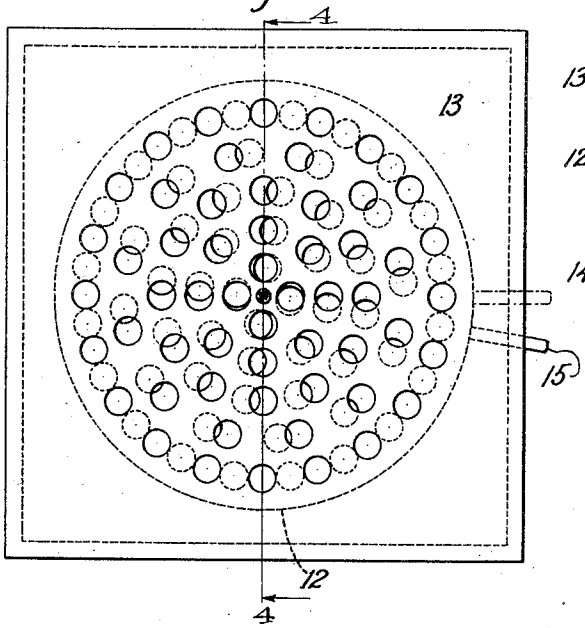
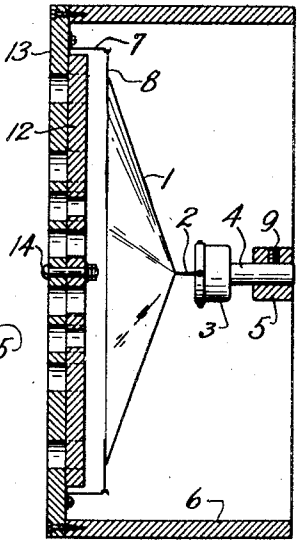


Fig. 4



Inventor:
Arthur C. Keller.
by Joel Ch. Palmer Atty.

Patented Oct. 25, 1932 1,884,724

UNITED STATES PATENT OFFICE

ARTHUR C. KELLER, OF NEW YORK, N. Y., ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

SOUND BOX FOR PHONIC DIAPHRAGMS

Application filed June 19, 1923. Serial No. 646,351.

This invention relates to a sound box for phonic diaphragms, particularly of the direct acting type, and has for an object to provide a sound box which will act in conjunction with the diaphragm to efficiently reproduce the frequencies in the low part of the voice frequency range, without disturbing high frequencies which are otherwise efficiently produced.

This is accomplished by associating with the diaphragm an apertured partition, the arrangement providing a chamber resonant to the desired frequency or frequencies.

For further details of the invention, reference may be made to the drawing, wherein Fig. 1 is a front elevation of the sound box. Fig. 2 is a sectional elevation of Fig. 1 along the line 2—2 of Fig. 1. Fig. 3 is a front elevation of a modified form having means for varying the effective size of the apertures in the partition. Fig. 4 is a sectional elevation of Fig. 3 along the line 4—4 of Fig. 3.

The sound radiator, which it is proposed to use, comprises a conical diaphragm 1, which may be of light stiff material, such as paper or cloth, which may be impregnated, if desired, with shellac or the like, or it may be of metal. This sound radiator, which in the form shown serves as a loud speaking receiver, is connected by means of the rod 2 to a suitable electric drive which may be an electromagnetic receiver of the form shown in Egerton Patent No. 1,365,898. To the casing of the receiver 3 is suitably fastened a shaft 4 which is suitably supported in a bar or the like 5 supported in the sound box 6, for instance, by extending between and being fastened to the opposite vertical walls thereof. Extending around the periphery of the cone 1 are a plurality of hangers 7, between which is interlaced or woven a cord or the like 8 in order to form a textile resilient support for the periphery of the cone. This form of support is described and claimed in Harrison Patent No. 1,613,609, issued Jan. 11, 1927. A suitable tension in the cone 1 may be had by pushing the shaft 4 inwardly and locking it in a desired position by means of the set screw 9 or the like in the support 5.

The front of the sound box comprises an apertured partition 10, which serves to support the hangers 7 and which forms with the cone 1 a chamber resonant to low voice frequencies which are thereby effectively reproduced.

In one form of the invention, which has given good results, the cone 1 was made of drawing paper nine thousandths of an inch thick with a density of .84 grams per cubic centimeter, about eighteen inches in diameter and three inches high. The number and size of the apertures 11 and the thickness of the partition 10, with relation to the size of the cone 1, were as illustrated in the drawing.

In the modification shown in Figs. 3 and 4, the effective size of the apertures may be varied by means of the partition 12 which is rotatably supported on the front partition 15 by means of the bolt 14. The handle 15 on the partition 12 permits it to be moved so that the apertures in the partition 13 and in the disc 12 register more or less as desired.

No back has been shown for the sound boxes illustrated in the drawing, since it has been found that nothing is gained from a transmission standpoint by using one. If desired, however, a back may be used.

It has been found unnecessary to position the diaphragm so that its periphery is any closer to the front or side partitions than as illustrated in the drawing. A spacing of about one inch from the front partition has proven satisfactory, although wider spacings have given equally good results.

By choosing a proper thickness of the apertured partition and a proper size of the apertures, the quality of the sound will be an improvement over and even a correction of the sound produced by the remainder of the system. By properly varying the size and number of the apertures and the proximity of the diaphragm to the partition, the load against which the diaphragm works may be varied and its operating characteristics controlled. To get the desired results, the relationship between the thickness of the partition and the effective aperture area must be suitably chosen. In the case of the loud speaker described above, it was found that a ratio of effective aperture area measured in square inches to

the thickness of the partition measured in inches equal to two, gave good results, although it is not necessary that this exact ratio be employed.

Furthermore, the ratio of the mass of the conical diaphragm to the effective mass of the air in the apertures in the partition should be within certain limits. For the loud speaker described above, good results were obtained with this ratio equal to about twelve or thirteen, although the desired effect can be obtained if this ratio is varied within rather wide limits, for instance, from three to twenty-five.

What is claimed is:

1. A large direct acting conical diaphragm, means for driving said diaphragm, said means being connected to a point on the surface thereof, means for resiliently supporting the periphery of said diaphragm, and a sound box therefor including means for altering the frequency characteristic of said diaphragm, said means comprising an apertured partition in front of one face of the diaphragm.

2. In combination, a large direct acting diaphragm, means acting in conjunction with the diaphragm to alter its frequency characteristics comprising a member positioned in close proximity to said diaphragm and containing a multiplicity of small openings whereby the area of the air column in front of the diaphragm is reduced and the air column is divided into a large number of small columns, and means connected to said diaphragm for driving it.

3. In combination, a large direct acting diaphragm, an apertured partition containing a multiplicity of openings, said partition and diaphragm being associated to form an intervening air chamber therebetween, the number, size and position of said openings being proportioned to make the diaphragm efficient in reproducing the lower frequencies within the sound range, and means connected to said diaphragm for driving it.

4. In combination, a large direct acting diaphragm, and means for loading said diaphragm, comprising a member positioned in front thereof and containing a multiplicity of small openings, the relationship between the thickness of this member measured in inches and the effective aperture area measured in square inches being approximately 1 to 2.

5. In combination, a large direct acting diaphragm, and means for loading said diaphragm comprising a partition positioned in front of the diaphragm and containing a multiplicity of small apertures, wherein the ratio of the mass of the diaphragm to the effective mass of the air in the apertures is approximately 12 to 1.

6. A large direct acting diaphragm, and a sound box therefor having an apertured partition, the diameter and length of the apertures being such that the mass of the diaphragm and the effective mass of the air columns in said apertures bear a ratio to each other of between 6 to 1 and 20 to 1.

7. A large direct acting diaphragm, a sound box therefor, comprising a partition containing therein a multiplicity of small apertures, the axes of all of said apertures being parallel to the axis of the large direct acting diaphragm, said apertures being distributed with respect to the diaphragm so as to provide a loading action on said diaphragm over substantially its entire surface, and means associated with said diaphragm for actuating it.

8. A device for producing sound without the aid of a horn, comprising a casing, a large conical diaphragm, means for resiliently connecting said diaphragm to said casing, means mounted in said casing for driving said diaphragm, an apertured partition in front of one face of said diaphragm and means associated with said partition for changing at will the size of the apertures in said partition to change the air loading on said diaphragm.

9. A loud speaker for reproducing sound without the aid of a horn comprising a dished diaphragm, a casing, means for flexibly securing said diaphragm to said casing, means mounted within said casing for driving said diaphragm, and a member having a plurality of openings secured to said casing in front of one face of said diaphragm, said openings extending over the entire face of said diaphragm to distribute the air load over the said face of said diaphragm.

10. In a loud speaker having a vibratile member, an air enclosing case supporting said vibratile member and having openings through its wall, an adjustable shutter coacting with said openings to vary the resonance of the enclosed air.

11. The combination of a large diaphragm, with a casing disposed about the edge of said diaphragm and providing a single sound chamber therefor at the rear thereof, serving to enhance the operation of said diaphragm throughout the frequency range thereof, and actuating means for said diaphragm disposed within said sound chamber.

12. The combination of a large conical diaphragm, with a casing open at opposite ends disposed about the edge of said diaphragm and providing an open sound chamber at the rear of said diaphragm serving to enhance the operation thereof throughout its frequency range.

In witness whereof, I hereunto subscribe my name this 13th day of June, A. D. 1923.

ARTHUR C. KELLER.