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C. KYLE

ACOUSTIC DEVICE

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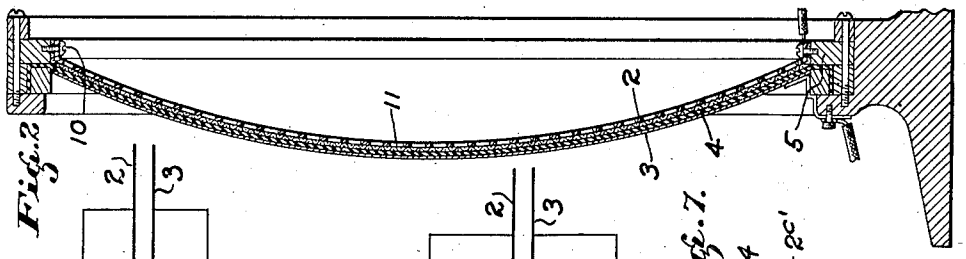


Fig. 2.

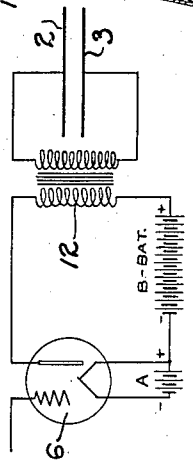


Fig. 3.

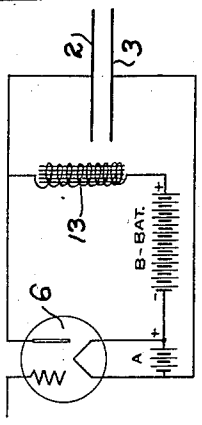


Fig. 4.

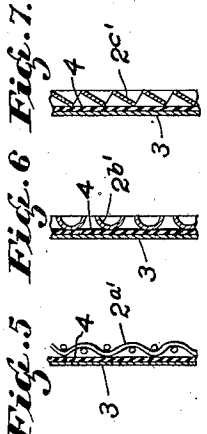


Fig. 5 Fig. 6 Fig. 7.

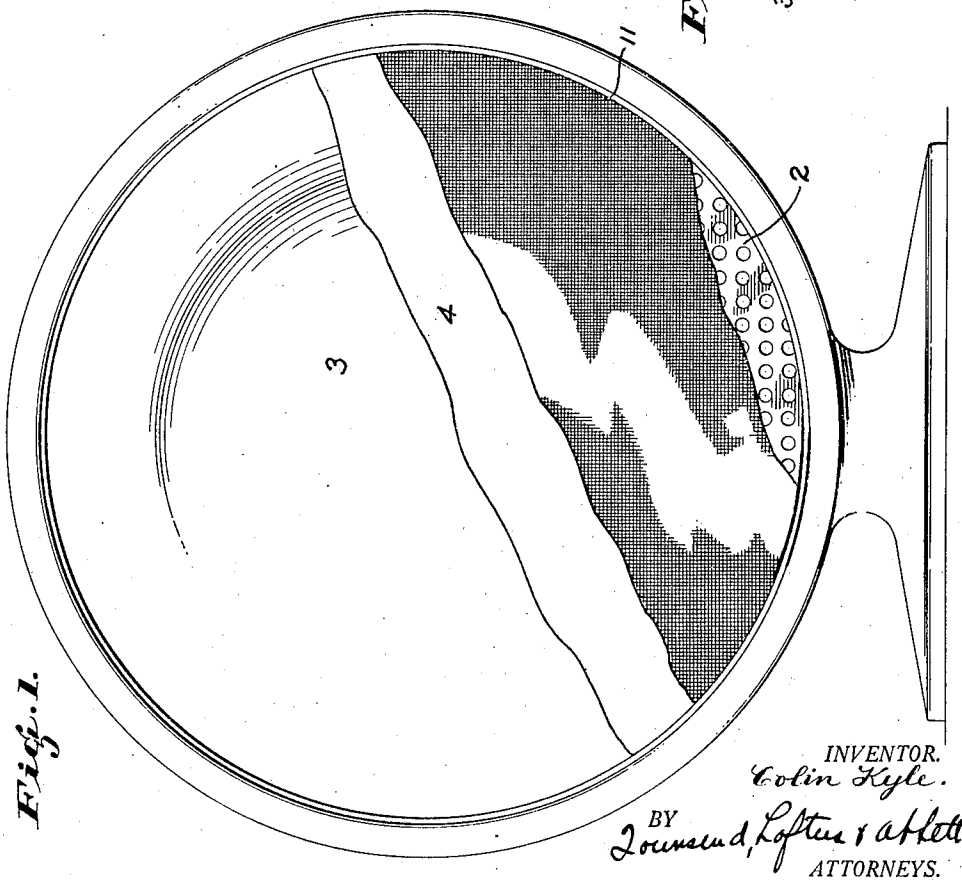


Fig. 1.

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COLIN KYLE, OF SAN JOSE, CALIFORNIA.

ACOUSTIC DEVICE.

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This invention relates to acoustic devices or sound reproducers and especially to that type known as "condenser reproducers."

The object of the present invention is to generally improve and simplify the construction and operation of sound reproducers; to provide a reproducer which is sensitive and responsive to audio frequencies ranging, for instance, from 150 to 9,000 vibrations per second or, in other words, capable of clear tone reproduction of the lowest to the highest pitched notes; to provide a sound reproducing device in which the diaphragm is constructed of a flexible dielectric material; to provide a single diaphragm of considerable area which is divided into a multiplicity of united diaphragms of small area and further to provide a sound reproducer in which a flexible dielectric diaphragm is interposed between a flexible and rigid plate and in which movement is imparted to the diaphragm by the flexible plate through alternate, positive and negative electric charges imposed on the plates.

The invention is shown by way of illustration in the accompanying drawings, in which:

Figure 1 is a front view of the sound reproducer, said view being partly broken away,

Figure 2 is a central vertical section of the sound reproducer,

Figure 3 is a wiring diagram showing one method of connecting the speaker with the output of a radio receiving set,

Figure 4 is a similar wiring diagram showing a modified form of connection,

Figures 5, 6 and 7 are enlarged partial sections of the sound reproducer, showing modified forms of plates.

The sound reproducer, briefly stated, consists of four members, to-wit: a pair of plates or conductors, such as indicated at 2 and 3, an intermediate flexible dielectric diaphragm 4 and a frame or support 5. The plate 2 is preferably rigid, while the plate 3, together with the diaphragm is flexible and form the vibrating members of the sound reproducer. The plates are connected with the last tube 6 or stage of audible frequency amplification of any suitable receiving set and as such are alternately, positively and negatively charged when the receiving set is in operation. The principle of the sound reproducer is based upon repulsions and attractions of like and unlike electric charges, that is, as soon as the plates acquire a potential they either repel or attract each other, due to the law that two bodies having a like electric charge repel while two bodies having an unlike charge attract. This action brings about a transformation of the electric impulses impressed on the plates into acoustic vibrations of the diaphragm and sound or tone reproduction is the result.

In actual practice, the rigid plate 2 is preferably constructed of metal. It may be perfectly flat, as shown in Figures 5, 6 and 7, but it is preferably slightly convex in shape, as shown in Figure 2. The plate is foraminated and it may consist of a wire screen as shown at 7, in Figure 5, or it may be perforated as indicated at 8 and 9 in Figures 2, 6 and 7. The diaphragm 4 is preferably constructed of india rubber and should be as thin as possible. It is stretched over the convex surface of the plate 2, as in Figure 2 and uniform tension and contact is thus obtained. Any other suitable dielectric flexible material may, however, be employed, for instance, paper, thin gelatine sheets, etc., are also suitable. The plate 3 is constructed of metal, but due to the fact that flexibility is required, thin leaf material such as gold leaf, aluminum leaf, etc., is employed. Other conducting materials have also been successfully used, such as powdered metal, carbon, graphite paste, etc.

In the form of the invention shown in Figures 1 and 2 the foraminated plate 2 is suitably secured to the frame, as indicated at 10. An open mesh fabric such as mosquito netting or the like, indicated at 11 is placed on top of the plate. The india rubber diaphragm indicated at 4 is next applied and finally the leaf material indicated at 3, the leaf material being preferably pasted or being otherwise secured to the diaphragm as it moves in unison therewith. The sound reproducer is connected to the radio receiving set, as shown in Figures 3 and 4. In the diagram indicated in Figure 3, a transformer 12 is interposed between the tube 6 and the plates, while in Figure 4 a choke coil, such as indicated at 13 is employed. The transformer and the choke are employed for the purpose of by-passing the D. C. current. At the present time, I am using two stages of transformer coupled audio-frequency amplification having a

U. X. 210 tube in the last stage with 525 volts on the plate thereof. This produces a volume equal to a three foot cone speaker. A very superior tone quality is obtained. The tone quality is probably due to the fact that both the diaphragm and the plates are dead as far as having any vibration period of their own is concerned. The sound comes from all parts of the diaphragm but the volume appears to be greater some distance from the speaker, than it is near by.

Mechanically, my method of construction is based on a back plate 2 which is open or perforated to permit air moved by the diaphragm to pass through. This can be accomplished by using a wire screen as shown in Fig. 5, by using herring-bone expanded metal lath, as indicated in Fig. 7, or by employing perforated metal sheets, as indicated in Figures 2 and 6. Such surfaces leave a large number of high spots above a low background, for instance, I have found that ordinary 14 mesh window screen is exceedingly efficient as it is dead. It produces perfect ventilation and the crossed wires provide high spots which divide the large diaphragm into a multiplicity of small diaphragms. Where a mosquito netting is placed over the perforated back plate, high and low spots are not necessary, as the mosquito netting itself provides the high and low spots. This inter-position of the mosquito netting is also advantageous as it eliminates any buzzing or rattling sound, particularly, if a gelatine sheet or diaphragm is employed, as a substitute for india rubber. While the potential on the plates has been referred to as 525 volts, it might be stated that the amount of B-battery current employed may be both increased or decreased. For instance, fairly successful results have been obtained with a voltage as low as 135.

In actual operation as soon as the plates acquire potential they immediately repel or attract each other under the influence of the electrostatic field and in moving they draw with them the flexible diaphragm to which the plate 3 is attached. In general it may be said that the diaphragm is limited in its movement by the perforated back plate. This, however, presents a multiplicity of high and low spots produced by the perforations, the screen surfaces employed, or by the inter-position of the mosquito netting. Due to the high and low spots, flexing of the diaphragm and the plate 3 takes place to a greater extent where the low spots occur and it might be said that the diaphragm is vibrating over its entire surface. This action brings about a transformation of the electric impulses on the plates into acoustic vibrations, making possible reproduction of the artistic qualities of music and speech without distortion as neither the plates nor the diaphragm have any vibration period of their own.

While certain features of the present invention are more or less specifically described, I wish it understood that various changes may be resorted to within the scope of the appended claims. Similarly that the materials and finishes of the several parts employed may be such as the manufacturer may decide or varying conditions or uses may demand.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. A sound reproducer comprising a perforated metallic plate, an open mesh non-metallic fabric covering one side of the plate, a dielectric flexible diaphragm engaging the open mesh fabric, and a flexible metallic member in contact with the opposite side of the dielectric diaphragm.

2. A sound reproducer comprising a convex foraminated metallic plate, a rubber diaphragm stretched over the plate and maintained in intimate contact therewith, and a covering on the opposite side of the diaphragm and cemented thereto consisting of a leaf metal.

3. A sound reproducer comprising a convex foraminated metallic plate, mosquito netting stretched over the convex surface of the plate, a rubber diaphragm stretched over the mosquito netting, and a covering on the opposite side of the rubber diaphragm consisting of leaf metal.

4. An acoustic device comprising a foraminated rigid plate, a di-electric diaphragm stretched over the plate and maintained in intimate contact therewith, and a flexible conducting material covering the opposite side of the diaphragm from its side of intimate contact with the plate.

5. A sound reproducer comprising a dielectric elastic diaphragm, a rigid perforated metallic plate with one side of which the diaphragm is maintained in intimate contact, said diaphragm carrying a thin flexible sheet of metallic material upon its face opposite the face in contact with the perforated plate.

6. A sound reproducer comprising a dielectric elastic diaphragm, a rigid perforated plate over which the elastic diaphragm is stretched and with which it is maintained in intimate contact due to the stretching thereof, a flexible metallic sheet carried upon the outer face of the diaphragm, said perforated plate dividing the diaphragm into a plurality of relatively small elastic diaphragms.

7. A sound reproducer comprising a stationary substantially rigid metallic member, said member being perforated throughout its area, a diaphragm member disposed over said rigid metallic member and in intimate but separable contact with relation thereto,

and a flexible metallic member carried upon the outer face of said diaphragm.

8. A sound reproducer comprising a foraminated metallic plate, said plate presenting a surface convex in all directions, a flexible elastic di-electric diaphragm uniformly stretched and tensioned over the convex surface of the plate and held in intimate contact therewith and a flexible metallic sheet in intimate contact with and movable with the opposite side of the di-electric diaphragm.

9. A sound reproducer comprising a foraminated metallic plate, said plate presenting a spherical surface, a flexible di-electric diaphragm uniformly stretched over the spherical surface of the plate and held in intimate contact therewith, and flexible conducting material disposed in intimate contact with the opposite side of the di-electric diaphragm.

10. A sound reproducer comprising a perforated rigid plate presenting a spherical surface, a diaphragm supported by said plate and maintained in intimate contact and tensioned therewith, said diaphragm being constructed of a material which is di-electric and sound deadening, and a flexible metallic coating maintained in intimate contact with the diaphragm on the side opposite the rigid spherical plate.

COLIN KYLE.