

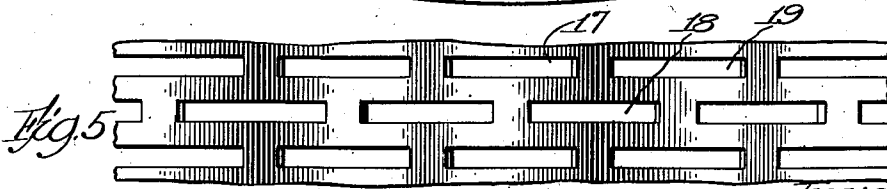
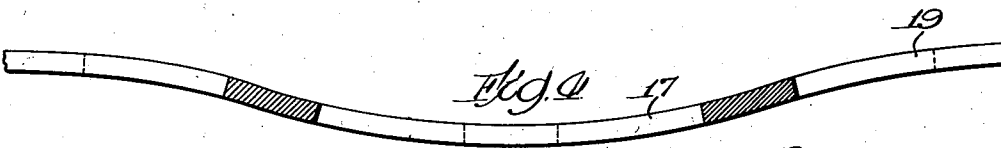
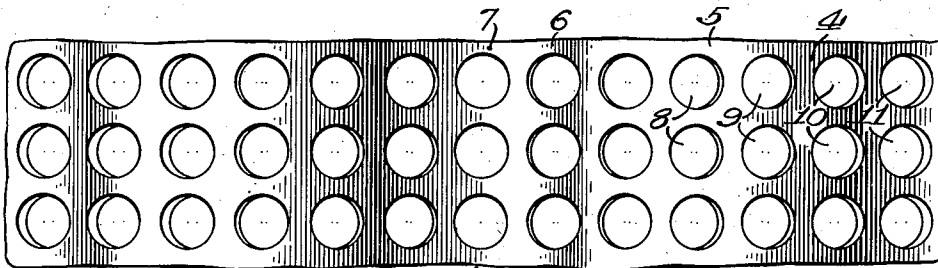
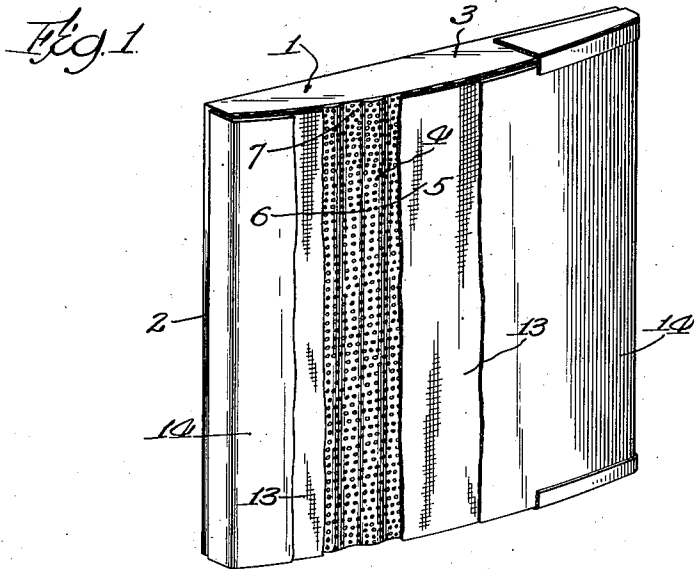
Jan. 20, 1931.

C. KYLE

1,789,554

ELECTROSTATIC SOUND REPRODUCER

Filed July 11, 1928



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UNITED STATES PATENT OFFICE

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ELECTROSTATIC SOUND REPRODUCER

Application filed July 11, 1928. Serial No. 291,885.

The present invention relates to sound producers and reproducers, such as those used in radio reception, and has reference more particularly to the type known as electro-static sound producers and reproducers. It is regarded as an improvement of that disclosed in the patent to Kyle, No. 1,644,387, granted October 4, 1927, and those disclosed in co-pending applications of Jesse B. Hawley, Ser. Nos. 259,717, and 261,495, filed March 7, and 14, 1928, respectively.

Among the objects of the invention is to provide a novel sound producer and reproducer of the electro-static type and having an electrically conducting member, such as a metal plate having an undulated form or shape with apertures or holes distributed over the plate for location in the crests, slopes, and troughs of the undulations for release of compressions, and rarefactions of air at all points or loci thereof, and having a thin flexible dielectric associated therewith to flex toward the slopes and troughs of the undulations, the outer surface or that opposite from the surface adjacent the crests, having a flexible conducting coat or the like, such as gold, silver, aluminum foil, sprayed metal or conducting substance, and the like. The plate is preferably curved to offer a generally convex surface, and the dielectric is normally made to extend against the convex side of the plate and in contact therewith on the crest lines of the undulations. The dielectric may be of any suitable material, such as sheet rubber, rubberized fabric, piano cloth, such as rubberized silk, and other like and similar dielectric materials.

When the dielectric portions between the crest lines, flex by reason of the electro-static attraction or repulsion of the proximate portions of the slopes of the undulations, there is a compression or rarefaction of air in the dihedral angle between such slope and the flexed portions of the dielectric. In the case of attraction, the greatest attraction is at the parts most proximate to each other, such as at or adjacent the line of contact. If the receding parts of the crests and the slopes be not provided with relief openings, it will become apparent that the compression

stresses travel laterally and toward the opening in the troughs, when such are provided in such troughs. The reaction of these stresses on the flexing parts of the dielectric appears to be greater against the dielectric parts that are less attracted by the electro-static charge on the plate by reason of the greater distance between these parts of the dielectric and the corresponding parts of the slopes and troughs. The invention, therefore, comprehends, as an important feature thereof, the provision of means for releasing the compressions at substantially all points or loci, the holes being in the crests, curved portions of the crests, in the slopes, the curved portions of the troughs and in the bottom portions of the troughs. The holes so located, are thus substantially at a normal to the corresponding flexing parts of the dielectric. Such relieving function removes resistance to the movement of the dielectric toward and from the attracting surface portions of the plate. The converse is also true where the dielectric is being repelled by a charge of opposite polarity, the holes likewise acting to relieve rarefaction or retarding stresses on the dielectric moving away from the surface of the plate.

As a result of this construction, the sound proceeds from the vibrating dielectric without any sense of direction, the sound appearing to be emitted from every point radially in every direction.

Other objects, advantages, capabilities and features are comprehended by the invention as will later appear, and as are inherently possessed thereby.

Referring to the drawings:

Fig. 1 is a perspective view with parts broken away of an electro-static sound producer constructed in accordance with the invention;

Fig. 2 is a fragmentary sectional view through a part of the device;

Fig. 3 is a fragmentary view in elevation of a part of the metal plate used in the device;

Fig. 4 is a fragmentary sectional view through a plate having elongated apertures; and

Fig. 5 is a fragmentary view in elevation of the plate shown in Fig. 4.

Referring now more in detail to the drawings, the embodiment selected to illustrate the invention is shown in connection with a frame 1 having side pieces 2 and top and bottom pieces 3. The forward edge portions of the top and bottom pieces are curved or convex, as clearly shown in Fig. 1.

To this curved or convex part of the top and bottom pieces, is secured a metal plate 4, having undulations as shown. The undulations have crest portions 5, slopes 6, and troughs 7. These undulations are preferably arranged parallel to the axis of curvature of the convex shape of the plate 4, and the convex edges of the top and bottom pieces of the device.

The plate is also provided with a number of apertures or holes 8, 9, 10, 11, and 12, such that the apertures 8 are located in the crest portions, while apertures 9 and 10 are in the slope portions of the undulations, and apertures 11 and 12 are in the trough portions, as clearly shown in Fig. 2 of the drawings. It will be noted that the plate is of general convex form, and against the outer surface of the same is stretched a suitable thin flexible dielectric 13 with the dielectric normally in contact with the crest portions of the undulations and with the ends of the dielectric suitably secured to the side pieces 2 of the frame. On the outer or convex surface of the dielectric is provided a flexible conducting coat of material, such as gold-leaf, silver-leaf, aluminum-leaf or foil, or sprayed metal and other conducting substance, and other like and similar thin, flexible conducting material.

The plate 4 and the conducting surface 14 are, in practice, connected to the opposite sides of the output circuit of an audio amplifying device or the like, whereby the charges in the plate 4 and foil 14 may vary in accordance with the audio variations in the electric circuit. When the charge in the plate 4 is an attracting charge, the dielectric and flexible conductor, is caused to move toward the plate with portions opposite the slopes and troughs flexed, as shown in the dotted line position thereof in Fig. 2. The depth of the trough is preferably at least as great as and preferably greater than the greatest amplitude of movement of the lowest audible tone to be reproduced. As the dielectric flexes, the portion 15 thereof near the curvature of the crest, or the start of the slope of the undulations, will be attracted through the small narrow angle 16 with greater force than at more remote loci. This attraction will progress along the slope as the dielectric is flexed toward the plate. It will thus be noted that with the apertures being located at the various points indicated, any compression of air tending to be effected in the dihedral angle between the flexed portion of the dielectric

and the sloping and curved portions of the plate, will be immediately released, and the dielectric be free to act under the attracting forces of the charges between the plate and the dielectric or the conducting coat thereon. Likewise, when the charges are of the repelling type, the flexing of the diaphragm is in the opposite direction or away from the surface of the plate, and rarefaction is released through the same apertures or openings, to allow free movement of the dielectric and flexible coating thereon.

In Figs. 4 and 5 is shown a plate similar to that shown in Figs. 2 and 3, with the exception that the apertures therein are elongated. One set of apertures 17 is located in the crests and extend into the sloping parts thereof or in the slopes of the undulations. Another set of apertures 18 is located in the slopes with portions extending toward the crest or into the curved portions thereof and into the curved portions of the troughs. A third set of apertures 19 is located in the troughs with the ends extending into the slopes. The action of these apertures is similar to that described above in connection with the form of plates shown in Figs. 1, 2 and 3.

While I have herein described and upon the drawings shown a few embodiments of the invention, it is to be understood that the latter is not limited thereto, but may comprehend other constructions, arrangements of parts, details, and features, without departing from the spirit thereof.

Having thus disclosed the invention, I claim:

1. An electro-static sound reproducer comprising an electrically conducting member having a continuously undulating surface, said member having apertures in the slopes and troughs of the undulations, a flexible dielectric extending normally over the crests of the undulations, and a flexible conducting coating on the opposite surface of the dielectric.

2. An electro-static sound reproducer comprising an electrically conducting member having a continuously undulating surface, said member having apertures distributed over the member, a flexible dielectric extending normally over the crests of the undulations, and a flexible conducting coating on the opposite surface of the dielectric, said apertures being so located as to relieve pressure and rarefaction substantially normally to the flexed portions of the dielectric.

3. An electro-static sound reproducer, comprising a frame having a convex side, a continuously undulated metal plate secured to said side and being generally convex, a flexible dielectric extending over the convex side of said plate and over the crests of the undulations thereof, said plate having apertures distributed over parts thereof, and a flexible

conducting coating on the outside surface of said dielectric.

4. An electro-static sound reproducer, comprising a frame having a convex side, a continuously undulated metal plate secured to said side and being generally convex, the undulations of said plate being parallel to the axis of curvature of said plate, a flexible dielectric extending over the convex side of said plate and over the crests of the undulations thereof, said plate having apertures distributed over parts thereof, and a flexible conducting coating on the outside surface of said dielectric.

5. An electro-static sound reproducer comprising an electrically conducting member provided with a continuously undulated surface, said member having apertures distributed over the slopes and troughs of the undulations thereof, a thin dielectric extending over the crests of the undulations, the portions of the dielectric opposite the slopes and troughs being adapted to flex toward said slopes and troughs, said apertures being capable of relieving compression and rarefaction of air substantially at a normal to the flexed parts of the dielectric, and a flexible conducting coat on the outer surface of the dielectric.

6. An electro-static sound reproducer comprising an electrically conducting member having a continuously undulating surface, said member having apertures in the troughs of the undulations, a flexible dielectric extending normally over the crests of the undulations, and a flexible conducting coating on the opposite surface of the dielectric.

In witness whereof, I hereunto subscribe my name to this specification.

COLIN KYLE.