March 29, 1932. W. D. CROZIER 1,851,240

ELECTROSTATIC SOUND PRODUCER

Filed Nov. 2, 1928

Fig. 1.

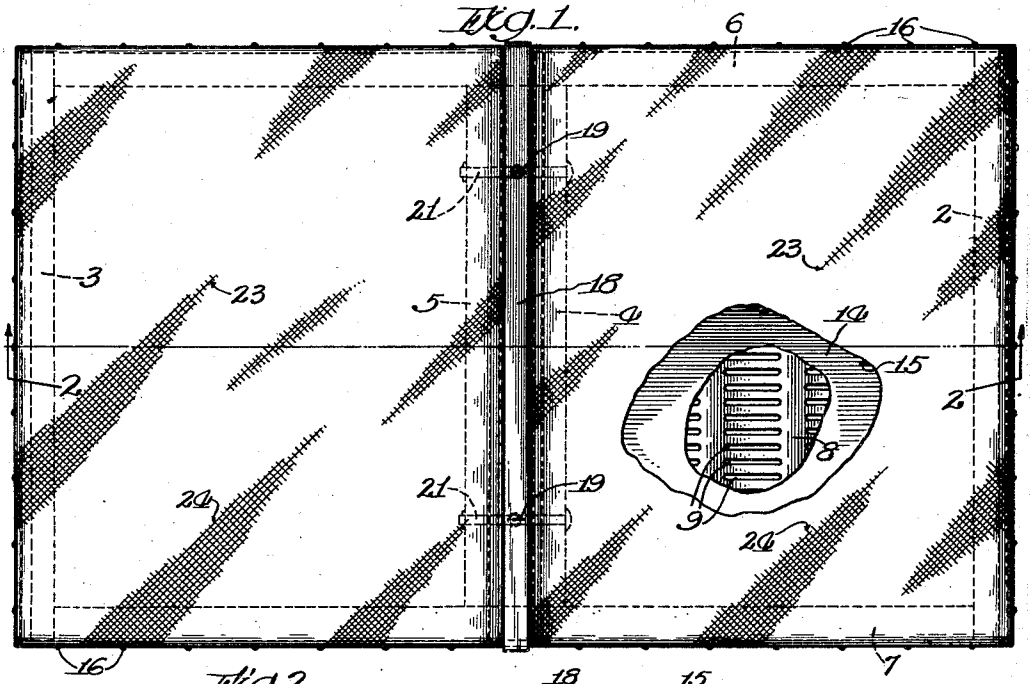


Fig. 2.

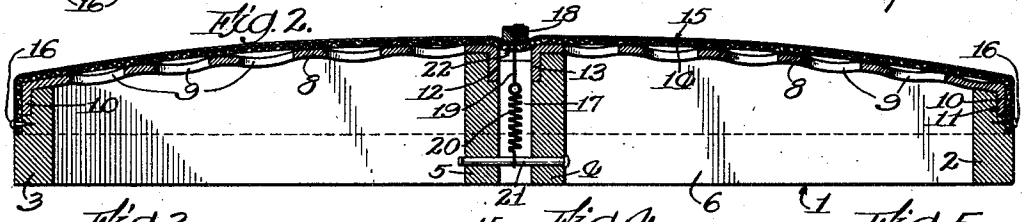


Fig. 3.

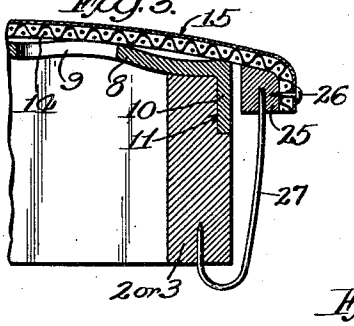


Fig. 4.

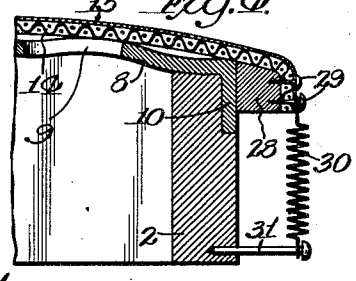


Fig. 5.

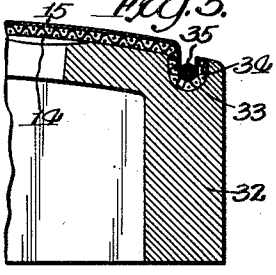
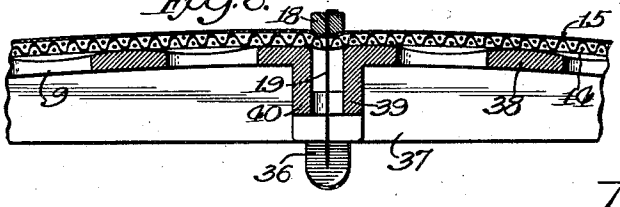


Fig. 6.



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By: Wallace R. Lane. Atty.

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UNITED STATES PATENT OFFICE

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ELECTROSTATIC SOUND PRODUCER

Application filed November 2, 1928. Serial No. 316,766.

The present invention relates to electrostatic sound producers, such as are used in radio reception, although capable of use as a recorder as well as a reproducer.

Among the objects of the invention is to provide a novel sound producer having a dielectric under proper tension to produce the best sound results and to avoid foreign sounds. In the case of using a dielectric sheet of fabric type, if the threads be in the direction of tension, wrinkles will form in the cross threads, and there is no tension in the direction of these wrinkled cross threads. With such a condition and when the dielectric vibrates under the electrostatic stresses, foreign sound and noises are produced. To avoid this, the fabric is disposed with the threads on a bias or diagonally to the direction of stress. This also aids in permitting the fabric to better flex under the impressed electrostatic stresses. Also changes in temperature will not distort the fabric so that unwanted sounds are avoided.

The invention also comprehends novel tensioning means which act automatically to maintain the dielectric always under the proper tension irrespective of the amplitude of vibration of the dielectric. By such novel means and with the biasing of the dielectric elements, it is facile to stretch the dielectric sheet over the conducting surface of the conductor, and the stretching will be even.

When using a rubberized fabric, such as rubberized silk, this invention allows a free stretching of the rubber constituent whereby better elasticity is obtained for the dips in the troughs of the conducting plate under the electrostatic forces, when the plate is made with corrugations, or troughs or depressions.

The invention also comprehends a novel form of securing means for the dielectric.

Other objects, capabilities, advantages 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 face view of an electrostatic sound producer constructed in accordance with the invention, with a part broken away to show the construction of the device;

Fig. 2 is a transverse sectional view taken in a plane represented by line 2—2 in Fig. 1 of the drawings;

Fig. 3 is a fragmentary sectional view showing a form of tensioning means;

Fig. 4 is a similar view showing an alternate form of tensioning means;

Fig. 5 is a similar view showing a novel form of securing means; and

Fig. 6 is a fragmentary sectional view showing a further alternate form of tensioning means.

Referring now more in detail to the drawings, the embodiments selected to illustrate the invention is shown in connection with a frame 1 which may be made of suitable insulating material, such as wood, fibre, bakelite, or the like, such frame having end pieces 2 and 3 and cross pieces 4 and 5 connected at their ends to the side pieces 6 and 7 shown in dotted lines in Fig. 1 of the drawings.

The top of the frame is curved or convexed and supports a curved or convexed metal plate 8, which is preferably provided with corrugations or undulations and a plurality of openings or slots 9. The edge portions of the plate may have flanges 10 fitting into rabbets 11 formed in the end and side pieces of the frame. Likewise, the plate may also have flanges 12 and 13 extending into and fitting in rabbets formed in the cross pieces 4 and 5, as clearly shown in Fig. 2 of the drawings.

Upon the plate 8 is stretched a dielectric sheet 14 which in the particular embodiment selected to illustrate the invention, is silk or rubberized silk. Upon the outer surface of the sheet 14 is provided a metallic coating, film or surface 15, such as gold leaf, tin foil, or metallized surface medium for the fabric. This dielectric 14 and the coating 15 thereon has its edge portion extending over the flanges of the plate and into rabbets formed in the frame 1 and secured thereto in any suitable manner, such as by tacks or the like 16 as clearly shown in the drawings.

Across an intermediate portion, and opposite the channel or passage 17 provided between the cross pieces 4 and 5, is located a tensioning bar 18 of any suitable material,

whether conducting or non-conducting. When of conducting material, it may serve as a lead element contacting with the conducting coating on the dielectric. This tensioning bar is connected by a wire 19 extending into the space 17 and secured to the end of a spring 20, which has its other end connected to a cross pin 21 secured and passing through the cross members 4 and 5, as clearly shown in Fig. 2 of the drawings. The spring 20 imposes a tension on the bar 18, which in turn imposes a tension upon the dielectric 14 and coating 15 so as to depress a part 22 of the dielectric fabric into the upper part of the channel 17, as clearly shown in Fig. 2 of the drawings.

When the dielectric is of fabric type, which is preferable, the fabric is disposed so that it will have its threads 23 and 24 on a bias or diagonally of the line of pull or tension of the tension member 18. Fig. 1 shows the diagonal disposition of the threads with reference to the bar 18. When assembling the device, the dielectric sheet may be stretched over the plate 18 and the edges secured by the securing elements 16 on three sides of each end portion of the frame. The tension means 18 will act upon the fourth side of each half of the sheet, and by reason of the biasing of the threads in the fabric, the tension will be evenly distributed and the fabric will not wrinkle, as well as having the fabric under the desired tension determined upon the strength of the spring 20 used. In operation, the electrostatic forces act upon the dielectric to make the same vibrate by attracting and repelling the same with reference to the rigid plate 8. When the dielectric is attracted, it flexes into the corrugations or depressions and when it is repelled, it is caused to move in the opposite direction. The apertures or slots 9 provide for ready release of the pressure or rarefaction of the air between the dielectric and the plate 8.

Referring to Fig. 3, instead of attaching the fabric to the end pieces of the frame, the edge portions of the fabric are attached to a tension member 25 by any suitable securing element 26. The tension member 25 is carried upon the ends of resilient members 27, such as spring wire, or the like. The other end of the element 27 being secured in a suitable manner to the cross member 2 or 3 as the case may be. The spring 27 will impose a constant lateral pull against the tension member 25 and maintain the dielectric under tension in the same manner as the member 18 (in Fig. 2) will maintain the fabric under tension at the middle of the device rather than at the end.

Fig. 4 is somewhat similar to Fig. 3, and has a tension member 28 to which the edge portion of the fabric is secured by suitable elements 29. From one of the securing elements 29 is connected a spring 30 which has an end connected to a pin 31 secured to the cross member 2. The spring 30 constantly urges the tension member 28 downwardly, and inasmuch as the fabric is extended around a curved portion of the member 28 there is a constant pull or tension on the fabric to maintain the same in proper stretched and tensioned condition.

In Fig. 5, instead of using a frame, the metal plate has a flange portion 32 in which is provided a channel or groove 33 into which a portion 34 of the marginal or edge portion of the fabric may extend. A securing element 35 in the form of a bar, rod or wire, is pressed into the channel 33 with the interposed curved portion 34 of the fabric, so as to hold and maintain the fabric in place. Any form of tensioning means, such as that shown in Figs. 1, 2 and 6 may be used to tension the fabric extending over the surface of the plate. The securing element may be, if desired, of insulating material, such as wood, fibre, bakelite or other suitable material.

In Fig. 6 is shown a tension means comprising a member 18 with which is connected a wire 19 having its end connected to a leaf spring 36 extending from and secured to a side flange 37 of the plate 38. In this case, the plate 38 and the flanges are integral and no frame is used as in the case of the forms shown in Figs. 1 and 2. The leaf spring 36 constantly urges a pull on the wire 19 and also on the tension member 18 so as to depress a part of the fabric into the space between the flange portion 39 and 40 of the plate 38, and hence maintain a constant and even tension on the fabric covering the plate 38.

While I have herein described and upon the drawings shown illustrative embodiments of the invention, it is to be understood that the invention 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 electrostatic sound producer comprising a rigid member having a conducting surface, a dielectric sheet stretched over said surface, said member having a channel, said dielectric sheet extending into said channel, and securing means in said channel for holding the sheet in place, a surface of said dielectric having conducting material.

2. An electrostatic sound producer comprising a rigid member having a conducting surface, a dielectric sheet stretched over said surface, said member having a channel, said dielectric sheet extending into said channel, and a rod-like securing element in said channel for holding the sheet in place, a surface of said dielectric having conducting material.

3. An electrostatic sound producer com-

prising a rigid member having a conducting surface, a dielectric sheet stretched over said surface, said member having a channel, said dielectric sheet extending into said channel, a rod-like securing element in said channel for holding the sheet in place, and tension means for holding the sheet in stretched condition, a surface of said dielectric having conducting material.

4. An electrostatic sound producer comprising a rigid member having a conducting surface, a dielectric sheet stretched over said surface, said member having a channel, said dielectric sheet extending into said channel, and securing means in said channel for holding the sheet in place, and tension means for holding the sheet in stretched condition, a surface of said dielectric having conducting material.

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

WILLIAM D. CROZIER.