P. DODGE.

METHOD OF MOUNTING DIAPHRAGMS IN SOUND BOXES.

APPLICATION FILED MAY 18, 1915.

1,215,500. Patented Feb. 13, 1917.

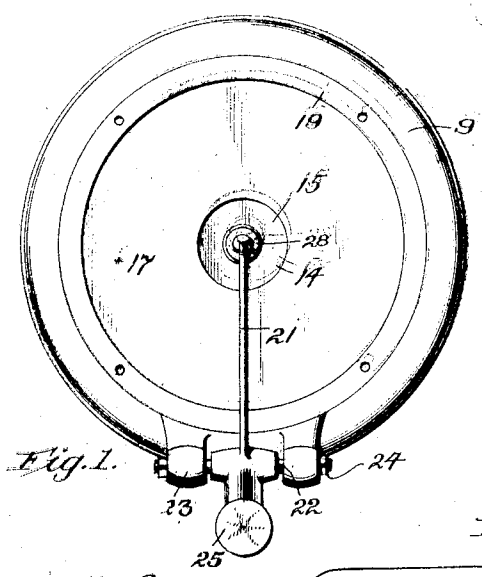



Fig. 1.

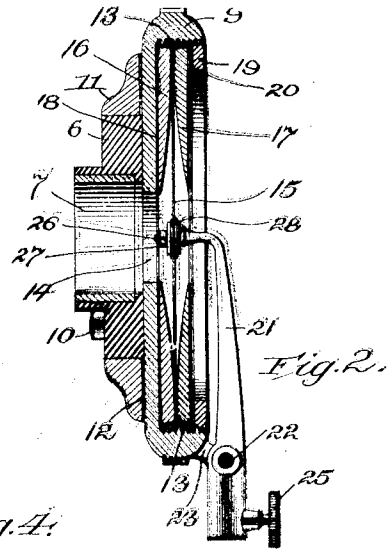
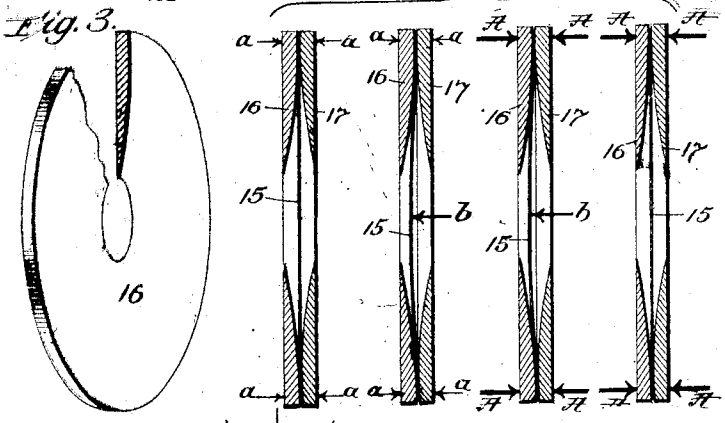



Fig. 2.

Fig. 4.

Fig. 3.



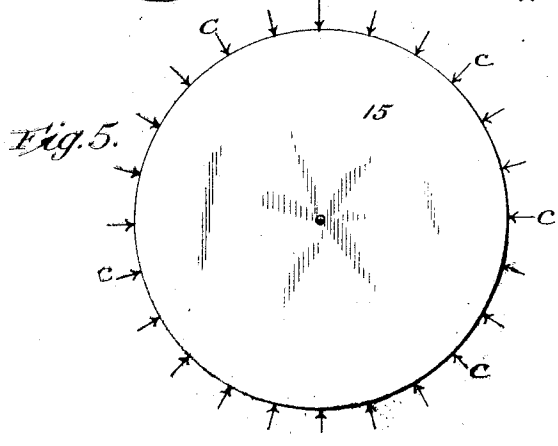




Fig. 5.

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# UNITED STATES PATENT OFFICE.

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## METHOD OF MOUNTING DIAPHRAGMS IN SOUND-BOXES.

1,215,500. Specification of Letters Patent. Patented Feb. 13, 1917.

Application filed May 18, 1915. Serial No. 28,910.

*To all whom it may concern:*

Be it known that I, PARKER DODGE, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Methods of Mounting Diaphragms in Sound-Boxes, of which the following is a specification.

This invention relates to sound boxes for gramophones, graphophones and the like, and particularly to a method of mounting the diaphragm under a uniformly distributed radial compressive stress, to render the diaphragm relatively inert, to increase its freedom of vibration and to secure other incidental advantages.

I shall describe the method as applied to a sound box in which it secures peculiarly pronounced beneficial results, that being the sound box having conoidally recessed diaphragm-clamping means described and claimed in my prior application for patent, Serial Number 12,578, filed March 6, 1915. In another copending application, Serial Number 28,911 filed May 18, 1915, I describe and claim a sound box having a diaphragm held under a radial compressive stress. The present application is accordingly restricted to the preferred method of placing and maintaining a diaphragm under such stress.

In the accompanying drawing—

Figure 1 is a front elevation of a sound box in assembling which my present method may be practised;

Fig. 2 is an axial section thereof;

Fig. 3 is a perspective view of a clamping ring used in such sound box;

Fig. 4 consists of four cross sectional diagrams illustrating four successive steps in the method of mounting the diaphragm, only the diaphragm and clamping rings being shown; and

Fig. 5 is a face view of a diaphragm with the stresses to which it is finally subjected diagrammatically indicated.

In the drawings 6 represents the usual rubber connector sleeve for connecting the sound box or reproducer to the goose neck or tone arm of the machine on which it is to be used. The sleeve has the usual brass lining tube 7 which fits over the end of the goose neck, and is provided with the usual bayonet lock pin (not shown). The cup-shaped body 9 of the sound box, which is of metal, is held to the connector sleeve 6 by means of screws 10 and by means of a metal weight ring 11 which closely embraces the sleeve 6 and is sealed to the rear face of the box-body 9 with a thin layer of bees-wax or similar plastic adhesive 12. The purpose of this weight is to damp any vibrations which might be set up in the box-body 9.

The box-body 9 is internally threaded as indicated at 13 and is provided with an aperture 14 leading through connector sleeve 6 to the goose neck or tone arm.

The diaphragm 15 which preferably is of mica is clamped between two rings 16 and 17 of substantially identical form, each having a central aperture which I prefer to make of substantially the size of aperture 14. The face of each of the rings 16 and 17 toward the diaphragm is a surface of revolution. The generating curve is tangent or approximately tangent to the contacting face of the diaphragm at or near its periphery and curves gradually away from such face toward the center of the diaphragm. The clearance between the opposed faces of the rings 16 and 17 need be only slight greater than the maximum amplitude of vibration of the diaphragm and is somewhat exaggerated in the drawing. The rings 16 and 17 may be of any relatively rigid material. The best results have been secured with celluloid but successful use has been made of metals, for example aluminum and brass. The brilliancy of tone seems to increase with the hardness of the material used for the rings.

The rear ring 16 is sealed to the rear wall of the box body 9 by a thin layer 18 of bees-wax or similar adhesive plastic and the front ring 17 is pressed toward it by a nut ring 19. Paper gaskets 20 may be interposed between front ring 17 and nut ring 19, partly to equalize the pressure by their resiliency and partly to permit nut ring 19 to turn more freely on ring 17 in assembling the sound-box.

The vibrator or stylus arm 21 is mounted on cone pivot screws 22 which are threaded in lugs 23 and locked with check nuts 24. It has the usual needle socket in which needles may be clamped by the set screw 25. The stylus arm 21 is connected to the center of the diaphragm 15 by means of a threaded stud 26 and nut 27, the usual washers 28 being used to distribute the pressure.

The sound box so far described is that claimed in my application Serial No. 12,578. I have discovered that the tone quality secured with such a sound box, and to a certain extent with any sound box having a rigid diaphragm-mount, is improved by mounting the diaphragm under a radially acting compressive stress.

To secure this result I may proceed as follows: I first loosely assemble the diaphragm 15, rings 16 and 17, nut ring 19 and washers 20 in the box body 9. This condition is represented in the first diagram of Fig. 4 where the small force arrows *a* represent a light clamping pressure on rings 16 and 17 merely sufficient to hold the parts together.

The second step is to deflect the diaphragm 15 at the center by a pressure exerted manually or by means of a clamp. This contracts slightly the periphery of the diaphragm 15. This condition is illustrated in the second diagram of Fig. 4 where the arrow *b* represents the deflecting stress.

The third step is to set down the nut ring 19 tight while holding the diaphragm 15 deflected. This condition is illustrated in the third diagram of Fig. 4 where the arrows A represent the heavy clamping pressure resulting from setting down the nut ring 19.

The fourth step is to relieve the diaphragm from the deflecting stress whereupon it returns to the condition illustrated in the fourth diagram of Fig. 4. Here the heavy clamping pressure represented by the arrows A prevents the expansion of the periphery of the diaphragm so that the diaphragm remains under a uniformly distributed radial compressive stress as indicated in diagram in Fig. 5. In Fig. 5 the arrows *c* are meant to illustrate a uniformly distributed radially acting stress and not a plurality of localized stresses.

A substantially equivalent method is to clamp the diaphragm with a very moderate clamping pressure and then run the sound box on a number of very "heavy" or loud records and then immediately clamp the diaphragm very tight. If the first or moderate clamping pressure is correct it will permit the periphery of the diaphragm to draw in or contract under the stresses induced by vibration. The expansive pressure of the diaphragm will not however be sufficient to overcome the friction of clamping except possibly very slowly, and the final tight clamping of the edge of the diaphragm thus holds this contracted.

Both methods have in common the idea of producing contraction of the periphery by deflection of the center, and of final clamping while this contraction exists.

A diaphragm so mounted is characteristically inert and non-resonant and very sensitive. The stressing increases the loudness and volume of sound secured in reproductions.

The increased sensitiveness introduces some difficulties, but such diaphragms can be used with marked success, for example in the particular type of sound box with which I have illustrated it.

Having thus described my invention, what I claim is:—

1. The method of mounting diaphragms in sound-boxes and the like, which consists in producing a contraction of the periphery of the diaphragm by deflecting the central portion of the diaphragm, and then positively clamping said periphery while contracted.

2. The method of mounting diaphragms in sound-boxes and the like, which consists in placing the diaphragm between a pair of clamping members adapted to engage its opposite faces at or near its periphery, producing a contraction of said periphery by deflecting the central portion of said diaphragm, and then forcing said clamping members together to clamp said diaphragm positively between them while its periphery is contracted.

3. The method of mounting diaphragms in sound-boxes and the like which consists in deflecting the central portion of the diaphragm to contract the periphery thereof, and then while maintaining said deflection positively clamping said contracted periphery.

4. The method of mounting diaphragms in sound-boxes and the like which consists in placing the diaphragm between a pair of clamping members adapted to engage its opposite faces at or near its periphery, deflecting the central portion of said diaphragm to contract its periphery, then while maintaining said deflection, clamping said diaphragm between said clamping members, and then relieving said diaphragm from the deflecting stress.

5. The method of mounting acoustic diaphragms which consists in contracting the periphery of the diaphragm by the application of force, and thereafter maintaining said contraction by means of a positive peripheral clamp.

6. The method of mounting acoustic diaphragms which consists in contracting the periphery of the diaphragm by the application of force, and thereafter maintaining

said contraction by the action of a rigid diaphragm mount, engaging the peripheral portion of said diaphragm.

7. The method of mounting acoustic diaphragms which consists in placing a diaphragm in contact with a rigid diaphragm mount; applying a distorting agency to cause the line of contact between the mount and the periphery of the diaphragm to move inward relatively to the mount; causing the mount to engage and hold the periphery of the diaphragm; and then terminating the action of said distorting agency.

In testimony whereof I have signed my name to this specification.

PARKER DODGE.