

E. C. SMITH.  
SOUND BOX.  
APPLICATION FILED MAY 27, 1901.

951,292.

Patented Mar. 8, 1910.

Fig.1

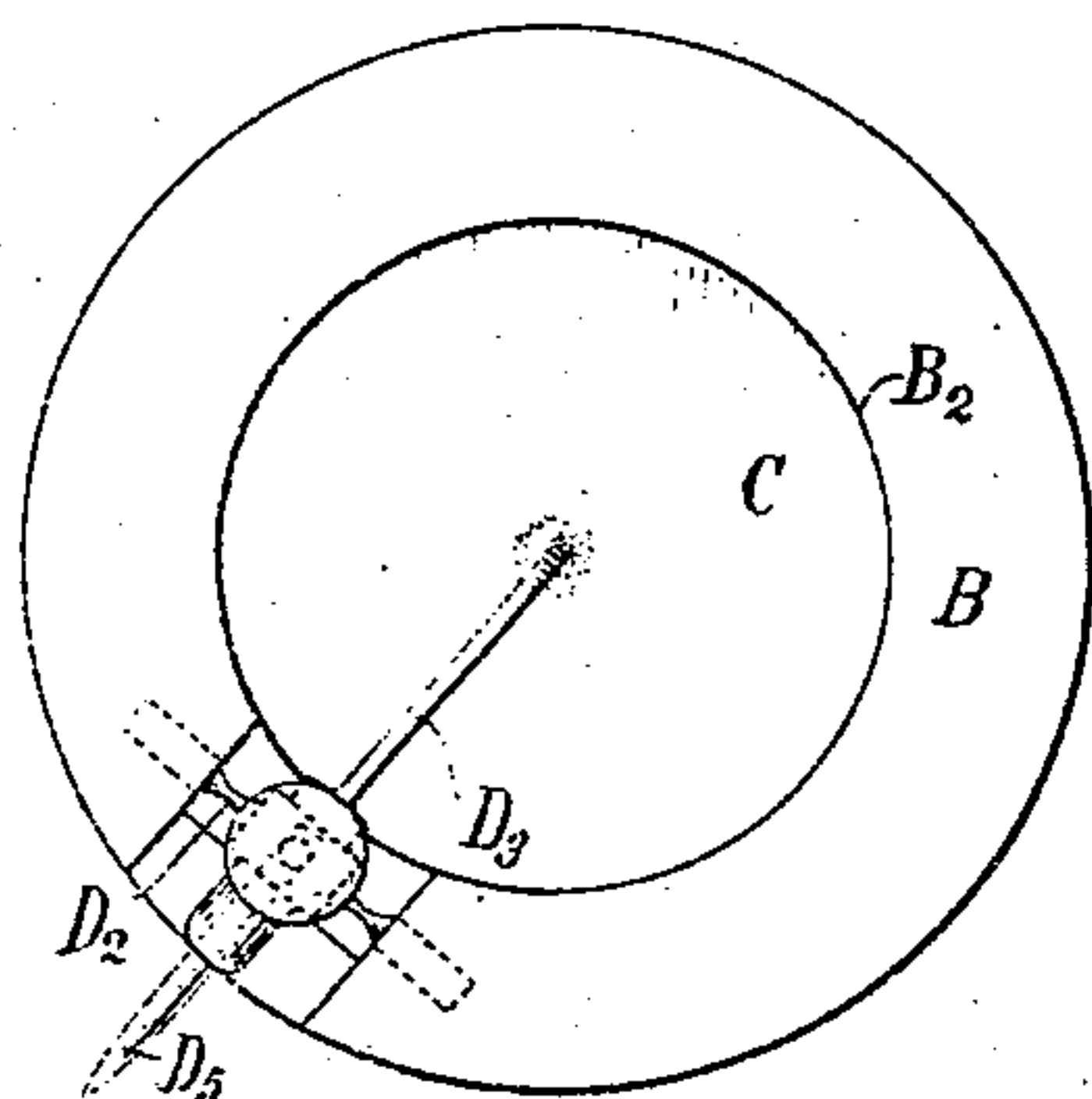


Fig.2

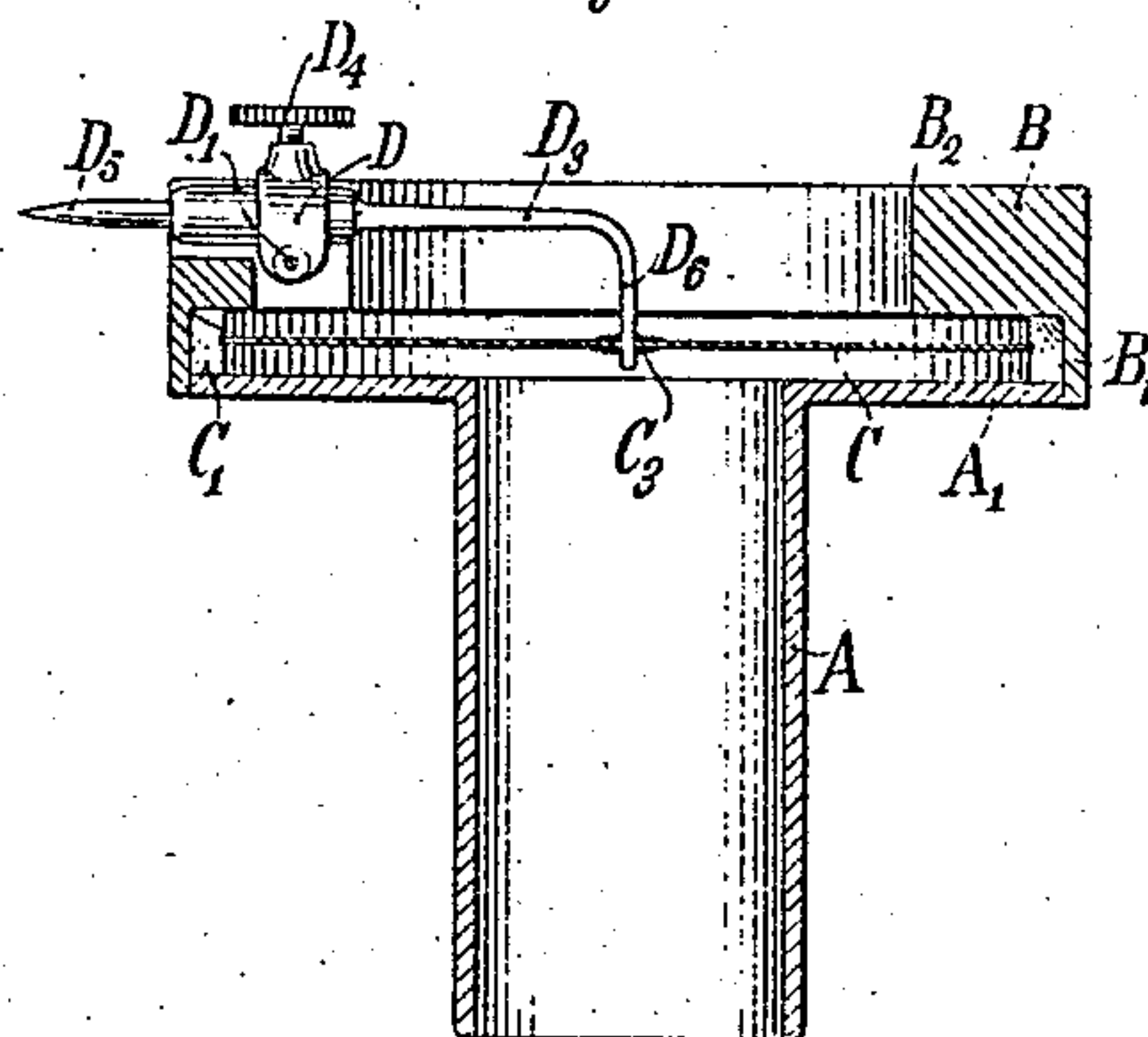


Fig.3

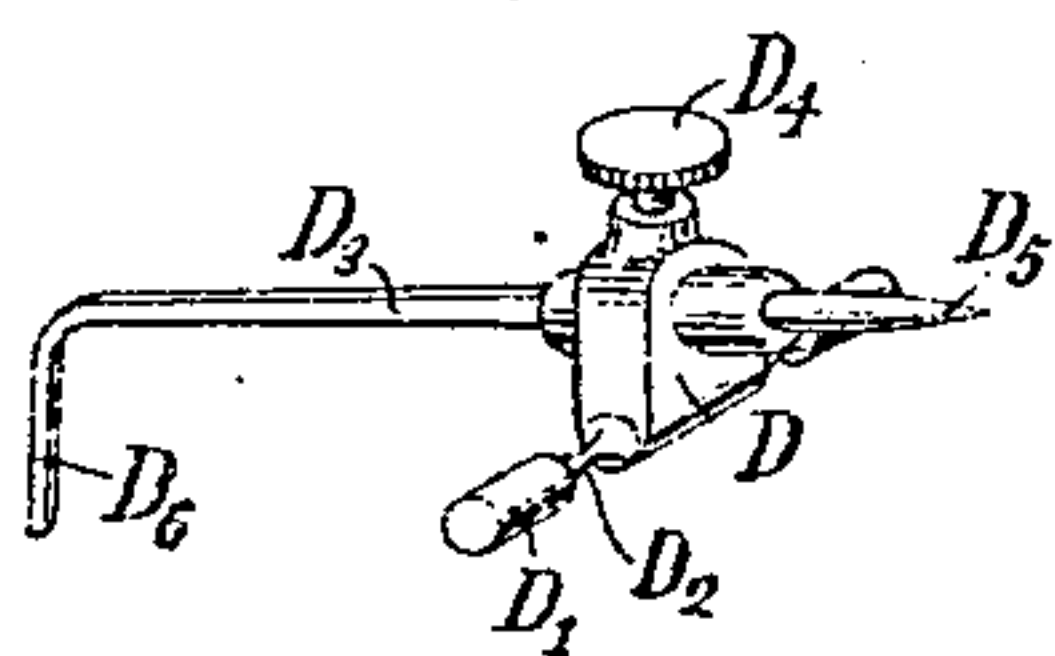
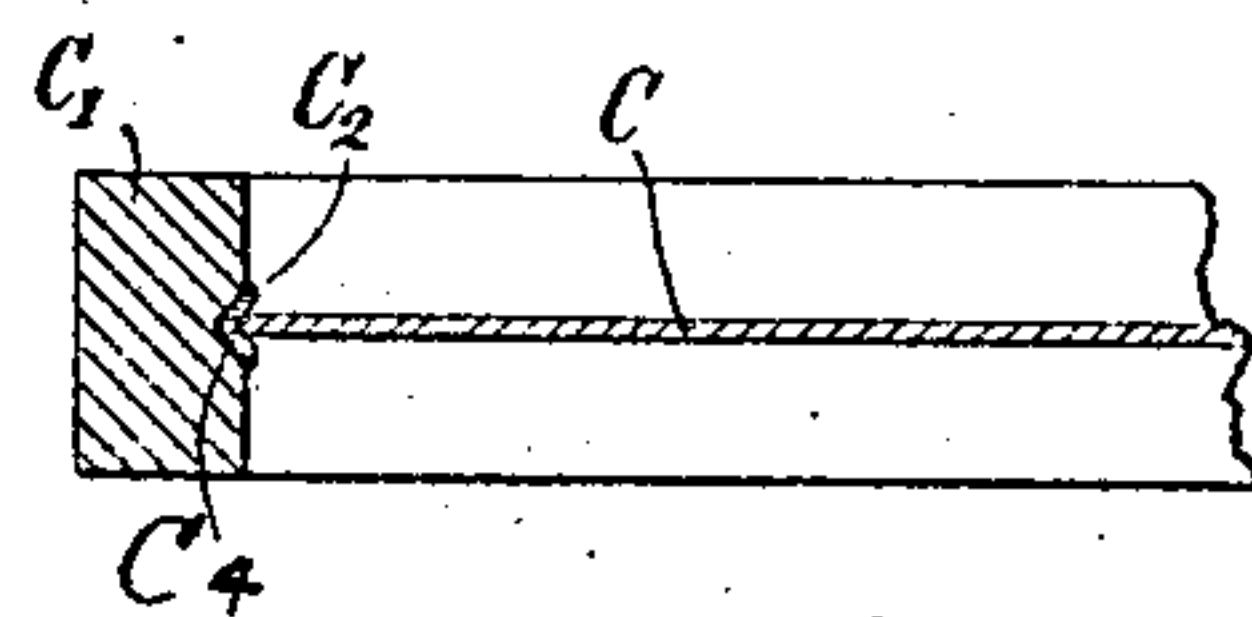


Fig.4



Witnesses:

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# UNITED STATES PATENT OFFICE.

EUGENE C. SMITH, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO  
VICTOR TALKING MACHINE COMPANY, A CORPORATION OF NEW JERSEY.

SOUND-BOX.

951,292.

Specification of Letters Patent.

Patented Mar. 8, 1910.

Application filed May 27, 1901. Serial No. 62,021.

To all whom it may concern:

Be it known that I, EUGENE C. SMITH, a citizen of the United States, residing in the city of New York, county and State of New York, have invented certain new and useful Improvements in Sound-Boxes, of which the following is a specification.

The main objects of this invention are, to provide an improved sound box for talking machines; to provide an improved casing for a sound box; to provide an improved mounting for a stylus bar; to provide an improved mounting for a diaphragm; to provide an improved connection between a stylus bar and a diaphragm; and to provide other improvements as will appear hereinafter.

In the accompanying drawings Figure 1 is a front elevation of a sound box constructed in accordance with this invention; Fig. 2 a longitudinal axial section of the same; Fig. 3 a perspective view of a portion of the same; and Fig. 4 a fragmentary axial sectional view of a portion of the same.

Referring to the drawings, one embodiment of this invention comprises a hollow casing preferably made of metal or other heavy material and having a cylindrical transmitting tube A open at both ends and adapted to communicate through its outer end with the usual sound amplifier of a talking machine and surrounding the inner end of this tube, integral and coaxial therewith is a flat annular plate A<sup>1</sup>, forming the back of the casing. Telescoping tightly over this back plate A<sup>1</sup> is a cylindrical cap or shell B having a cylindrical bore B<sup>2</sup> and provided upon its outer or front end with a relatively thick and heavy inwardly extending flat annular flange forming the face of the casing, the flange being coaxial with the cap B and the transmitting tube A. These two tightly telescoping sections A and B of the casing may be secured together by any suitable means, for instance by shellac, filling the joint between these two parts. The annular groove or recess bounded by the inside flat annular surface of the back plate A<sup>1</sup>, the opposite inside flat annular surface of the flange of the cap B, and the cylindrical surface of the bore of the cap constitutes the diaphragm chamber. The flange of the cap

B is made unusually thick and heavy and extends inwardly farther than has heretofore been usual for purposes hereinafter explained.

For mounting a diaphragm in the diaphragm chamber, a cylindrical ring or diaphragm support C<sup>1</sup> is fitted snugly but removably within the cylindrical bore B<sup>2</sup> of the cap B. This ring is rectangular in cross section, completely filling the outer portion of the diaphragm chamber, the end walls of the ring being in contact with and clamped between the inner flat walls of the front and back respectively of the casing. An internal annular groove or depression C<sup>2</sup> is provided in the cylindrical bore of the ring in a plane perpendicular to the axis of the ring substantially midway between the end edges of the ring. Within this groove C<sup>2</sup> is an annular layer of rubber cement or other yielding material C<sup>2</sup> within which is supported a diaphragm C, preferably made of thin mica or other flexible material. The diaphragm normally rests in a plane perpendicular to the axis of the casing of the sound box and is spaced midway between the flat annular walls forming the ends of the diaphragm chamber. The ring C<sup>1</sup> is preferably formed of thoroughly seasoned wood and is rendered proof against distortion by suitable treatment, such as by being varnished with shellac, and also if desired, by being held inclosed by a binding metallic rim secured to the edge of the same.

In mounting the diaphragm, after the ring or support C is formed, a layer or ring of rubber cement, made in a well known manner of pure gum and any suitable solvent, such as carbon bisulfid, or any other similar cement, is placed in the internal groove C<sup>2</sup> of the support. When this cement has solidified slightly, but while it is still soft and plastic, the diaphragm, the diameter of which is preferably slightly greater than the internal diameter of the cylindrical bore of the ring, and slightly less than the diameter of the groove therein, is sprung into the ring of cement by pressing the center of the diaphragm, to reduce its diameter. The periphery of the diaphragm is then placed in proper position and the diaphragm is then released and its



peripheral edge springs outwardly and engages the soft rubber cement forming an internal groove therein and permitting the diaphragm to assume its normal configuration. The diaphragm is thus held with substantially the same force throughout its whole extent and any distortion or unsymmetrical constraint of the diaphragm is avoided. When the diaphragm is thus mounted it contacts at its peripheral edge substantially only, with the rubber cement by which it is supported, the walls of the groove in the cement sloping from the peripheral edge of the diaphragm away from the sides of the diaphragm. This rubber cement remains sufficiently elastic to permit the diaphragm to yield readily radially in its own plane or in any other direction with respect to its supporting ring, and since the diaphragm is flexible and as the plane surface or sides of the diaphragm are not in contact with the cement, the diaphragm is free to flex or vibrate in a direction transversely of its plane throughout its whole extent.

A stylus bar comprising a main portion D is mounted upon a torsional resilient rod D<sup>1</sup> in a recess provided therefor in the front of the sound box casing. The torsional rod D<sup>1</sup> is soldered or otherwise rigidly secured at its two ends as shown in Fig. 1 to the cap B of the sound box casing and the central portion of the rod is likewise rigidly secured to the main portion D of the stylus bar, the rod forming two torsional spaced arms extending in opposite directions from the stylus bar and forming the sole support thereof. Upon each side of the stylus bar the torsional rod is reduced in diameter between the stylus bar and the cap forming two comparatively short slender portions D<sup>2</sup>, as shown in Figs. 1 and 3. These reduced portions D<sup>2</sup> are circular in cross section and are preferably only about 1/100 of an inch in smallest diameter so that they offer little resistance to the oscillation of the stylus bar about the longitudinal axis of the rod, but at the same time, by reason of their shortness and spaced arrangement, the stylus bar is held thereby substantially rigid against any other movement. The axis of oscillation of the bar, which coincides with the longitudinal axis of the rod D<sup>1</sup> is substantially parallel to the plane of the diaphragm and is between the diaphragm and the front surface of the sound box casing.

The main portion D of the stylus bar has a hollow lug projecting outwardly therefrom radially of the sound box forming a stylus socket in which is carried the usual stylus or needle D<sup>3</sup>, held in position by the usual retaining screw D<sup>4</sup>, threaded through the outer part of the main portion of the bar and engaging against the upper end of the needle.

Extending radially inwardly from the main portion D of the stylus bar and rigidly secured thereto is an arm D<sup>3</sup> the inner end D<sup>5</sup> of which is turned toward the diaphragm, and projects slightly through a suitable opening in the center thereof. This end D<sup>5</sup> of the stylus bar may be secured to the diaphragm by any suitable means, but preferably by a celluloid cement formed of celluloid dissolved in any suitable solvent. The elasticity of the cement allows sufficient play between the diaphragm and the stylus bar so that the diaphragm will not be distorted by the oscillation of the bar, but still enables the bar to transmit perfectly the sound vibrations which it is desired to impress upon the diaphragm. The diaphragm and stylus bar are so mounted and connected that normally no pressure is exerted by the bar upon the diaphragm.

This sound box is adapted to be operated in the usual well known manner by being mounted in communication with a horn or sound amplifier, to permit the needle D<sup>5</sup> carried by the box to be actuated by the usual sound record which is revolved relatively thereto. In this operation the record communicates in general, two sets of movements to the stylus bar, first the true sound vibrations, which it is desired to transmit to the diaphragm, and second the surgings, as they may be called, in a direction transverse to the sound vibrations. These surgings are due to the inaccuracies of the record and should not be transmitted to the diaphragm.

By having the stylus mounted as heretofore described, so that it will oscillate freely in a plane perpendicular to the diaphragm, when in operation, in response to the undulations of the record corresponding to sound waves, upon an axis substantially fixed with respect to the sound box, and so that it will be held substantially rigid against movement in any other direction, only the true sound vibrations of the stylus bar will be transmitted to the diaphragm. Furthermore by mounting the stylus bar upon a resilient torsional rod having reduced portions as described, the reduced portions of the rod exert a slight torsional effect upon the stylus bar in operation, tending to restore the bar to its normal position after it has been deflected and to cause the vibrations of the diaphragm to be symmetrical with respect to its normal central position.

The sound box casing is preferably made comparatively heavy, as heretofore described, by making the flange of the cap B unusually heavy, to give it sufficient inertia to remain substantially unaffected by the vibrations of the stylus bar and diaphragm, corresponding to sound waves, but the casing is not made so heavy that the slow surgings transmitted to the stylus bar by the imperfections of the record will not readily overcome the inertia



of the box and permit the box to follow these surgings without placing any undue stress upon the delicate parts of the box or upon the record.

5 The improved mounting above described for the diaphragm has proved very advantageous in practice, since it permits of a greater freedom of movement of the diaphragm than is possible when the diaphragm is clamped between two rubber rings and held against radial movement, as heretofore has been the practice; and it has been found, furthermore, that this mounting is very effective in reducing the metallic quality which has heretofore been noticeable in the reproduction of vocal sounds.

By having the diaphragm mounted substantially midway between and parallel to the inner parallel annular walls of the front and back of the sound box casing, an annular recess is formed on each side of the diaphragm and the pressure of the air in the recess upon the outer side of the diaphragm acts to counterbalance the pressure of the air in the recess upon the inner side of the diaphragm when the diaphragm is in operation, and results in a more uniform and symmetrical action on the part of the diaphragm in response to the vibration of the stylus bar, whereby the quality of the reproduction is improved.

Although only a single form has been shown in which this invention may be embodied, it is desired to have it distinctly understood that the invention is not limited to the single construction shown. Instead of the torsional mounting shown and described for the stylus bar, any other suitable mounting might be employed. Furthermore, parts of this invention might be employed without using other parts. These, and other changes might be made in the construction described without departing from the spirit of this invention of the scope of the appended claims.

45 Having thus described my invention, I claim and desire to protect by Letters Patent of the United States:

1. In a sound box, the combination with a casing having spaced walls, of a diaphragm between said walls and restrained at substantially its peripheral edge only.

2. In a sound box, the combination with a casing having two substantially parallel spaced walls, of a diaphragm substantially parallel to said walls restrained at its peripheral edge only, substantially midway between said walls.

3. In a sound box, the combination with a support, of a diaphragm, movable in its own plane with respect thereto.

4. In a sound box, the combination with a support, of a diaphragm movable in its own plane, and a stylus bar connected to said diaphragm and mounted to oscillate in a plane transverse to the plane of the diaphragm.

5. The combination with a diaphragm, of means contacting with the peripheral edge only of said diaphragm, forming the sole support of said diaphragm.

6. The combination with a diaphragm, of yielding means contacting with the peripheral edge only of said diaphragm forming the sole support of said diaphragm.

7. The combination with a diaphragm, of resilient means contacting with the peripheral edge only of said diaphragm, forming the sole support of said diaphragm.

8. In a sound box, the combination with a support, of a diaphragm, and means between said support and the peripheral edge only, of said diaphragm, to support said diaphragm.

9. In a sound box, the combination with a support, of a diaphragm, and yielding means between said support and the peripheral edge only, of said diaphragm, to support said diaphragm.

10. In a sound box, the combination with a support, of a diaphragm, and elastic cement for yieldingly connecting the said diaphragm to said support.

11. In a sound box, the combination with a removable support having a recess, of a diaphragm having its edge in said recess, and yielding means to hold said diaphragm in position.

12. In a sound box, the combination with a removable support having a recess, of a diaphragm having its edge in said recess, and elastic cement to hold said diaphragm yieldingly in position.

13. In a sound box, the combination with a support, having a recess, of a diaphragm having its edge in said recess, and means between the peripheral edge only of said diaphragm and said support, to support said diaphragm.

14. In a sound box, the combination with a support, having a recess, of a diaphragm having its edge in said recess, and yielding means between the peripheral edge only of said diaphragm and said support to support said diaphragm.

15. In a sound box, the combination with a yielding ring, of a diaphragm contacting at its peripheral edge only with said ring.

16. In a sound box, the combination with a yielding ring, of a diaphragm contacting at its peripheral edge only with said ring, and entirely supported thereby.

17. The combination with a ring, of a diaphragm, and means, interposed between said ring and said diaphragm, forming the sole support of said diaphragm.

18. The combination with a ring, of a diaphragm and yielding means, interposed between said ring and said diaphragm, forming the sole support of said diaphragm.

19. The combination with a ring, of a diaphragm, and means contacting with said



ring, and substantially only with the peripheral edge of said diaphragm, forming the sole support of said diaphragm.

20. The combination with a ring, of a diaphragm, and yielding means contacting with said ring, and with substantially only the peripheral edge of said diaphragm, forming the sole support of said diaphragm.

21. The combination with a yielding ring having an internal annular groove, of a diaphragm having only its peripheral edge in contact with said ring in said groove, the side walls of said groove being inclined away from the sides of said diaphragm.

22. The combination with an integral ring having an internal annular groove, of a diaphragm slightly greater in diameter than the internal diameter of said ring and slightly less in diameter than the diameter of said groove supported in said groove, and yielding means between said diaphragm and the wall of said groove, to hold said diaphragm yieldingly in position.

23. The combination with a stylus bar, of a mounting therefor comprising a torsional member.

24. The combination with a stylus bar, of a mounting therefor comprising a resilient torsional member.

25. The combination with a stylus bar, of a mounting therefor, comprising a torsional member forming the sole support for said bar.

26. The combination with a stylus bar, of a mounting therefor comprising a resilient torsional member forming the sole support for said bar.

27. The combination with a stylus bar, of a mounting therefor, comprising a torsional member rigidly secured to the bar.

28. The combination with a stylus bar, of a mounting therefor, comprising a torsional member rigidly secured to the bar, and extending in opposite directions therefrom, forming spaced yielding arms.

29. The combination with a stylus bar, of a mounting therefor comprising spaced yielding arms.

30. The combination with a stylus bar, of a mounting therefor, comprising spaced yielding arms forming the sole support of said bar.

31. The combination with a stylus bar, of a mounting therefor comprising spaced yielding arms extending in opposite directions from the bar.

32. The combination with a stylus bar, of a mounting therefor comprising spaced yielding arms extending in opposite directions from the bar and forming the sole support thereof.

33. The combination with a stylus bar, of a mounting therefor comprising spaced resilient arms.

34. The combination with a stylus bar, of

a mounting therefor comprising spaced resilient arms forming the sole support of said bar.

35. The combination with a stylus bar, of a mounting therefor comprising a torsional member having a reduced portion to permit of the free oscillation of the bar.

36. In a sound box, the combination with a casing, of a stylus bar and a torsional member fixed to said casing and to said bar.

37. In a sound box, the combination with a casing, of a stylus bar and a torsional member fixed to said casing and to said bar, and forming the sole support of said bar.

38. In a sound box, the combination with a casing, of a stylus bar and a yielding member having its intermediate portion fixed to said bar and its ends fixed to said casing.

39. In a sound box, the combination with a casing, of a stylus bar, and a resilient member having its intermediate portion fixed to said bar and its ends fixed to said casing.

40. In a sound box, the combination with a casing, of a stylus bar and a torsional member having its intermediate portion fixed to said bar and its ends fixed to said casing.

41. In a sound box, the combination with a casing, of a stylus bar, and a torsional rod having its intermediate portion fixed to said bar and its ends fixed to said casing forming the sole support of said bar, said rod being reduced in diameter between said bar and said casing upon each side of said bar.

42. In a sound box, the combination with a diaphragm, of a stylus bar mounted to oscillate and a yielding connection between said diaphragm and said bar.

43. In a sound box, the combination with a diaphragm, of a stylus bar mounted to oscillate and celluloid cement connecting said diaphragm to said bar.

44. In a sound box, the combination with a diaphragm, of a support therefor comprising means applied to said diaphragm in a plastic condition.

45. In a sound box, the combination with a diaphragm of a wooden support therefor, and a yielding connection between said diaphragm and said support.

46. In a sound box, the combination with a wooden ring having an annular internal recess, of a diaphragm in said ring, and rubber cement in said groove supporting said diaphragm.

47. A sound box comprising a casing, a ring removably clamped in said casing and a flexible diaphragm permanently secured to said ring by a film of flexible cement to allow said diaphragm to move radially with respect to said ring.

48. In a sound box, the combination with a removable ring, of non-elastic material mounted within said sound box made in one



piece, and having an interior groove, and a diaphragm having its peripheral portion seated in said groove, confined between the side walls thereof, and elastically supported therein.

49. The combination in a sound box of a removable ring of non-elastic material having an interior groove and mounted within said sound box and a diaphragm having its peripheral portion situated in said groove and loosely confined between the side walls thereof.

50. The combination in a sound box, of a removable ring having an interior groove mounted within said sound box and a diaphragm having its peripheral portion situated in said groove and loosely confined between the walls thereof.

51. A support for a diaphragm of a sound box consisting of a ring of non-elastic material adapted to be mounted within a sound box, made in one piece and having an interior groove and a diaphragm having its peripheral portion permanently situated in said groove and loosely confined between the side walls thereof.

52. A support for a diaphragm of a sound box, consisting of a ring having a groove and adapted to be mounted within a sound box and a diaphragm having its peripheral portion permanently situated in said groove and loosely confined between the walls thereof.

53. A diaphragm support having a groove, and adapted to be mounted within a sound box and a diaphragm having its peripheral portion permanently situated in said groove, loosely confined between the side walls thereof and elastically supported therein.

54. A diaphragm support having a recess therein, a diaphragm fitting in said recess

and elastic means securing said diaphragm to said support.

55. In a sound box for reproducing and recording sound waves, the combination of a ring having its interior surface formed of different diameters in different parallel planes but the same in cross section throughout its circumference, with a thin layer of yielding material within the ring and in contact with its surface of larger diameter, and a diaphragm having its extreme perimeter formed into retaining engagement with the ring, through the yielding material, for holding the diaphragm only at its perimeter and leaving its faces free and unobstructed.

56. In a sound box, the combination with a casing comprising two separate parts forming an annular internal groove, of a diaphragm, and an annular mounting for said diaphragm in said groove, said mounting being substantially rectangular in cross section and being equal in width and diameter to the width and diameter of said groove.

57. In a sound box, a diaphragm, a support therefor, said diaphragm being mounted in said support by its edge substantially only.

58. In a sound box, the combination of a diaphragm, of a mounting therefor, and a permanently yielding material between the peripheral edge of said diaphragm and said mounting to hold said diaphragm in place.

59. In a sound box, the combination with a diaphragm, of a mounting therefor, and a permanently resilient material between the peripheral edge of said diaphragm and said mounting to hold said diaphragm in place.

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Witnesses:

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