

No. 655,556.

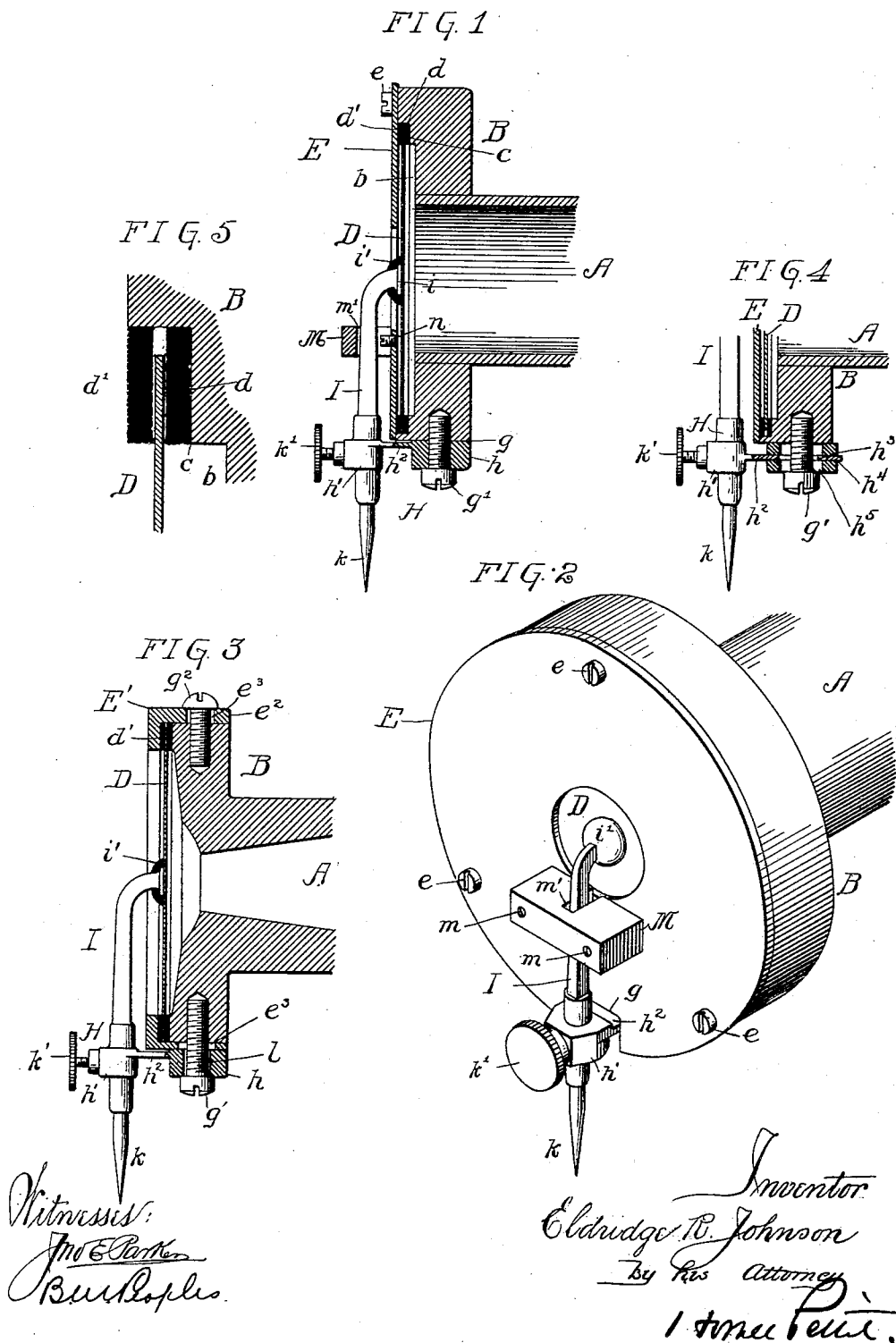
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E. R. JOHNSON.

SOUND RECORDING AND REPRODUCING MACHINE.

(Application filed June 1, 1897.)

(No Model.)



UNITED STATES PATENT OFFICE.

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SOUND RECORDING AND REPRODUCING MACHINE.

SPECIFICATION forming part of Letters Patent No. 655,558, dated August 7, 1900.

Application filed June 1, 1897. Serial No. 886,038. (No model.)

To all whom it may concern:

Be it known that I, ELDRIDGE R. JOHNSON, a citizen of the United States, and a resident of Camden, State of New Jersey, have invented certain new and useful Improvements in Sound Recording and Reproducing Machines; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to certain improvements in sound recording and reproducing machines, and has for its object to improve and simplify the construction of the recording and reproducing mechanism commonly known as the "sound-box," as more fully set forth hereinafter.

In the accompanying drawings, Figure 1 is an elevation, partly in section, of the sound-box constructed in accordance with my invention. Fig. 2 is a perspective view of the same. Fig. 3 is a view similar to Fig. 1, illustrating a modification of the structure to permit the adjustment of the rubber rings or gaskets in their relation to the diaphragm. Fig. 4 is a similar view illustrating a further modification, and Fig. 5 is an exaggerated sectional diagram illustrating the diaphragm and the adjacent rubber rings.

To produce the best results, the diaphragm and the stylus-bar should be so connected that either will instantly yield to the movement of the other; but the connection between the two and the mounting of each must be such that while one will instantly respond to the vibration of the other no checking of the vibration will be possible and all impulses tending to move one or the other beyond the proper limit will be avoided.

To obtain the best results and to secure from the full surface of the diaphragm the full force and effect of the sound-waves, the diaphragm at the periphery should be practically free. Further, where the fulcrum-point of the stylus-bar tends in operation by reason of the construction to yield in any appreciable degree the diaphragm should be sufficiently loose at the edges to allow the plane of the diaphragm to accommodate itself to the

changing fulcrum-point. A further difficulty so found in the ordinary machines is that no allowance is made for the shifting movement of the diaphragm in its casing. Where no such movement is provided for, in cases where the stylus-bar is attached at one end to the center of the diaphragm a slight jar laterally upon the stylus will tend to break the connection between the stylus and the diaphragm. Provision for the lateral movement tends to obviate this. To remedy these defects, and, further, to provide for the adjustment of the various parts for the recording and reproduction of sound-waves of varying intensity are the principal objects of my invention.

Referring to the drawings, A represents the tubular section of the diaphragm-supporting frame connected at one end to a recessed diaphragm-holding disk B, and at its opposite end leading and connected directly or indirectly to a mouthpiece, trumpet, or similar sound-conveying device. In the front face of the disk B is formed a recess b, having a step or flange c, on which is placed a ring or gasket d, of rubber or other suitable yielding material, for the reception and support of the diaphragm D. On the outer face of the diaphragm is placed a second rubber ring d', the latter being confined in place by a disk E, secured by screws e to the recessed disk B. It is to be noted that the edge of the diaphragm is, as shown more clearly in Fig. 5, preferably at a slight distance from the adjacent circular portion of the wall of the recess b. In other words, the diameter of the diaphragm is preferably slightly less than the diameter of the recess formed in the casing.

In a recess g, formed in the peripheries of the disks B and E, is fitted the stylus-bar holder or spring-support H, preferably reduced at about midway of its length, comprising two block-like portions h h', connected by a plate h², the distance between the blocks and the thickness and width of the plate h² governing the freedom of movement of the stylus-bar I. The support H is secured to the disk B by a screw g', as illustrated in Figs. 1 and 4. It is clear that the plate h² may be

integral with the block-like portion h or they may consist of two separate parts, being secured to the disk B by the screw g' . The enlargement of the orifice in the block h and plate portion h^2 , through which the screw g' passes, will obviously permit of a slight lateral adjustment of these parts. In Fig. 1 the orifice through which the screw g' passes is not shown as enlarged. In Fig. 3 it is shown slightly enlarged, which will permit of a slight adjustment. In Fig. 4 the orifice through which the screw g' passes is shown as considerably enlarged to permit of a more extended adjustment.

The stylus-bar I is rigidly secured to or is formed integral with the block h of the support H and at one end is recessed for the reception of a stylus or needle k , which is held in position by a set-screw k' . It is clear that as the stylus-point or needle k is provided in a longitudinally-disposed recess or bore in the lower end of the stylus-bar, as illustrated in the drawings, and is held in position by the set-screw k' , the said needle-point k may be adjusted in said stylus-bar so as to be lengthened or shortened relatively to the stylus-bar, limited only by the length of the needle and the length of the bore, which practically permits of the arm being lengthened or shortened to any desirable extent. The opposite end of the bar is turned at an angle to its length and has a slightly-enlarged head i , which is phonetically connected to the diaphragm and is preferably secured by a slightly-elastic cement i' . In adjusting the stylus-bar to the diaphragm much care must be taken to prevent even the slightest pressure upon either the diaphragm or the bar. The two must be so connected that both will yield and each respond to the movement of the other, but neither be under the slightest strain or tension. To accomplish this, the head i of the stylus-bar is allowed to come into contact with the center of the diaphragm after the latter has been carefully adjusted, and the head is then slightly raised out of contact with the diaphragm—say to the extent of about one one-thousandth of an inch—and the cement is placed or poured around the head of the bar, and, if necessary, heat is employed to melt the cement and firmly unite the two pieces to each other.

At a suitable point in the length of the stylus-bar is a guard M, secured by screws m to the face of the disk E and having at its center a slot m' , through which passes the stylus-bar I, the distance between the side and bottom walls of the slot and the sides of the stylus-bar being about one one-hundredth of an inch, so that lateral movement of the stylus-bar to any greater extent than this is absolutely prevented. The vibration of the diaphragm beyond the normal limits is prevented in one direction by the bottom wall of the slot m' and in the opposite direction by an adjustable stop-screw n , screwing into the disk E at a point within the slot and immediately under the stylus-bar.

To obtain the best results and to reproduce pure and musical notes loud, distinct, and clear, the diaphragm should move as a whole in both recording and reproducing and not be rigidly confined at its peripheries in such a manner as to make it simply a round spring in which the vibratory movement is greatest at the stylus contact or the center. This purely-center vibration is a great disadvantage in both recording and reproducing. As the recording is caused by the sound-wave's action on the surface of the diaphragm, it is clear that if the whole surface responds to the action of the waves it will give a much more powerful movement to the stylus-bar, thereby assisting to make a more perfect record, as it will to a much greater extent overcome the resistance to the stylus caused by friction or resistance, in cutting or marking the record of the sound-waves. To provide for this free movement of the diaphragm, I preferably construct the holding devices in the manner shown in Fig. 3, in which a flanged ring E' takes the place of the disk E, the annular flange e^2 of said ring fitting over the periphery of the disk B and being provided with slots e^3 , through which pass holding-screws g^2 to properly adjust the gaskets in the casing to their proper position relative to the diaphragm. In this construction it is desirable that the block h of the stylus-support H be slotted, as shown at l , so that the stylus-support and the stylus may be adjusted with the diaphragm in order to prevent any straining or tension on one or the other.

In Fig. 5 I have illustrated on an exaggerated scale a cross-section of the rubber rings or gaskets and diaphragm, showing the naturally-rough surface of the rubber rings. These rings should be of less thickness than the distance between the respective adjacent faces of the inclosing casing and the respective faces of the diaphragm when in its normal position. It is clear that the construction should be such, as far as the relation of the gaskets and the diaphragm is concerned, that the gaskets shall not interfere with the free vibratory movement of the diaphragm approximately evenly throughout its entire area, though the degree of proximity may vary within these limitations.

The construction of the stylus-support illustrated in Fig. 1 is one adapted for ordinary purposes, the length and thickness of the plate h^2 being sufficient to check excessive vibration, while at the same time it permits perfect freedom of movement to the stylus-bar and increases the sensitiveness of the device. Where, however, the instrument is employed for the reproduction of extremely-large vibratory waves, the length of the plate h^2 would be materially shortened, as in such case the greater tendency to excessive vibration must be overcome. For notes where the tendency to excessive vibration is much smaller the length of the plate may be materially increased. To accomplish this adjustment I

prefer to employ the construction illustrated in Fig. 4, in which the block h' is made integral with the plate h^2 , the latter being of considerable length and slotted at h^3 for the passage of the securing-screw g' . The plate h^2 passes through a slot h^4 , formed in the center of the block h , which latter is also provided with a slot h^5 in line with the slot h^3 for the passage of the securing-screw g' . In adjustment for the lower or higher notes the relative positions of the stylus-bar and diaphragm should not be altered, and the plate h^2 therefore remains in the same position at all times, while the slotted block h is moved toward and from the block h' , so as to decrease or increase the length of the plate between the adjacent edges of the blocks h and h' and then firmly secured in position to bind the plate, the effect being substantially the same as though the block h were formed integral with such plate. It is clear, however, that the plate h^2 , having the elongated slot h^4 , as shown in Fig. 4, may, if desired, be also laterally adjusted in the block h to accomplish the same purpose, though the former adjustment is preferable.

I have herein described a preferable construction of spring for mounting the stylus-bar, but do not limit myself to the form described, as other forms may be employed without departing from my invention as claimed; nor is it absolutely necessary to the successful operation of the loosely-mounted diaphragm that the spring-mounting of the stylus shall be adjustably secured upon the sound-box, though it is preferable.

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

1. In a sound recording and reproducing machine, a diaphragm mounted upon the stylus-bar having its periphery free from contact with the casing in which it is mounted to allow the diaphragm to vibrate substantially evenly throughout its entire area, and yielding rings arranged near the periphery of the diaphragm, said rings being so constructed and arranged as to permit of the free vibratory movement of the diaphragm at the portion adjacent to said rings substantially evenly throughout its entire area, said rings operating as retainers against abnormal displacement, substantially as described.

2. In a sound recording and reproducing machine, a spring-mounted stylus-bar, a diaphragm loosely mounted in its casing free to vibrate approximately evenly throughout its entire area carried at its central point upon the upper end of said stylus-bar, yielding rings arranged on either side of and near the periphery of the diaphragm to retain said diaphragm against abnormal displacement and arranged and adjusted so as not to interfere with the free vibratory movement of the diaphragm substantially evenly throughout its entire area as described.

3. In a sound recorder or reproducer, the

combination of a sound-box, a loose diaphragm free to vibrate at its periphery and loose gasket, substantially as described.

4. In a sound recording or reproducing machine, a spring-mounted stylus-bar, a diaphragm loosely mounted in its casing free to vibrate approximately evenly throughout its entire area, yielding rings arranged on either side of and near the periphery of the diaphragm to retain said diaphragm against abnormal displacement and arranged and adjusted so as not to interfere with the free vibratory movement of the diaphragm substantially evenly throughout its entire area as described.

5. In a sound recording or reproducing machine, the combination of a sound-box, a loosely-mounted diaphragm free to vibrate at its periphery, a retaining-gasket therefor, and a spring-mounted stylus phonetically connected with the said diaphragm, substantially as described.

6. In a sound recording or reproducing machine, the combination of the sound-box, a loosely-mounted diaphragm therein free to vibrate at its periphery, a stylus-bar supporting said diaphragm and gaskets sufficiently loose not to interfere with the free vibratory movement of the diaphragm at its periphery, substantially as described.

7. In a sound recording and reproducing machine, a loosely-mounted diaphragm carried at its central point upon a spring-supported stylus-bar, said stylus-bar being longitudinally bored at its lower end for the reception of the needle or stylus point, a thumb-screw provided in the lower end of said stylus-bar for securing and regulating the length of adjustment of the stylus-point in its relation to the main bar, a spring-plate rigidly secured to said stylus-bar intermediate of its length and to the casing of the sound-box, means for regulating the longitudinal adjustment of the said spring-plate, said spring-plate operating as a fulcrum for the stylus, the whole constructed to allow the loosely-mounted diaphragm to vibrate substantially evenly throughout its entire area from its central point, substantially as described.

8. In a sound recording and reproducing machine, the combination of the centrally-supported diaphragm loosely mounted in the sound-box casing, a spring-supported stylus-bar having one end thereof connected with the center of the diaphragm, and peripheral portions of the said diaphragm being freely and loosely mounted within the casing of the sound-box so as to allow said diaphragm to vibrate substantially evenly throughout its entire area, a yielding stylus-bar support secured to said casing and to said stylus-bar at opposite ends respectively, said support comprising a metallic spring-plate, rigidly secured at one end to the stylus-bar and at the other end adjustably mounted upon the sound-box, substantially as described.

9. A yielding stylus-bar support for sound

recording and reproducing machines comprising a metallic plate, h^2 , having an enlarged head or block, h' , adapted to be secured to the stylus-bar, the opposite end being adjustable upon the sound-box, said metallic plate, h^2 , being reduced in thickness to provide the requisite stiffness in the plate, substantially as described.

10. In a sound recording and reproducing machine, a diaphragm loosely mounted in the casing free to vibrate approximately evenly throughout its entire area, a stylus-bar carrying said diaphragm centrally upon the upper end of said bar, a spring-support for the stylus-bar comprising a thin spring-plate, h^2 , having an enlarged end portion, h' , rigidly secured upon the stylus-bar, an enlarged block portion, h , provided upon the opposite end of the spring-support integral with the plate, h^2 , and orifice, l , transversely provided through the portion, h , for the reception of and adjustment upon the securing and adjusting screw, g , for securing said support to the sound-box of the machine, substantially as described.

11. In a sound recording and reproducing machine, a sound-box casing, a loosely-mounted diaphragm provided therein, a stylus-bar attached to the said diaphragm at its upper end, yielding rings provided on either side of said diaphragm near the periphery thereof constructed and arranged to permit of the free vibratory movement of the diaphragm substantially evenly throughout its entire area operating as retainers against abnormal displacement of the diaphragm and adjustable flanged ring provided upon the upper side of the casing to regulate the adjustment of the said yielding rings in relation to the diaphragm, substantially as described.

12. In a sound recording and reproducing machine, a sound-box, a loosely-mounted diaphragm free to vibrate substantially evenly throughout its entire area, yielding material provided upon either side of the diaphragm near the periphery to retain the diaphragm against abnormal displacement and so as not to interfere with the free vibratory move-

ments at points adjacent to said yielding material and flanged cap E' , adjustably provided upon the sound-box to regulate the adjustment of the yielding material to the diaphragm and means for adjusting and securing said flanged cap upon said sound-box, substantially as described.

13. In a sound recording and reproducing machine, a sound-box casing, a spring-supported stylus, a diaphragm mounted in said casing at its central point upon the upper end of said stylus, a spring secured to said stylus and to the walls of the casing constituting a yielding support for said stylus, said diaphragm being of a diameter less than the diameter of the recess in said casing in which it is mounted to allow of play between the edges of the diaphragm and the circular walls of said recess, the faces of the said diaphragm near the periphery being loosely mounted to allow of full and free vibration, substantially as described.

14. In a sound recording and reproducing machine, a spring-mounting for the stylus-bar adjustable lengthwise upon the sound-box, said spring being secured at one end to the stylus-bar and at its opposite end upon the sound-box and an adjustable flanged retaining-ring adapted to the main frame of the sound-box adjustable thereon and means for holding the flanged ring in its adjusted positions, substantially as described.

15. In a sound-box, a casing, a loosely-mounted diaphragm therein free to vibrate approximately evenly throughout its entire area and a stylus-bar arranged substantially parallel to the face of the diaphragm yieldingly mounted upon the casing and having its upper end phonetically connected with the center of the diaphragm, substantially as described.

In witness whereof I have hereunto set my hand this 26th day of May, A. D. 1897.

ELDRIDGE R. JOHNSON.

Witnesses:

JNO. E. PARKER,
B. G. ROYAL.