T. A. EDISON.

SOUND RECORDING APPARATUS.

APPLICATION FILED NOV. 18, 1903. RENEWED JUNE 10, 1909.

943,664. Patented Dec. 21, 1909

Fig. 1.

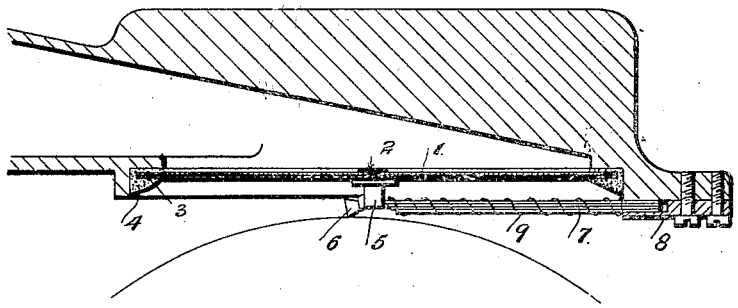


Fig. 2.

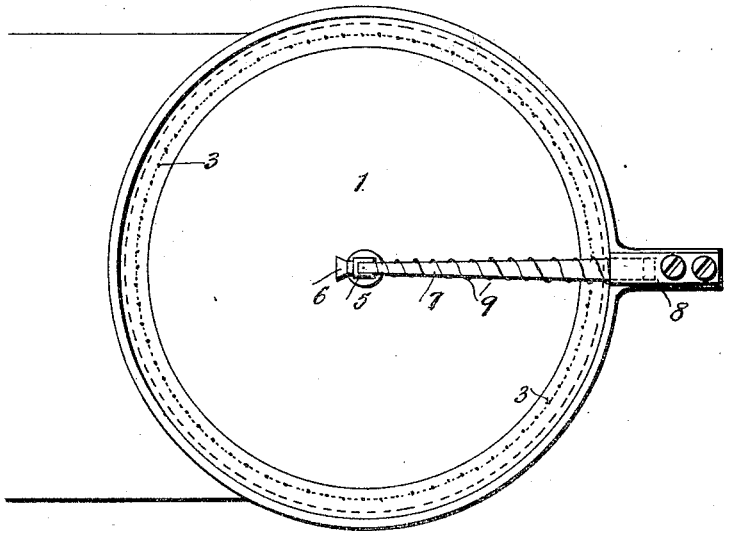
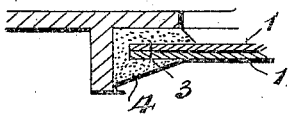


Fig. 3.



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SOUND-RECORDING APPARATUS.

943,664. Specification of Letters Patent. Patented Dec. 21, 1909.

Application filed November 18, 1903, Serial No. 181,590. Renewed June 10, 1909. Serial No. 501,414.

To all whom it may concern:

Be it known that I, THOMAS ALVA EDISON, of Llewellyn Park, Orange, in the county of Essex and State of New Jersey, have invented certain Improvements in Sound-Recording Apparatus, (Case No. 1122,) of which the following is a description.

My invention relates to an improved apparatus for recording sounds, preferably of the phonograph type wherein the record is of varying depth and width, but it may be utilized in connection with gramophonic apparatus wherein the record is of the same depth and width but of sinuous formation.

The object of the invention is to eliminate, as far as possible, sympathetic vibrations in sound recording apparatus, whereby the vibrations will be always forced and the recording of extraneous or distorted sound waves will be prevented.

In applications for Letters Patent filed November 13, 1903, I describe a method and apparatus for recording sounds, wherein is used a diaphragm whose edges are immersed in a viscous semiliquid, whereby the diaphragm is free to respond to forced vibrations. With an ordinary diaphragm arranged in this way, its fundamental tone is so high that it responds sympathetically only to very high notes, and with such tones generally the amplitude is so slight that the recording knife is not disturbed to any great extent. At the same time tones which are in sympathy with the diaphragm are unduly emphasized, so that it is desirable to eradicate even this small disturbance when the perfect quality of music is to be recorded and reproduced, especially when of instruments the majority of the notes of which are very high, like a piccolo.

To this end, the invention consists, first, in the employment of a diaphragm of a new type, which while free to respond to the sound waves, is dead and non-elastic, so that when once flexed to one side of its medial line, it has no tendency of itself to vibrate to and fro like an elastic body having a fundamental tone of its own. This is important, because if the diaphragm is elastic it stores up energy when forcibly flexed to either side of its medial line, and when released vibrates in accordance with its fundamental tone, which vibrations detract from or add to succeeding sound vibrations, thereby producing interference. With my non-elastic diaphragm the energy stored up by said flexure is quickly absorbed as heat and work when the diaphragm is released, and the diaphragm has no tendency in returning to pass its medial line because the said energy is consumed during the return of the diaphragm to the medial line, in this respect resembling a dead beat galvanometer. There is practically no tendency for it to swing past the said medial line. In other words, I provide a composite diaphragm comprising members, which while in themselves elastic and capable of flexure or forced vibrations are so hindered in their movement as to be practically incapable of any independent vibration, their elasticity merely serving to bring them back to their medial position when flexed.

The invention consists secondly, in making the so-called reed, which connects with and receives the thrust of the recording knife, also dead and non-elastic, and incapable of vibrating of itself, although free to follow the forced vibrations of the diaphragm by means which operate upon substantially the same principle as the diaphragm.

In order that the invention may be understood, attention is directed to the accompanying drawing forming a part of this specification and in which—

Figure 1 is a longitudinal view on an enlarged scale of a phonographic recording apparatus embodying my invention in its preferred form; Fig. 2 a plan view of the same; and Fig. 3 an enlarged sectional view of a part of the diaphragm.

In all of the above views corresponding parts are represented by the same reference numerals.

The diaphragm is composed of a plurality of disks 1 as shown, preferably formed of mica and of the usual diameter. These disks may all be of the same thickness, but they preferably are of different thicknesses, one being say 1/1000 of an inch in thickness, the second 2/1000 of an inch in thickness, etc. Under ordinary conditions it is not desirable to use more than three of these disks in the make-up of the composite diaphragm. The disks are assembled together with a thin layer of a very viscous permanent semiliquid, such as burned rubber, between them and are secured by a rivet 2 at the center, made preferably of aluminum, and at their

edges by a sewing 3 of silk thread. It will, of course, be understood that the disks may be sewed together by additional stitchings, arranged concentrically between the center and circumference, but under ordinary conditions a single line of stitching is sufficient. The edges of the composite diaphragm are immersed in a body 4 of a viscous semi-liquid, as I describe in my said applications. A composite diaphragm constructed in this way has its capacity to execute movements sympathetically entirely destroyed for the reason that the elasticity of the disks which under ordinary conditions would cause the diaphragm to vibrate to and fro, is here absorbed by friction developed between the surfaces of the disks and the viscous semi-liquid and by friction developed between the molecules of the said semi-liquid, the result being that while the diaphragm is free to execute forced vibrations due to sound waves, no single impulse has a tendency to cause the diaphragm to execute a series of vibrations. The structure may be appropriately called a dead beat diaphragm.

Although my improved composite diaphragm is very sensitive to forced vibrations so as to accurately follow and record the sound-waves, yet if flexed to one side or the other of its medial line the pressure released, it immediately returns to its normal form without partaking of vibrations.

Secured to the under-side of the rivet 2 is an aluminum foot 5 held in place by shellac or other cement and carrying the recording knife 6 of any suitable construction.

The so-called reed 7 whose front end is cemented to the foot 5 and which receives the thrust of the recorder, is secured at its rear end by a clamp 8 and embodies the same idea as the improved diaphragm, inasmuch as it is also dead and non-elastic and incapable of vibrating sympathetically. This reed is therefore composed of a series of thin glass sections preferably of varying thickness, separated by thin layers of a viscous permanent semi-liquid, like burned rubber, the whole being wound by a silk thread 9. Instead of securing the reed sections together by a silk thread, a series of small rubber bands may be employed with good results. It will of course be understood that the reed may be made of other material than glass, such as thin splints of bamboo.

With the arrangement described, I eliminate all vibrations other than those which are forced so that a record formed is characterized by being composed solely of graphic representations of the sound-waves themselves recorded with absolute accuracy and free of extraneous disturbances and distortion.

Having now described my invention what I claim as new and desire to secure by Letters Patent, is as follows:

1. A composite diaphragm, comprising an elastic member and a permanently semi-liquid material of great internal friction or viscosity applied over the surface thereof, whereby said member is rendered practically incapable of sympathetic vibration, substantially as set forth.

2. A composite diaphragm comprising two or more elastic members and means applied over the adjacent surfaces thereof for rendering said members practically incapable of sympathetic vibration, substantially as set forth.

3. A composite diaphragm comprising two or more elastic members and a permanently semi-liquid material characterized by great internal friction or viscosity applied to said members over the surfaces thereof, whereby said members are rendered practically incapable of sympathetic vibration, substantially as set forth.

4. A composite diaphragm comprising two or more rigid disks secured together with a viscous semi-liquid between the disks, substantially as set forth.

5. A composite diaphragm comprising two or more rigid disks of different thicknesses secured together with a viscous semi-liquid between the disks, substantially as set forth.

6. A composite diaphragm composed of two or more rigid disks secured together at the center with a viscous semi-liquid between the disks, substantially as set forth.

7. A composite diaphragm composed of two or more rigid disks secured together at their center and edges and a viscous semi-liquid between the disks, substantially as set forth.

8. A composite diaphragm composed of a plurality of disks riveted together at the center and sewed at their edges with a viscous semi-liquid between the disks, substantially as set forth.

9. A composite reed for receiving the thrust of a phonographic recorder comprising an elastic member and means for rendering said member practically incapable of sympathetic vibration, substantially as set forth.

10. A composite reed receiving the thrust of phonograph recorders composed of a plurality of thin leaves with a viscous semi-liquid between them, substantially as set forth.

11. A composite reed for receiving the thrust of phonograph recorders composed of a series of leaves of varying thickness with a viscous semi-liquid between them, substantially as set forth.

12. A reed for receiving the thrust of phonograph recorders composed of a series of glass leaves with a viscous semi-liquid between them, substantially as set forth.

13. A composite reed for receiving the thrust of phonograph recorders composed of

a series of thin leaves with a viscous semi-liquid between them and wound with an exterior thread, substantially as set forth.

14. In a phonograph recorder, the combination of a composite diaphragm comprising an elastic member and means for rendering said member practically incapable of sympathetic vibration, a recording stylus connected to the diaphragm, and a composite reed receiving the thrust of said stylus and comprising an elastic member and means for rendering said member practically incapable of sympathetic vibration, substantially as set forth.

15. In recording apparatus, the combination of a composite diaphragm composed of a plurality of disks with a viscous semi-liquid between the disks, a recording stylus connected to said diaphragm and a composite reed connected to the stylus and composed of a series of leaves with a viscous semi-liquid between them, substantially as set forth.

This specification signed and witnessed this 16 day of Nov. 1903.

THOMAS A. EDISON.

Witnesses:
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