T. A. EDISON.

PHONOGRAPHIC RECORDING OR REPRODUCING APPARATUS.

APPLICATION FILED MAR. 16, 1907.

1,078,264. Patented Nov. 11, 1913.

2 SHEETS—SHEET 1.

Fig. 1

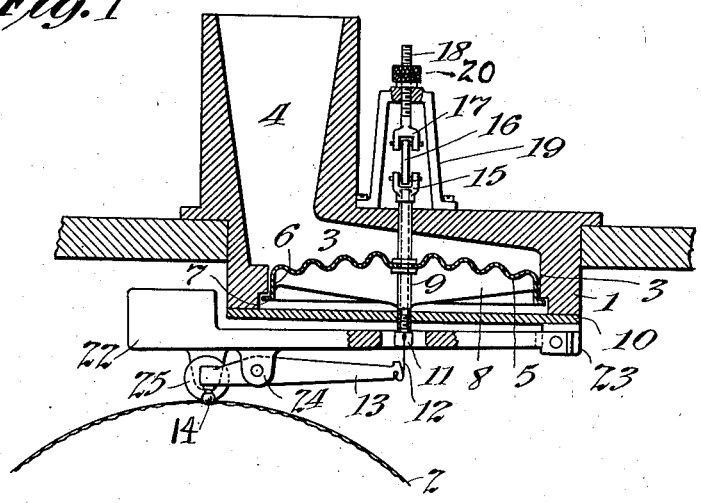


Fig. 2

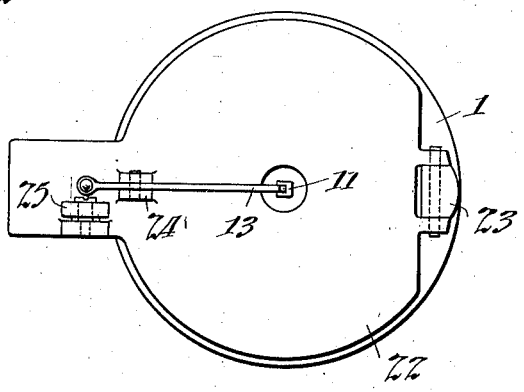


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Fig. 3

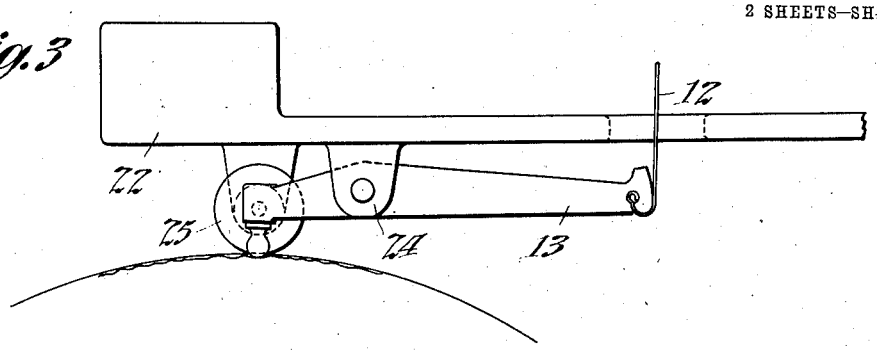



Fig. 6

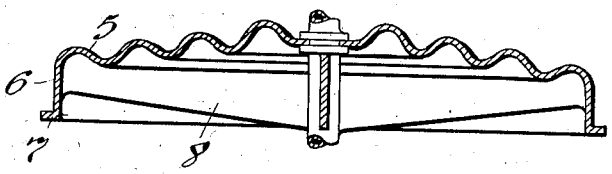



Fig. 4

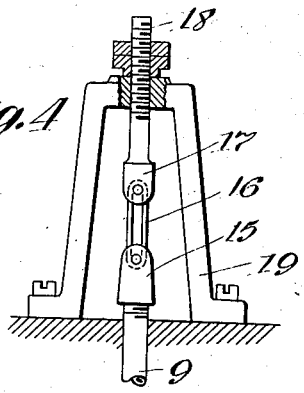



Fig. 7

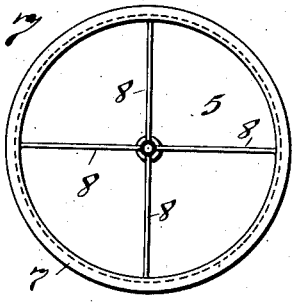
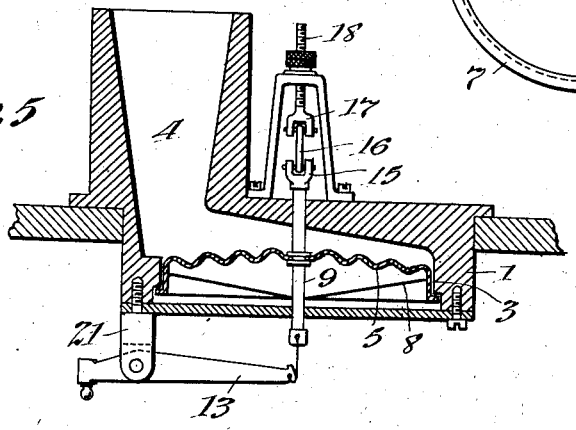



Fig. 5

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# UNITED STATES PATENT OFFICE.

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## PHONOGRAPHIC RECORDING OR REPRODUCING APPARATUS.

1,078,264. Specification of Letters Patent. Patented Nov. 11, 1913.

Application filed March 16, 1907. Serial No. 362,597.

*To all whom it may concern:*

Be it known that I, THOMAS ALVA EDISON, a citizen of the United States, and a resident of Llewellyn Park, Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Phonographic Recording or Reproducing Apparatus, of which the following is a description.

My invention relates to improvements in recording or reproducing apparatus for phonographs or other talking machines, but the improvements are particularly directed to reproducing apparatus.

With phonographic reproducing apparatus as now made, the diaphragm which is rigidly clamped at its periphery, comprises a single disk corrugated so as to be as stiff as possible, or a series of disks of gradually reduced diameters. With such a diaphragm the limit of amplitude is comparatively slight, since in vibrating to one side or the other of the medial line the diaphragm is not only flexed but it undergoes stretching and contraction as it recedes from or approaches the medial line. Furthermore, the resistance of the diaphragm to the vibrating effect enormously increases as the diaphragm is distorted out of its normal plane. For these reasons any attempts to increase the loudness of phonographic reproduction by increasing the amplitude have been unsuccessful, for the reason that to materially increase the amplitude of vibration would impose an enormous increase in the wear of the record surface. Furthermore, I find that even under existing conditions, where floating weights are used that are as heavy as can be employed without imposing objectionable wear on the record, the weight itself is more or less responsive to the vibrations and particularly vibrations representative of tones of low pitch, so that the weight vibrates under the effect of such tones and correspondingly detracts from the reproduction obtained from the diaphragm itself. Consequently phonographic reproductions, particularly of a piano, are characterized by a slurring of the bass notes.

The object of my invention is to provide an improved phonographic apparatus, particularly for reproducing purposes, in which the means for setting up vibrations in a static column of air is susceptible of vibrations of relatively enormous amplitude and wherein the power necessary to effect such vibrations remains practically constant throughout the entire movement.

A further object is to provide a recording or reproducing apparatus in which a compensating weight may be used of great mass, so as to be unresponsive to any of the vibrations of the record but maintaining the stylus in correct relation to the surface regardless of mechanical variations or eccentricities therein, and at the same time the said weight, notwithstanding its great mass, will not impose any undue wear on the wax-like material.

To this end the invention consists, in a broad sense, of employing as a means for setting up vibrations in a static column of air a vibrating piston instead of a diaphragm, the piston fitting very closely but not touching the bore of the casing in which it operates, connected to the stylus so that the two will move in unison, and combined with suitable elastic tension devices for maintaining the stylus in proper engagement with the recording surface or the record as the case may be. Such a vibrating piston is made as light as possible so as to reduce momentum and inertia to a minimum, and it is therefore preferably formed of thin sheet aluminum or magnesium (preferably the latter) having a depending flange, with its body formed with concentric corrugations and preferably provided with radial ribs, so as to be as stiff as possible. With these devices I contemplate using a compensating weight of greater mass than is customary, which is supported on the record itself preferably by an anti-friction roller, and I pivot the stylus lever to this weight in such position that the stylus will be in line with that part of the weight that bears on the record, such as the roller referred to, so that the desired relation of the stylus and the weight will be always maintained.

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

Figure 1 is a sectional view of a reproducing apparatus embodying my present improvements in their preferred form, and

showing the use of a compensating weight; Fig. 2 is a bottom view of the same; Fig. 3 is an enlarged detail view showing the compensating weight and the connection with the stylus lever; Fig. 4 is an enlarged detail view showing the adjustment for the tension mechanism; Fig. 5 is a cross sectional view similar to Fig. 1, showing the apparatus without the compensating weight, as it may be used if the records are sufficiently true; Fig. 6 is an enlarged view showing the construction of diaphragm, and Fig. 7 is a bottom view of the diaphragm.

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

The casing 1 is made preferably of aluminum and is supported in any suitable way with respect to, and is fed longitudinally of, the record 2. The casing 1 is formed with a bore 3, turned very true and from which leads the air passage 4, connected to the usual horn. Working closely within the bore 3, is a piston 5 formed with a depending flange 6 and preferably also a horizontal rim 7, and the main portion of said piston is formed with concentric corrugations as shown, and preferably with radial ribs 8, so as to be as stiff as possible. Preferably the piston is made of thin sheet aluminum or magnesium, while the ribs 8, three or four in number, are made of the same metal secured in place by means of shellac or other appropriate cement. The fit of the piston 5 within the bore 3 is very close, say within .0005 of an inch, so that while the piston is free to move it does not touch the walls of the casing.

Secured to the center of the piston 5 is an aluminum or magnesium tube 9, working in a bearing in the casing 1, as shown and guided by a bearing in the bridge piece 10 secured to the under side of the casing. Preferably the holes for the screws by which the bridge 10 is held in place, are larger than the screws so that after the piston has been properly centered the bridge may be secured in place. The lower end of the tube 9 is formed with a small head 11 to which is secured the upper end of a very fine steel spring 12, connected, as shown, to the end of the stylus lever 13. Such a spring is preferable, but instead thereof an extremely fine chain may be used, such as is employed in the manufacture of certain Swiss watches. The outer end of the stylus lever 13 is curved so that as the lever moves the piston will be actuated in a straight line and will not become jammed in its bore. The stylus 14 is connected at the other end of the stylus lever 13, and the fulcrum of the stylus lever is preferably nearer the stylus so that the movement of the stylus will be amplified at the piston and increased amplitude will thereby be secured.

The stylus lever is preferably formed of metallic aluminum. At its upper end the tube 9 is provided with a small head 15 through which extends a pin with which a spring 16 is connected. The spring 16 is preferably a small elastic band whose upper end is connected to the head 17 on an adjusting rod 18. The adjusting rod passes through the yoke 19 and is preferably square so as not to turn therein. Nuts 20 effect the adjustment of the rod 18. It will be understood of course that instead of a rubber spring, any other kind of a spring may be employed. The spring 16 supports the piston 5 and imposes an upward tension on the stylus lever 13 to keep the stylus always in close engagement with the record surface, and at the same time maintains a stress on the connections between the piston and the stylus lever so as to prevent lost motion. Since the piston is free to occupy any position within the bore 3, it will, by means of the spring 16, be automatically brought to the desired medial point on each side of which it will be vibrated by the vibrations of the stylus and to an amplified extent depending obviously upon the leverage.

When the records are sufficiently true for the purpose and are substantially concentric throughout, the stylus lever 13 as shown in Fig. 5, may be pivoted on an arm 21, depending from the casing 1, the tension mechanism always keeping the stylus in engagement with the record, notwithstanding small variations in the record, but under ordinary commercial conditions a compensating weight is desirable. This weight 22 is pivoted from an arm 23 depending from the casing 1 with sufficient lost motion to permit the stylus to automatically track the record, and the weight is formed with depending lugs 24 between which the stylus lever is pivoted. By reason of the fact that the vibrating piston is susceptible of relatively great movement within the casing, so as to occupy a desired medial position in which it may be drawn by the spring 16, it is no longer necessary with the improved device to float the compensating weight and to practically sustain it from the stylus itself. On the contrary the weight may rest directly on the record, being supported by an anti-friction roller 25 arranged in line with the stylus and of sufficient width of face to bridge over a number of the record grooves, so that no wear will be imposed on the record, nor will the weight be affected by the minute vibrations which characterize the record itself. At the same time any mechanical eccentricities or variations in the record as a whole, will cause the compensating weight to rise and fall carrying the fulcrum of the stylus lever with the same, and permitting the stylus to be always main-

tained in proper engagement with the record surface, notwithstanding very considerable variations in the record.

In the present application I shall not specifically claim the form of device shown in Fig. 5, as I propose, in a separate application, Serial No. 362,596, filed concurrently herewith, to claim that construction specifically. Certain of the claims of this case, however, which may not be limited to the compensating weight, will necessarily include the form of device shown in Fig. 5.

I do not claim herein broadly the suggestion of a diaphragm unsupported at its edge or, in other words, a vibrating piston operating to set up vibrations in a static column of air, because that construction is broadly disclosed and claimed in my Patent No. 500,281 of June 27, 1893. With my prior patent, however, the stylus was maintained in engagement with the record solely by the weight of the piston and the parts connected therewith, and if such piston and connected parts were made light enough to be readily responsive to the sound vibrations, the proper engagement would not be maintained between the stylus and the record; while if made heavy enough to hold the stylus in engagement with the record, the inertia would be so great as to make the device but slightly responsive to the variations of the record. For a successful apparatus some independent elastic tension device is necessary to maintain the stylus in proper engagement with the record.

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

1. A phonographic recording or reproducing apparatus employing in combination a casing, a vibrating piston freely mounted in said casing and adapted to impart sound vibrations to the static column of air therein, a stylus lever connected at one end to said piston, a stylus at the other end of the lever, and a tension device connected with the piston for imposing an elastic pressure between the stylus and the record or recording surface, and for maintaining the connections between the piston and stylus lever under tension, substantially as and for the purposes set forth.

2. A phonographic recording or reproducing apparatus employing in combination a casing, a vibrating piston freely mounted therein, a stylus lever mounted below the casing, a connection between the piston and one end of the stylus lever, a stylus at the other end of the stylus lever and a tension device above the piston for imposing an upwardly acting elastic tension thereon, substantially as and for the purposes set forth.

3. A phonographic recording or reproducing apparatus employing in combination a casing, a vibrating piston freely mounted therein, a stylus lever mounted below the casing, a connection between the piston and one end of the stylus lever, a stylus at the other end of the stylus lever, a tension device above the piston for imposing an upwardly acting elastic tension thereon, and means for adjusting the tension device, substantially as and for the purposes set forth.

4. In a phonographic recording or reproducing apparatus, the combination of a casing, a vibrating piston freely mounted therein, a stylus lever below the casing, a metal spring connecting the piston with the stylus lever and a tension device above the piston for exerting an upwardly acting elastic tension thereon, substantially as and for the purposes set forth.

5. In a phonographic recording or reproducing device, the combination with a casing, a vibrating piston freely mounted therein, an elastic tension device above the piston for exerting upward stress thereon, a stylus lever having a curved end mounted below the casing and a connection between the curved end of the stylus lever and the piston, substantially as and for the purposes set forth.

6. In a phonographic recording or reproducing apparatus, the combination with a casing, a vibrating piston freely mounted therein and adapted to impart sound vibrations to the static column of air in said casing, a compensating weight below the casing, a stylus lever pivoted to the compensating weight, connections between the stylus lever and the piston and means for guiding the movement of said piston in a straight line parallel to the bore of the casing in which it is mounted, and an elastic tension device for exerting elastic pressure between the stylus and the record or recording surface, substantially as and for the purposes set forth.

7. In a phonographic recording or reproducing apparatus, the combination of a casing, a vibrating piston freely mounted therein, a stylus lever below the casing, a stylus mounted on said lever on one side of the fulcrum thereof, connections from said piston to said lever on the other side of the fulcrum, including rigid means and flexible means, and means for guiding the rigid means to prevent movement of said piston other than in a straight line parallel to the bore of the casing in which it is mounted, substantially as set forth.

8. In a phonographic recording or reproducing device, the combination of a casing, a vibrating piston freely mounted in said casing and adapted to impart sound vibrations to the static column of air in said casing, a compensating weight pivoted below the casing and arranged to bear upon the record or recording surface, a stylus lever pivoted to the compensating weight,

connections between the stylus lever and said piston, and a tension device for imposing an elastic pressure of the stylus on the record or recording surface, substantially as and for the purposes set forth.

9. In a phonographic recording or reproducing device, the combination of a casing, a vibrating body, a compensating weight pivoted below the casing and arranged to bear upon the record or recording surface, said weight being free to move with respect to said casing when bearing upon the record or recording surface, a stylus lever pivoted to the compensating weight, connections between the stylus lever and said body, said connections being maintained under stress, and a stylus mounted on the lever and in line with the part of the compensating weight in engagement with the record or recording surface, substantially as and for the purposes set forth.

10. In a phonographic recording or reproducing device, the combination of a casing, a vibrating piston freely mounted in said casing, a compensating weight pivoted below the casing and arranged to bear upon the record or recording surface, a stylus lever pivoted to the compensating weight, connections between the stylus lever and said piston, a stylus mounted on the lever and in line with the part of the compensating weight in engagement with the record or recording surface, and a tension device for imposing an elastic pressure of the stylus on the record or recording surface, substantially as and for the purposes set forth.

11. As a new article of manufacture, a vibrating piston for phonographic recording or reproducing apparatus, made of sheet metal with a depending peripheral flange having a rim at the bottom thereof at right angles to the flange and a corrugated main portion, substantially as and for the purposes set forth.

12. As a new article of manufacture, a vibrating piston for phonographic recording or reproducing apparatus, made of sheet metal having a depending peripheral flange having a rim at the bottom thereof at right angles to the flange and radial ribs, substantially as and for the purposes set forth.

13. As a new article of manufacture, a vibrating piston for phonographic recording or reproducing apparatus, made of sheet metal with a depending peripheral flange having a rim at the bottom thereof at right angles to the flange and a corrugated main portion and provided with radial ribs, substantially as and for the purposes set forth.

This specification signed and witnessed this 25th day of February 1907.

THOS. A. EDISON.

Witnesses:

FRANK L. DYER,

FRANK D. LEWIS.