

(No Model.)

3 Sheets—Sheet 1.

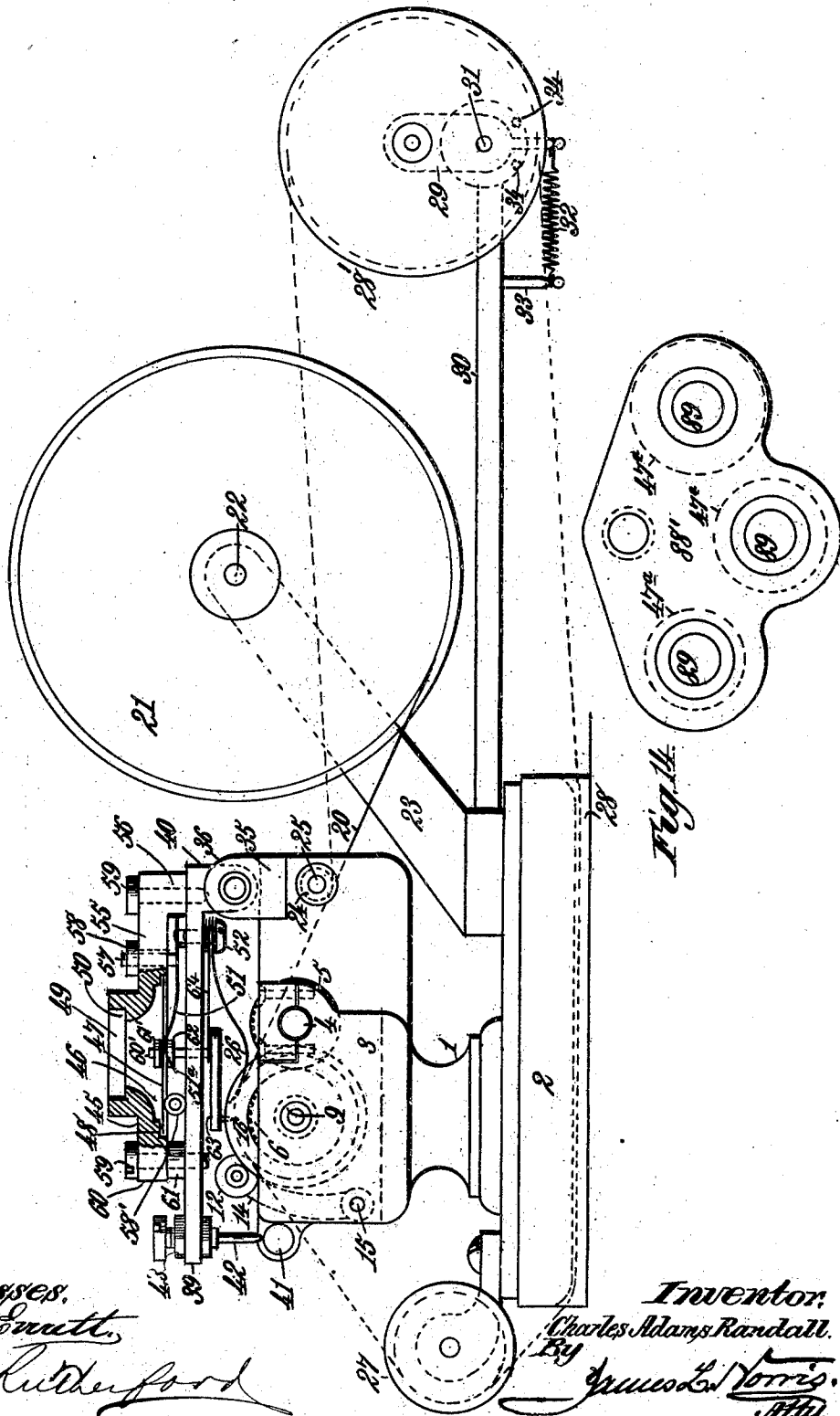
C. A. RANDALL.

APPARATUS FOR RECORDING AND REPRODUCING ARTICULATE SPEECH.

No. 502,383.

Patented Aug. 1, 1893.

Fig. 1.



Witnesses.

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(No Model.)

3 Sheets—Sheet 2.

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Fig. 2.

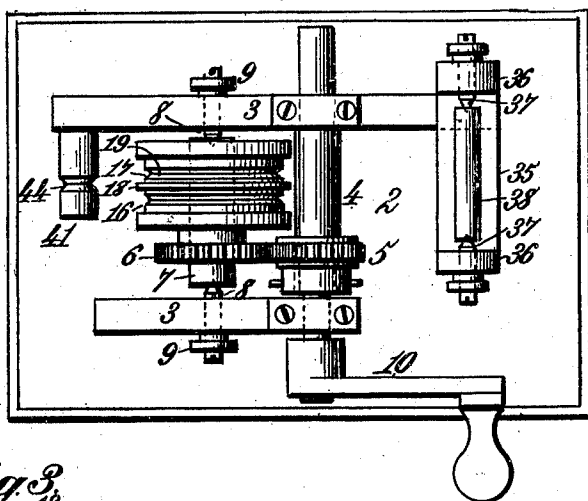


Fig. 3.

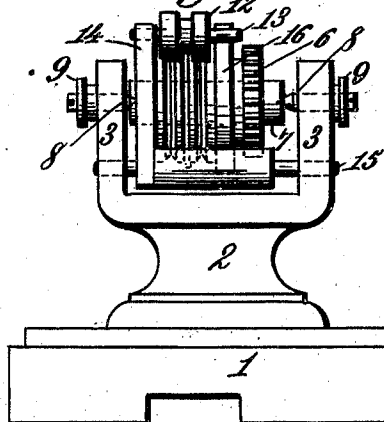


Fig. 4.

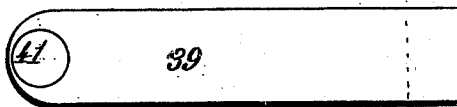


Fig. 5.

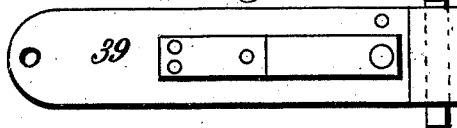


Fig. 6.

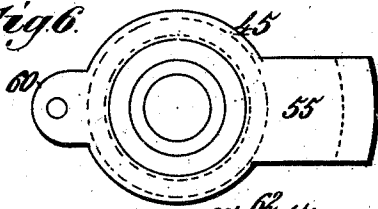


Fig. 7.

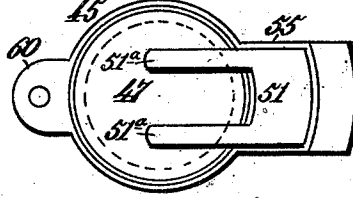


Fig. 9.

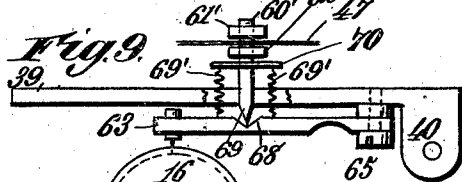


Fig. 8.



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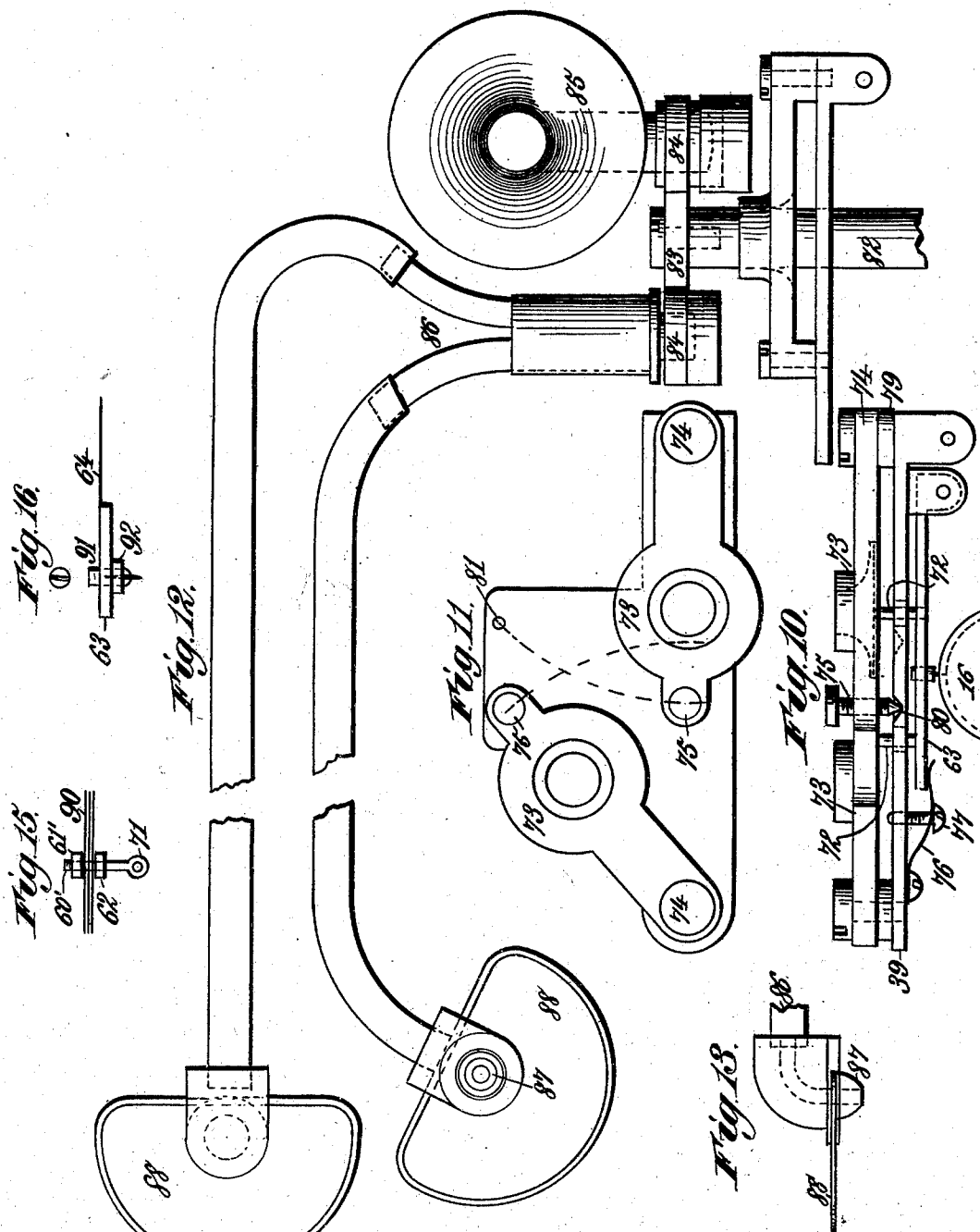
By *James L. Norris.*
Att'y.

(No Model.)

3 Sheets—Sheet 3.

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APPARATUS FOR RECORDING AND REPRODUCING ARTICULATE SPEECH.
No. 502,383.

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UNITED STATES PATENT OFFICE.

CHARLES ADAMS RANDALL, OF LONDON, ENGLAND.

APPARATUS FOR RECORDING AND REPRODUCING ARTICULATE SPEECH.

SPECIFICATION forming part of Letters Patent No. 502,383, dated August 1, 1893.

Application filed August 25, 1892. Serial No. 444,105. (No model.) Patented in England March 14, 1892, No. 4,971, and June 20, 1892, No. 11,476.

To all whom it may concern:

Be it known that I, CHARLES ADAMS RANDALL, a citizen of the United States, residing at London, in the Kingdom of Great Britain, have invented new and useful Improvements in Apparatus for Recording and Reproducing Articulate Speech and other Sounds, (for which I have obtained patents in Great Britain, No. 4,971, dated March 14, 1892, and No. 11,476, dated June 20, 1892,) of which the following is a specification.

My invention relates to phonographic mechanism and the purpose thereof is the provision of simple means whereby an accurately responsive vibration may be given to the recording and reproducing styles, or points.

It is my purpose, also, to simplify and improve the construction and operation of mechanism of this type, to prevent the danger of false vibrations of the diaphragm actuating the recording stylus, or point, to provide means for the better and more accurate feed of the record receiving material and in other respects to provide an improved construction of the individual parts and novel combinations of said parts.

To enable those skilled in the art to understand and to make, construct, and use my said invention, I will now proceed to describe the same in detail, reference being had to the accompanying drawings, in which—

Figure 1 is a sectional side elevation of a phonautographic mechanism organized in accordance with my invention. Fig. 2 is a plan view of the same, the pay-off reel being removed. Fig. 3 is an end view of said mechanism taken from the left hand of Fig. 1. Fig. 4 is a detail view of the pivotally mounted diaphragm-supporting plate. Fig. 5 is a bottom plan view of the same, showing the lever carrying the recording or reproducing styles, or points. Fig. 6 is a plan view of the diaphragm-frame, or housing. Fig. 7 is a bottom plan view of the diaphragm with the adjustable, tension-changing device. Fig. 8 is a detail side elevation of the diaphragm-supporting plate and style-carrying lever, showing a modification in construction. Fig. 9 is a further detail view showing an additional modification. Fig. 10 is a side elevation of the same parts, showing a construction adapt-

ed to the use of a plurality of styles and of diaphragms. Fig. 11 is a partial plan view of the parts shown in Fig. 10. Fig. 12 is a detail side elevation, showing the concentrator, or mouth-piece, and the ear-tubes, or trumpets. Fig. 13 is a detail view showing a feature of construction of the ear-attachments. Fig. 14 is a plan view showing a modified form of diaphragm-supporting plate. Fig. 15 is a detail view showing a special construction of diaphragm. Fig. 16 is a detail view showing one form of stylus.

The reference-numeral 1 in said drawings indicates a pedestal support for the essential parts of the phonograph, said pedestal resting upon a base 2 of any suitable form, both parts being constructed of wood, metal, or any other material suitable for the purpose. Upon the two sides of the pedestal nearest the longer sides of the base 2, are formed, or mounted, two vertical plates 3 rising to suitable height above the top of the pedestal. In the vertical plates 3, not far from their central upper portions, is mounted the principal shaft 4, upon which a driving pulley 5 is made fast. This pulley is geared, preferably by friction, with the face of a driven pulley 6, fast upon a shaft 7 which is usually supported by cone-bearings 8, which are adjustable in the plates 3 and provided with jam-nuts 9, or other suitable means, whereby they may be securely fastened after the proper adjustment is made. Revolution is given to the shaft 3 by any suitable means, such as a crank 10, although I usually substitute some approved type of mechanical power, such, for example, as the electric motor adapted to the operation of the phonograph, or graphophone. Said revolution is imparted, through the pulley 6 and shaft 7, to rolls 12, having comparatively small diameter, and geared with the roll 6 by friction, only. Said friction-rolls are mounted upon a shaft 13, having support in the ends of arms 14, which are pivotally supported at their other ends by a rod, shaft, or bar 15, supported in the vertical plates 3 at or near the ends thereof which lie upon that side of the shaft 7 most remote from the driving shaft, or principal shaft 4. The small friction-rolls 12 rest upon the face of a roll 16, carried by the driven-shaft 7, and having

a face of considerable width, in which are formed two peripheral seats 17, separated by a central rib, or flange 18. Each of these seats is wide enough to readily admit one of the friction-rolls referred to, and allow it to revolve therein by friction contact, the latter being preserved by means of spring-pressure. A circumferential channel, or trough 19 is cut in each seat in the center of the same, or substantially so.

The record-receiving material, is preferably in the form of a ribbon, or ribbons, 20, and is taken from a reel 21, having support upon a shaft, or spindle, 22, mounted in the end of an inclined bracket 23, attached to the base-plate 2. I prefer to use this material in duplicate, by employing two similar strips, or ribbons, which will be led from reels similar to the reel 21 over the top of the roll 16, in the circumferential seats of which the said strips, or ribbons, lie, passing between said roll 16 and the friction-rolls 12. In passing from the reel 21, the material will be brought under a guide-roll 24, which has journal-support upon a stud 25, having support in one of the plates 3, in order that it may, at all times, have the same tangential relation to the roll 12, without material variation of its angle of inclination by the reduction in diameter of the coil of strips, or ribbons, on the reel 21, as the same are paid off by said reel. As the material comes upon the pulley 16, it passes beneath a spring presser-foot 26 which exerts a moderate pressure thereon at a point near the stylus. This presser-foot may, and preferably does, serve as a burnishing, or smoothing device, acting upon the record-receiving material as the latter passes beneath it, and before it reaches the point where it is acted upon by the recording or reproducing stylus. When this material is in simple ribbon-form, it passes, after receiving the record, or after reproducing the same, into any suitable receptacle, such as a basket, or, if preferred, it may be rewound upon a separate reel. It will be understood that this form is in contradistinction to long bands, or ribbons of such material, which are not endless, but are simply wound upon the reel, or reels 21. When used, however, in the form of continuous bands, or filaments, it passes from the pulley, or spool, 28', (the reel, or reels, 21 being removed,) under the roll 25, thence beneath the presser foot, 26, then over the pulley, 6, over the guide-pulley 27, and then passes beneath the base-plate of the machine. After leaving the pulley 16, the material passes over a guide-roll 27, if used in the form of continuous bands, and thence goes beneath the base-plate 2, which is provided with suitable channels, or guide-ways, 28, to guide the endless band, or bands, back to the pulley from which they are paid off. When using material of this form I prefer to use a pulley 28' instead of the reel 21. This pulley 28' is journaled in the upper end of a post 29,

pivoted in an extension-piece 30, projecting from the end of the base-plate 2. The pivotal axis 31 of the post 29 is horizontal, or practically so, and the reduced end of the post extends below the said axis and provides a means of attachment for one end of a spiral spring 32, the other end of which is attached to a rigid support 33. The tension of this spring draws the journal supports of the pulley 28 toward the right-hand, as seen in Fig. 1, and thereby affords a steady, uniform tension for the record-receiving material, which may be varied in any manner and to any degree required. The pivotal movement of the post 29 is limited by two stop-pins 34, between which the lower portion of said post turns.

Upon one of the vertical plates 3, immediately above the guide-roll 24, is mounted a bracket 35, having opposite lugs 36, (Fig. 2) in which are arranged cone-bearings 37, which give support to the ends of a shaft 38, either of solid or tubular form, and having suitable recesses in its ends to permit the engagement of the cone bearings.

The shaft 38 gives support to a swinging plate 39, having lugs 40, at one end, said lugs projecting at right angles with the flat, lower face of the plate and having openings which receive the shaft 38. The plate 39 extends over the pulley 6 and friction rolls 12, its length being such that its free end overhangs a fixed bar 41, rigidly mounted in the vertical plates 3. Through the end of the plate 39 is passed an adjustable stop-pin 42, the point of which has bearing upon the fixed bar 41, and affords support to the said plate, the stop-pin being rendered adjustable by means of nuts 43 turned thereon, one above and the other below the plate. The fixed bar 41 is provided with a groove, or circumferential channel 44, which receives the end of the stop-pin 42.

Upon the plate 39 is mounted the diaphragm carrier, which consists substantially of a housing, or frame 45, having a suitable diaphragm-chamber 46, lying above the diaphragm 47, which is arranged in an annular, undercut recess, or seat 48. Above the diaphragm-chamber, or in the upper part of the same, is formed a concentric opening 49 having a seat 50 for the insertion of a mouth-piece, or concentrator, or for the attachment of the sound-conducting tubes, trumpets, or other devices.

The diaphragm 47 is not positively secured in the seat 48 provided for it, but is held in place by an elastic strip, or filament 51, rigidly attached at one end to the plate 39 by a screw, or bolt, 52, which also holds the presser-foot 26. At its other end the elastic strip or filament 51 is bifurcated, or provided with arms 51^a arranged on opposite sides of the center of the diaphragm 47. Projecting from one side of the diaphragm housing, or frame, 45, is a tongue, or plate 55, which extends to, or nearly to, the end of the plate 39, where it has a downwardly projecting lip, or extension 56,

resting upon the plate. Between this point and the diaphragm-chamber 46, is a threaded pin 57, which is passed through the tongue 55 and has its lower end affixed to the elastic strip, or filament 51, a nut, or equivalent device 58 being turned upon the end of said pin rising above the plate. By adjusting this nut the pin 57 may be raised, or lowered, and the diaphragm 47 may be thereby placed under tension to any required degree; or, on the other hand, it may be released so far as to restore its highest sensitiveness and maximum amplitude of vibration. In order to deaden, destroy, or prevent false vibration, one or more dampers 58' may be used, formed of any material suitably irresponsive to phonetic vibration. I have found that a short piece of elastic, or flexible, rubber-tubing, of suitable diameter, will answer the purpose proposed excellently, and the damper shown in Fig. 1 is of this character.

The diaphragm-frame, or housing 45 is secured to the plate 39 by screws 59, one passing through the tongue 55, and lip 56, and the other through a lug 60, opposite said tongue. A washer nut 61 is placed beneath the lug 60, to supply the place of a lip similar to the extension 56, upon the tongue 55.

The connection between the diaphragm 47 and the recording point, or style, is a matter of much importance, as there should be the utmost freedom of movement and all danger of causing lost motion must be carefully avoided. I regard it as desirable, also, that the style be carried by a lever, intermediate of said style and the diaphragm, to increase the amplitude of vibration of the recording point. It is important, also, in order to obtain the best results, that the connection between the style and the diaphragm be of a certain rigid character, but without imposing strain or tension upon the diaphragm, or upon any part, or parts thereof, in excess of any other part, or parts, should the circumstances of the case render it impossible to entirely avoid the imposition of strain, or tension upon said diaphragm, which should possess the maximum sensitiveness to all phonetic vibrations. I prefer to make the connection of these parts by means of a post 60' having one end passing through the diaphragm 47 at, or near, its central point and connected thereto by two nuts 61' and 62, both turned upon the threaded end of the post one below and the other above the diaphragm. The other end of the post 60' hangs below the diaphragm and is suitably connected to a lever 63, the point of connection being quite near one end, which projects from said point toward the pivotally supported end of the plate 39, just far enough to afford a secure attachment for the end of a flat-leaf-spring 64, which is rigidly mounted by one end upon the under side of the plate 39, quite near the pivotal end thereof, where it is secured by means of a screw 52, the latter also forming the means of attachment of the presser-foot or burnisher

26. The post 60' may, if preferred, be attached to the diaphragm 47 by cement, in lieu of the means described. In this case, the nuts 61' and 62 may be applied to the lower end of the post, one above and the other below the lever 63.

A substitute construction of the parts last described is shown in Fig. 8, in which the lever 63, on which the style is mounted, is given pivotal support upon drop-brackets, or lugs, 66, by cone-bearings, or other suitable means. In this modified form I consider it preferable to arrange the point of connection of the post 60' at, or about, the same distance from the point of connection to the plate 39 shown in Fig. 1, the main difference being that the lever 63 is continuous between said points, in place of the flexible, elastic connection 64. The latter may be dispensed with, however, and the lever may be continuous, as described above, its end being secured by the screw or bolt, 65, in the same manner as the leaf-spring 64. To provide for the required elasticity, in the absence of the said leaf-spring, the body portion of the lever may be cut away, Fig. 9, or the entire end of the lever may be reduced in thickness to any desired, or suitable degree. In this substitute form the lever is provided with a V-shaped notch, or cone-shaped seat 68, which receives the pointed, or tapered end 69 of the post 60'. A suitable clearance of the contacting parts is provided, in order to permit a slight rocking movement, or change of angularity, may be made as the post and diaphragm partake of the vibratory movement of the diaphragm. The post 60' is held in engagement with its seat 68 in the lever by means of springs 69' one or more, of light tension. The post will be preferably secured to the diaphragm 47 by means of nuts 61' and 62, as already described. If more than one spring 69' is used to hold the post in engagement with its seat 68, their upper ends may be connected to cross-pin, or to a light spider 70, which is mounted on the post 60' beneath the lower nut 62, the other ends of said springs being connected to the lever in any suitable manner. I may, however, without any material variation, use a single spring, of slightly greater force, to make the connection last mentioned. In this case the spring will preferably be of such diameter that it will surround the post at a proper distance therefrom, in order to exert its force without any interference with the slight oscillation, or change of angularity of said parts, as the diaphragm and post rise and fall and raise and depress the end of the lever which carries the style, or styles.

In Figs. 8, 10 and 11 I have shown certain modifications of these parts. In Fig. 8 the stylus is carried by the lever, as already described, but the post is connected to the diaphragm by means of nuts, 61' and 62, one on each side the diaphragm. The post 60', in this construction, is connected to the lever 63 by means of a pivot joint 71. In Fig. 10 I have

shown the style-supporting lever 63 as provided with two upright studs 72, which pass freely through the arm 39, which supports the diaphragms. In this form I contemplate the use of a plurality of diaphragms, both carried by the plate 39. Said diaphragms are arranged in housings 73, which have pivotal attachments 74 to the plate 39, their free ends being provided with adjusting screws 75, whereby the exact degree of impact of the diaphragms upon the ends of the upright studs 72 may be made. A damper-spring 76 is provided, mounted on the under side of the plate 39 and having its end bearing beneath the free end of the lever 63. A tension-adjusting screw 77 is provided, also, to enable the operator to increase the tensional action. In this form the diaphragm-housings 73 are mounted on the diaphragm-carrying plate 39, by means of the pivotal connections 74, an interval of separation being obtained by means of washers, or nuts, 79, placed upon the screws between the two. In order to place the diaphragms correctly seats 80 are formed in the plate 39, in which the points of the adjusting screws 75 will rest. Either diaphragm may thus be swung into, or out of, position for service. Similar seats 81 may be formed at suitable points to permit the like engagement of the points of said screws when the housing 73 is swung into such position as to render the diaphragm inoperative.

I provide, in some instances, a post 82, which rises from the base 2, and supports a pivotally turning piece 83, in which are two diaphragm-openings 84 arranged in a manner to receive a mouth-piece, or concentrator, 85, or listening-tubes, 86, to which suitable ear-attachments are connected. I prefer to construct said ear-phones with a nozzle 87, loosely fitting the ear, or resting upon, or over it. A supporting-plate 88 is attached, formed of metal, or other suitable material. This supporting plate fits over and is supported by the external ear.

The projecting ends of the plate carried by the post are provided with a tubular curtain of silk, textile fabric of any kind, or any other suitable material, fitting around the end of the tubular diaphragm-housing, when the plate is in position for use, and forming a soft non-vibratory connection between the parts, especially useful in reproducing, as it largely prevents and deadens the disagreeable scratching and other sounds set up by the movement of the material and by the moving parts of the apparatus. These sounds are conveyed to the ear by the molecular vibration of the solid portions of the mechanism, and are frequently confusing and sometimes practically extinguish the articulating vibrations.

In Fig. 14 I have shown a diaphragm-plate 88', having three diaphragm-openings 89, adapted to diaphragms 47^a of varying diameter and therefore of different susceptibility to respond to sound-vibrations. These diaphragms may be of the same, or of different material and held and damped in different ways, to adapt

them to respond to different voices and sounds of varying force, or phonetic intensity. I also provide a diaphragm 90, of special construction. I have found, in practice, that a diaphragm composed of a plurality of disks, or plates, such as thin mica, or mica combined with other suitable material, or all made of wood with the grain running in different directions is of great advantage, being less rigid than a single disk of the same thickness. It is less affected also, by temperature and is more effectively responsive to articulation. It produces, also, less false vibrations than diaphragms of other construction. I have shown this compound diaphragm formed of three disks held together by the central post 60', but they may have other means of connection, either central, or non-central.

I use any preferred form of stylus, but prefer a point of small, hardened steel-wire, placed in a tubular, split socket, 91, having a thread to receive a nut 92, by which the socket may be closed.

I prefer, in some instances, to use a plurality of points, or styles, upon the single point-carrying arm 63. This construction is shown in Fig. 5, in which the reference numeral 63, indicates the point-carrying arm, and the numerals 63^a, 63^b, a pair of styles, or points, mounted thereon in the usual manner, or in any preferred way. As I prefer to use the record-receiving material in duplicate, as already described, a plurality of points, or styles is necessary and they will be mounted on the single point-carrying-lever, as set forth and receive their vibrations from a single diaphragm.

What I claim is—

1. In a phonographic apparatus a support for the record-receiving material, a swinging-arm adjustable, relatively to said material, an independent, point-carrying arm, diaphragms secured to the swinging arm and a swinging piece carrying the concentrator upon one side and the ear-tubes and phones on the other side of the axis of movement of the swinging piece, substantially as described.

2. In an apparatus having a record-receiving, or record-containing material the combination with means for moving the same, of one or more suitably held styles or points, a diaphragm and an adjustable tension-regulator exerting a variable pressure upon the diaphragm within the line of its marginal attachment, and between the same and the recording or reproducing point, substantially as described.

3. In a phonographic apparatus a rotating support for the continuous record-receiving band, suitable supporting and guiding-rollers, a diaphragm and means, substantially as shown, for keeping the latter under tension, the tension-devices having surface-contact with the face of the diaphragm at a plurality of points between the center and the line of marginal attachment, substantially as described.

4. In a phonographic apparatus, a pivoted, point-carrying arm, or lever, a diaphragm, and a connecting-piece between the diaphragm and said point-carrying arm, a rigid connection being formed between the latter and said connecting piece, and constituting the sole support of said point-carrying-arm, substantially as described.

5. In a phonographic apparatus, a pivoted or vibrating, point-carrying lever, upward projecting studs thereon, a dampener, swinging diaphragm-carriers and diaphragms and a swinging arm supporting such parts, substantially as described.

6. In a phonographic apparatus a recording-diaphragm and a reproducing-diaphragm each of different tension and constructed to be swung, or moved into and out of position for use independently, substantially as described.

7. In a phonographic apparatus, separate recording and reproducing-diaphragms upon a support common to both and arranged to be moved into and out of use independently of each other, in combination with an independently supported arm or lever carrying the point or style, one or more, for recording or reproducing, and having loose contact with the diaphragms, substantially as described.

8. In a phonographic mechanism, the combination with a support for the record-receiving material, a diaphragm, a supporting arm for the diaphragm-housing, or frame, and an elastic dampener between the lower face of said diaphragm and said supporting-arm, and eccentric to the central point of attachment of the point, or style, substantially as described.

9. In a phonographic mechanism, the combination with a diaphragm-frame, or housing, of a diaphragm loosely placed in a seat in said housing and an elastic strip, or filament, having non-central contact with the diaphragm at a plurality of points pressing the diaphragm upward and retaining it in its place in said housing, substantially as described.

10. In a phonographic apparatus, the combination with a diaphragm-frame, or housing, of a diaphragm loosely placed therein, an elastic strip or filament having surface-contact with the said diaphragm at a plurality of points, and exerting an upward pressure upon the diaphragm to hold it in its seat, and means

for varying said pressure substantially as described.

11. In a phonographic apparatus a movable or vibratory point-carrying arm or lever provided with a V, or cone-shaped recess or seat, a diaphragm, an adjustable connecting-piece between the arm or lever and the diaphragm arranged to rest or bear in the V, or cone-shaped seat in the lever, and means for holding the same together with a yielding contact by spring-tension, substantially as shown.

12. In a phonographic apparatus the combination with two or more styles of two or more recording diaphragms having different tensions as and for the purpose set forth.

13. In a phonographic apparatus two or more recording-diaphragms, having different tension, rigidity, or elasticity, fixed upon a support common to all and arranged to be moved into and out of place interchangeably, substantially as and for the purpose set forth.

14. In a phonographic apparatus, the combination with a diaphragm of an adjustable arm supporting the housing, or casing, of said diaphragm, and a soft, non-vibratory connection between the diaphragm and said arm, substantially as described.

15. In a phonographic apparatus, the combination with a single vibratory arm, of a plurality of styles, or points, carried by said arm and a diaphragm adapted to vibrate said arm, substantially as described.

16. In a phonographic apparatus, the combination with a single diaphragm of a single vibratory arm having rigid connection with said diaphragm at or near one end and a plurality of styles, or points, carried by the said arm, and arranged to operate upon different ribbons, or strips, of record-receiving material, substantially as described.

17. In a phonographic apparatus, the combination with a diaphragm composed of a plurality of disks, or plates, of the same diameter and having a common point of support, of a point, or stylus, connecting all of said diaphragm plates, or disks, substantially as described.

In testimony whereof I have affixed my signature in presence of two witnesses.

CHARLES ADAMS RANDALL.

Witnesses:

THOMAS LAKE,
T. T. BARNES.