

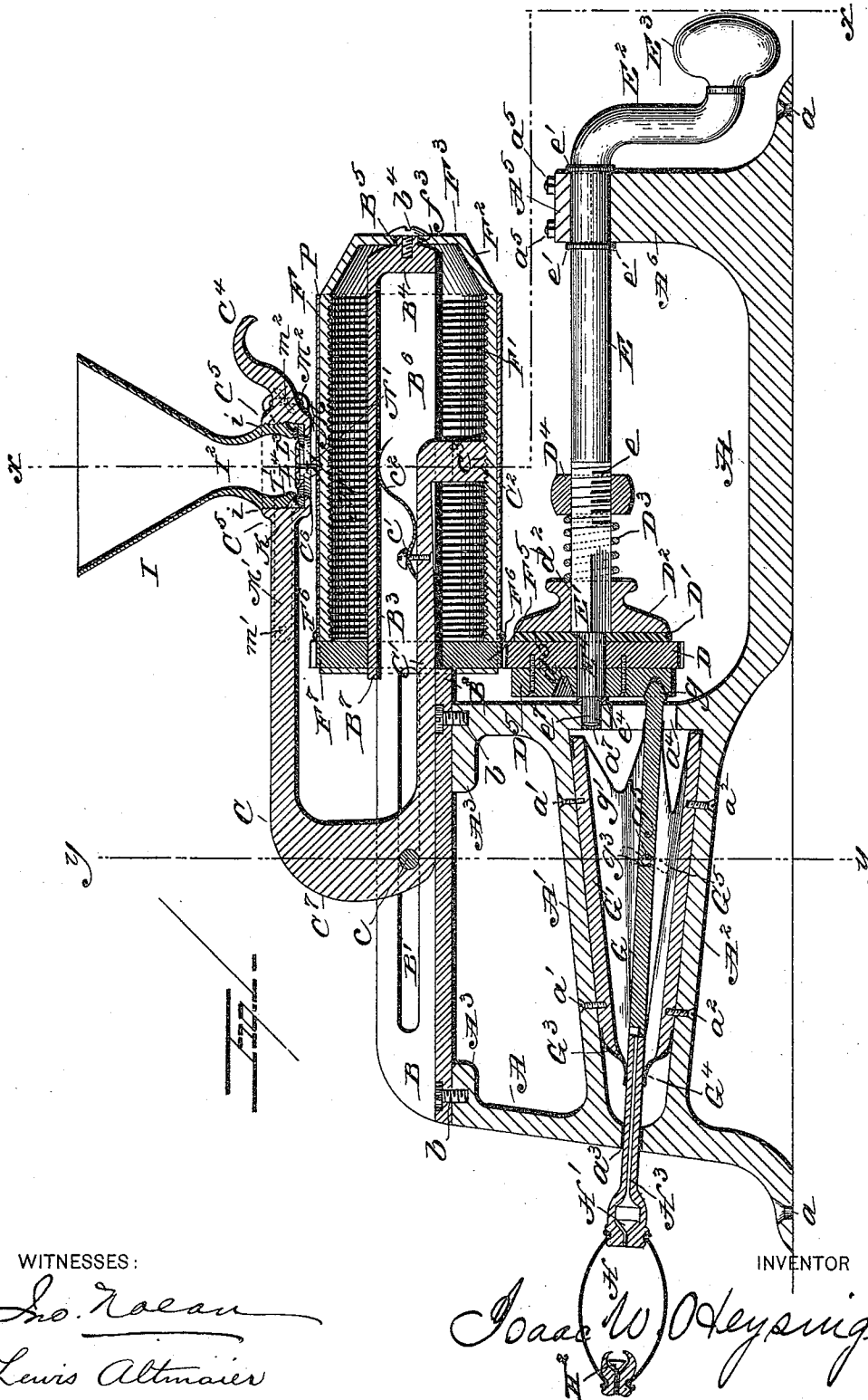
(No Model.)

3 Sheets—Sheet 1.

I. W. HEYSINGER.
PHONOGRAPH.

No. 440,155.

Patented Nov. 11, 1890.



WITNESSES:

Geo. Raean
Lewis Altmaier

INVENTOR

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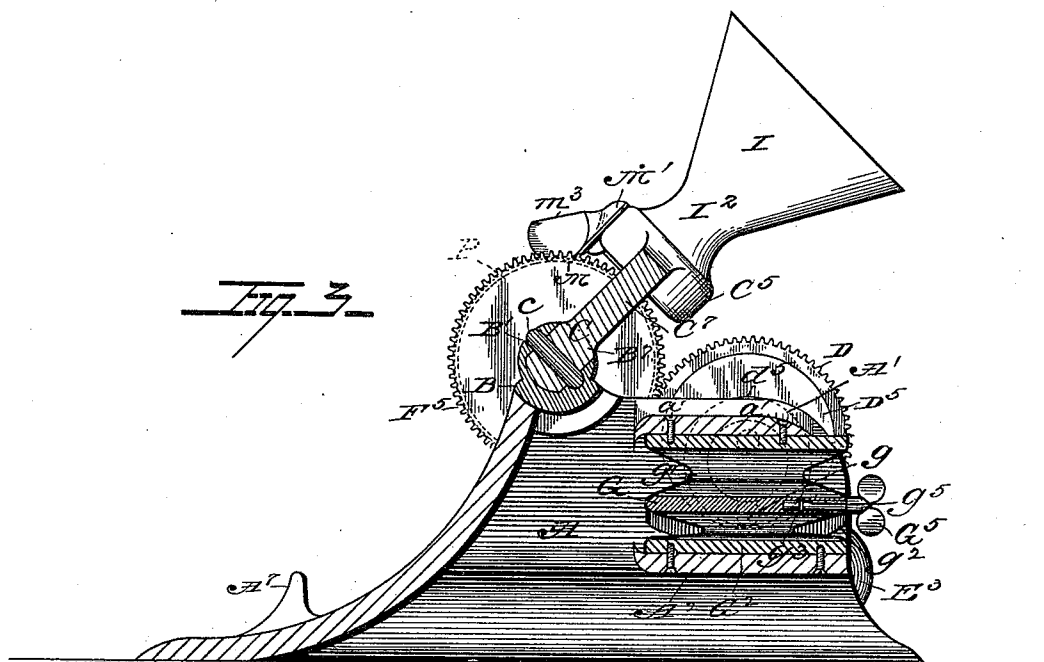
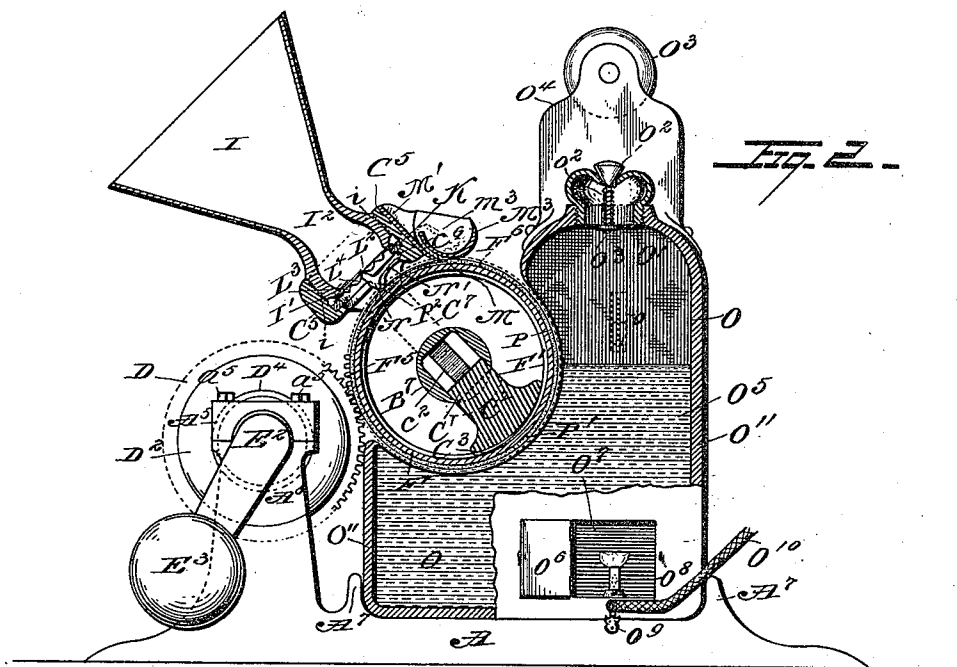
(No Model.)

3 Sheets—Sheet 2.

I. W. HEYSINGER.
PHONOGRAPH.

No. 440,155.

Patented Nov. 11, 1890.



WITNESSES:

Thos. Keen
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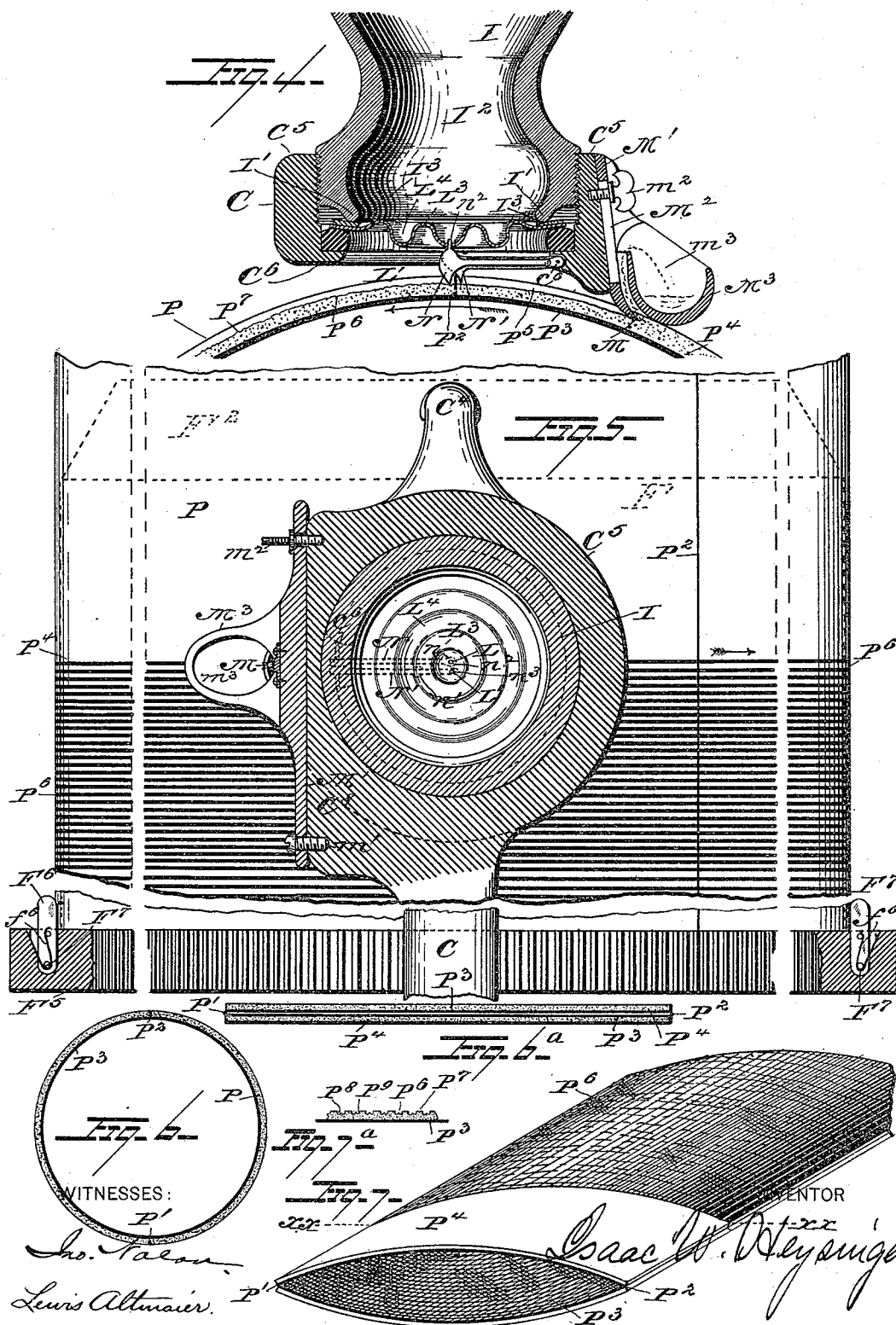
INVENTOR

Isaac W. Heysinger

3 Sheets—Sheet 3.

No. 440,155.

Patented Nov. 11, 1890.



UNITED STATES PATENT OFFICE.

ISAAC W. HEYSINGER, OF PHILADELPHIA, PENNSYLVANIA.

PHONOGRAPH.

SPECIFICATION forming part of Letters Patent No. 440,155, dated November 11, 1890.

Application filed February 7, 1888. Serial No. 263,282. (No model.)

To all whom it may concern:

Be it known that I, ISAAC W. HEYSINGER, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a certain new and useful Improvement in Phonographs, of which the following is a full, clear, and exact description, reference being had to the drawings accompanying and forming a part of this specification, in which—

Figure 1 is a side elevation of a phonograph embodying my invention, partially shown in section and the parts relatively somewhat displaced to more clearly show the construction, the heating-vessel O not being shown in the figure. Fig. 2 is a transverse vertical section along the dotted line *xx* of Fig. 1, the parts being shown in proper relation as made for use. Fig. 3 is a transverse vertical section along the line *yy* of Fig. 1, seen from the rear, the section shown in Fig. 2 being looked at from the front. Fig. 4 is an enlarged transverse vertical section of the funnel, diaphragm, grooving and indenting mechanism, and recording-tablet as in use, the same detached from the other parts of the machine. Fig. 5 is a top view, partly sectional, of Fig. 4. Fig. 6 is a view of the collapsible tablet expanded into a cylinder, as when placed in the machine for use. Fig. 6^a is the same flattened for mailing purposes, or for preservation. Fig. 7 is a perspective view of a tablet collapsed and having its surface partly written over in the machine; and Fig. 7^a is a transverse sectional view of the written surface of Fig. 7, showing the grooves and lines of writing when two indenting-points are used.

The lettering in all the figures is uniform.

My invention relates to the construction of a phonograph or instrument for recording and reproducing the sounds of the voice, &c., by mechanical means, in which the words spoken are made to act upon a vibrating diaphragm, and by the movements thereof are indented upon a comparatively soft or yielding surface, to be subsequently reproduced by moving the said surface under and in contact with a stylus attached to the said movable diaphragm, or one similar thereto, in which certain improvements, as hereinafter described, enable the same to be accomplished

more perfectly and the records to be preserved with greater security than with those now in use.

The first part of my invention consists in the use of a rotating cylinder, which carries the recording-surface supported upon a central bearing or rod extended along within the said cylinder and supported by the frame of the machine at one end only, so that one end of the cylinder is constantly free, so that the cylindrical tablet may be slipped over the free end of the cylinder or removed therefrom at any time without interfering with the other parts of the machine.

The second part of my invention consists in making this rotating cylinder hollow and providing its inner surface with an accurately-threaded screw from end to end, and against this screw-threaded surface engages a threaded block.

The third part of my invention relates to the use of a plow point rigidly secured to the arm or its attachments and not to the vibrating diaphragm.

The fourth part of my invention relates to the use of a tablet composed of a comparatively-hard substance adapted to protect the writing against rough usage, but capable of being made soft and plastic by the use of heat or chemicals, so that the tablet or surface is used in the machine in a soft and plastic state, but afterward when cooled or immersed in a chemical bath, or otherwise treated, it becomes hard and resistant and is capable of being put away for future use or sent through the mails without defacement or injury.

The fifth part of my invention relates to the use of a heater to be removably applied to my phonograph, in which heated surfaces are brought nearly in contact with the rotating tablet to soften it for the recording devices.

The sixth part of my invention relates to the means whereby I bridge over the split sides of my collapsible tablet when used in the machine. These split sides when the tablet is put upon the cylinder are brought very closely together, and the plow still further brings them together; but it often happens that when put on for reproducing the sounds there may be some indistinctness at this point. To

prevent this and to improve the quality of the sound generally, I use a double indenting-stylus consisting of two points side by side.

The seventh part of my invention relates to the construction of the diaphragm and its surrounding parts. It is desirable to have this vibrating diaphragm quite sensitive to the undulations of sound, and for this purpose I make it of a thin, elastic, and resonant plate of metal or hard rubber or other equivalent material, and I form it with a series of circular concentric corrugations or waves with a flat outer rim, so that its elasticity and the mobility of its center are much increased, and whereby also the middle part is not only capable of being raised or lowered by the waves of sound, but also tilted from one side to the other somewhat as the sound vibrates at an angle to the axis of the diaphragm.

The eighth part of my invention relates to the means whereby I equalize the rotation of the recording-cylinder, so that the record will be characteristic and regular.

The detailed description hereinafter given will exhibit certain other matters of construction and arrangement which form a part of my invention, and which I shall illustrate by letters and reference to the drawings.

Referring now to the drawings, A is a framework of metal, adapted to stand upon a table and provided with screw-holes *a a* for attaching the same securely.

A⁶ is an elevation, which terminates in a bearing for the driving-shaft E, seated at A⁵. The shaft E is provided with flanges *e' e'*, to prevent longitudinal motion of the same. The rear end *e'* of the shaft E is journaled into an upright extension of the base A at *a'*, Fig. 1, and its forward end is provided with a handle E² and a hand-knob E³ for operating the same, though gearing, weights, or springs may be used instead, if desired. The shaft E is screw-threaded at *e*, and a hand-nut D⁴ is fitted thereupon.

D³ is a coiled spring around the shaft E, which is compressed by the nut D⁴ against the collar D², which slides to and fro along the angular part E' of E, and rotates with it. The collar D², having an angular opening *d'* at its center, fitted loosely upon E', is provided with a flanged rear surface, having a smooth face, and it bears against a leather disk D', which in turn is forced against the smooth face of the spur-wheel D, which turns freely upon the cylindrical part E⁴ of the shaft E. Attached to the rear side of the spur-wheel D and moving with it is a cam-plate D⁵, having in its rear face, Figs. 1 and 3, a cam-groove *d'*, circular in form and eccentric to the bearing of D. This cam-groove *d'* is tapered, so as to be narrower at the bottom.

A' and A² are supports formed upon the frame A, to the inner sides of which are secured bellows-leaves G' G², and between them is the vibrating leaf G, the bellows being formed and made air-tight by the leather or other folded sides *g' g'*, Figs. 1 and 3. The

middle leaf G extends forward from the bellows and terminates in a conical pin or roller *g*, which enters the cam-groove *d'* and is controlled thereby.

e' is a little washer, or a number of washers, interposed between the journal *e'* of the shaft E and its seat *a'* in the frame-work A. As the action of the spring D³ forces back the spur-wheel and cam against the washers *e'*, a firm seat will be had in the cam-groove *d'* by the pin *g*, and as wear occurs one of these washers can be removed or a thinner one substituted to compensate for wear and prevent play or looseness.

The middle leaf G of the bellows is provided with an opening, preferably a slit *g'*, connecting the two sections of the bellows, and a cock G⁵ is inserted in the body of this middle leaf projecting at the side, Figs. 1 and 3, and provided with a thumb-piece, as shown. The stem of this cock is also perforated or slitted transversely, so that it may be rotated to close the slot entirely or regulate the size of the opening, as in a gas-burner cock, for instance. There is no other communication between the two sections of the bellows, and there is no external opening except where in rear is attached a small force-pump or rubber-ball syringe having valves closing outward, (see H H' H² H³, Fig. 1,) by means of which air can be forced into the bellows and pressure maintained therein. The operation of this part of my invention is as follows:

When the shaft E is rotated and proper tension is made upon the collar D² by the nut D⁴ acting through the spring D³, the collar D² will rotate with the shaft E and carry around with it the leather disk D', and this in turn will by its friction carry around with it the spur-wheel D and the cam-wheel D⁵, attracted thereto by the screws *d'* *d'* or otherwise. As the cam-wheel rotates, the pin *g* of the bellows will rise and fall as the eccentric cam-groove *d'* changes its position with reference to the surrounding parts. As the pin *g* rises and falls, the middle leaf G of the bellows will rise and fall and the contained air will be forced through the slot *g'* to and fro. If the cock G⁵ is turned entirely off, the air cannot pass through the slot *g'* and the leaf G cannot rise or fall, and hence the cam-groove cannot change its position nor the spur-wheel D rotate, but the collar D² will slip upon the friction-disk D'. If the cock G⁵ is turned a little way on, the motions will be slow, and they will increase in rapidity as the cock is turned on more and more. As compressed air is used, the reversal of direction of the leaf G will make no slip, the pressure being constant, so that a practically even and regular motion of the spur-wheel D will be secured so long as the motion of rotation of the shaft E is in excess of that of the spur-wheel D, and this relative speed can be regulated by the cock G⁵.

While for illustration I set forth very clearly the specific construction, I do not con-

fine myself to the use of a wind bellows or the specific friction devices or eccentric cam-groove shown, but use other mechanical equivalent for one or another part, as piston and cylinder, other fluid besides air, other frictional contact, and other mode of reciprocating the piston besides a cam-groove on the face-plate eccentric to its axis, and so, also, for the specific details of other parts of my invention.

The spur-wheel D gears with the spur-wheel F⁵, which rotates the cylinder of my phonograph. The construction is as follows: A bar B, Figs. 1, 2, and 3, is attached at its rear end *b b* by screws or otherwise to an elevation of the frame-work A at A³ A³ and extend forward over the base parallel with the shaft E. This bar B is longitudinally grooved, the rear half B² cut out or open above, and the front half B⁶ open below, and the front end B⁴ is a solid head provided with a journal B⁵. Along the rear half is a transverse slot B' to admit a cross-pin *c*, forming a sliding bearing. At B⁸, Fig. 1, a shoulder is formed, as shown. The cylinder F, which carries the plastic tablet is made hollow and has a funnel-shaped end F² to enable the tablet to be more readily applied; but this may be dispensed with in whole or in part, if desired. The end of the cylinder F is closed and is provided with a perforation *f*³, through which passes the journal B⁵ of the supporting-bar B, and the headed screw *b*⁴, seated in the end of B, holds all in place, permitting rotation only. At the rear end of the cylinder F is attached the spur-wheel F⁵, larger than the cylinder, preferably, and having a large central opening, which passes over the bar B, (made cylindrical to form a journal,) and the cylinder F is thus supported to rotate upon bearings at its opposite ends.

B⁸ forms a shoulder against which the rear face of the spur-wheel bearing is supported, as shown. The cylinder projects from end to end free from other support, and a tablet can be applied or removed without disturbing the machine in any part. As the spur-wheel F⁵ is geared to the driving spur-wheel D rotation of the shaft E will operate the cylinder F with a regular and uniform motion.

The hollow cylinder F is internally screw-threaded from end to end with an accurate and slow-pitched thread, so that the screw operates to the right side, and from the left when the handle E³ is rotated in a right-hand direction.

C is a U-shaped arm, having its lower half extended along the slot in the bar B and its upper half extended over the upper surface of the cylinder F. At the bend C⁷ in rear is a cross-pin *c*, which traverses the cross-groove B', so that the U-shaped arm C may be slipped to and fro along the bar B, the upper part traversing along over the cylinder as the lower part traverses along within the cylinder. At the forward and upper end is a hook C⁴, which enables the hand of the operator to seize it and move the arm C along the cylinder, as de-

sired. The lower half of C is prevented from side motion by the sides of the bar B, as shown in Fig. 2. At the lower end of C is a downward projection C², expanded to form a segment of a cylinder, Fig. 2, and its lower surface screw-threaded to fit the threads of the internal screw F' of the cylinder F. As the cylinder is rotated, the arm C will be seen to travel to and fro with a slow motion corresponding to the pitch of the screws F' and C². A spring *c*², attached to the upper surface of the arm C within the cylinder, bears at its free end against the under side of the closed part B³ of the longitudinal slot B⁶ of the bar B, so that when the arm C is lifted by the thumb-piece C⁴ the sectional screw C³ will be raised to clear the internal threaded surface of F and the arm may be moved longitudinally along the cylinder, and whenever the thumb is released from C⁴ the spring *c*² will bring down the free end of the arm C and cause the threaded surface thereof to again engage with the internal screw of the cylinder. The spring *c*² slides along the under surface of B³, and a set-screw *c*' varies the strength of the spring and the resistance of the arm C, as may be desired.

The upper part of the arm C (see Figs. 4 and 5) is provided near the thumb-hook C⁴ with an enlargement C⁵, pierced with a circular opening, screw-threaded internally and provided with an inturned lip or flange C⁶ at its lower side. Upon this inturned lip rests a ring of elastic india-rubber K, and upon this is laid, so as to close the opening in the arm C, a thin, resonant, elastic diaphragm L, supported at its edges by the elastic ring K. The conical funnel I, bell-shaped above, is provided with a neck I³, and then is again expanded downwardly to face the diaphragm, and the outer surface of its lower part, which forms a ring *i*, is threaded to engage with C⁵ and is screwed down upon the outer edge of the diaphragm L. A lip I' is carried inward, Fig. 4, from the lower edge of the ring *i* to bear upon the top surface of the diaphragm slightly within the line upon which it rests over the elastic ring K, so that the funnel I may be screwed down in its socket, and by so doing the lip I' will engage with the diaphragm and tend to force down the middle part of the same, so as to present a slightly-convex surface toward the cylinder; or this convexity may be presented upwardly, if desired, though I prefer to make it as shown. The object of this is to limit the vibration of the diaphragm somewhat in an upward direction, but give it the greatest freedom downwardly. I sometimes interpose a small disk or ring I³ open at its center between the lower lip of I and the diaphragm L to prevent rattle; but if the ring *i* be well screwed down it will not be necessary. I show the ring *i* and the regulating-screw, which closes down upon and compresses the periphery of the diaphragm, formed integral with the funnel or cone I; but it may be made separate,

if desired. The funnel forms a convenient handle to operate it, as I have shown it in the figures.

To increase the amplitude of the vibrations of the diaphragm and to enable it to undulate laterally, I form my diaphragm with a series of concentric corrugations or circular bends $L^3 L^4$, which enable the middle of the diaphragm to be, so to say, drawn out or thrust in by the waves of sound, and also to wave or undulate from side to side or angularly as the waves of sound act upon the upper surface of the same more freely than when a plane surface is used. I graduate these corrugations for the special uses of the instrument and increase or diminish them in number, depth, or size, substituting one for another, as may be preferred.

I make my diaphragm of metal, or, preferably, of hard vulcanite, though chemically-prepared paper, cellulose, or other substances may be used, if preferred. As shown in the figures, the adjustment of the diaphragm is produced by screwing down the cone or funnel I, which compresses the elastic ring K and brings the diaphragm L more and more near to the cylinder F and its plastic covering P. Of course any form of diaphragm or compressing-spring may be used with these adjusting devices; but I prefer to use the corrugated diaphragms and rubber rings shown, for the reasons stated.

The recording-tablet of my phonograph is placed upon the cylinder F, and as the same is rotated the tablet passes under the diaphragm, and the plastic or yielding surface of the said tablet is capable of being scored or indented by a point or points attached to the arm C above the same. For this purpose (Fig. 4) I provide a plow-point M, which is attached to the farther side of the arm C immediately opposite the center of the diaphragm and it projects downward, so that its cutting or scoring point engages with the outer surface of the tablet as it passes beneath and cuts or plows a groove in the same. Since the arm C as the cylinder rotates is carried slowly along the cylinder this groove will form a spiral along the tablet corresponding to the internal thread of the threaded cylinder F'. As shown in Figs. 4 and 5, this plow-point is mounted upon the free end of an armlet M', pivoted at m' to the side of C^8 , a lateral expansion of C. At its forward end the armlet M' has a slot M^2 concentric with m' , in which is seated a thumb-screw m^2 , so that the free end of the said armlet may be raised or lowered to cause the plow-point M to cut more or less deeply, and the thumb-screw m^2 being tightened up the cutter or plow-point will be fixed at a certain depth relatively to the arm C, and will cut at such depth at all times. As this plow-point takes up a shaving which would fall over upon the tablet, the upper part is curved backward, and a small disk M^3 is attached to the armlet M' in rear of the cutter, into which the spiral of

shaving produced by the cutter is directed (see dotted line m^3 , Fig. 4,) and in which it is retained.

To the rear side of the under surface of C^5 , immediately in front of the plow-point M, Figs. 4 and 5, I pivot my indenting levers or lever with a slightly-loose cross-pin. In the figures I show two levers side by side N N', pivoted at c^6 . The arrow upon the tablet shows the course of rotation of the cylinder, which is from the plow-point and toward the center of the diaphragm. These levers N N' terminate under the center of the diaphragm L, and the said diaphragm is provided (see Fig. 5) with two small holes L L', into which are inserted two small pins or stems $n^2 n^3$, attached to and forming a part of the levers N and N', and these stems are securely attached to the diaphragm by solder, cement, or otherwise, and operate in conformity with the various movements thereof. Instead of these holes and pins in Fig. 2, I reverse the corrugations of my diaphragm and securely attach the pins of my levers, properly fitted, to the middle cup of my diaphragm; but in Figs. 4 and 5 the convexity of the middle corrugation extends downwardly, and these are perforated and securely support the pins of the indenting-levers N N'. The levers N and N' (see Fig. 4) have a wedge-shaped stylus projecting downward directly under the pin n^2 , having a slightly-rounded tip, and both sides of the wedge may have the same slope, or one may be more abrupt than the other. The parallel lever N' is seated in the diaphragm very near to N, but has its wedge-shaped stylus somewhat in rear of that of its fellow, so that they will engage with the tablet upon parallel lines as the spiral of rotation is produced, but one slightly in rear of the other. The styluses of these indenting-levers, where they touch the surface of the tablet, are made slightly conical from side to side, as well as from front to rear, so that the indented line will be narrower at the bottom than at the top. The function of these styluses is not to cut but to ride over the surface of the prepared groove made by the fixed plow-point M with a varying pressure corresponding to the vibrations or undulations of the diaphragm, and each of these indenting-styluses traces an independent line, the one correcting the inaccuracies of the other or taking the record while the other is passing a break or interruption in the surface of the recording-tablet. For use with ordinary tablets a single stylus and lever may be used; but I prefer the double ones for the reasons stated.

When the shaft E is rotated, the cylinder F will rotate in a contrary direction and toward the operator. (See Fig. 2.) The arm C being raised and pushed back to the spur-wheel end of the cylinder F the screw-block $C^2 C^3$ will be brought into engagement with the internal screw F'. A tablet properly surfaced being placed over the cylinder C and

pushed back to the rear its surfaces will be caught by the spring-clips $F^6 F^7$, which may be of any kind necessary, and the tablet will be prevented from rotating except with the cylinder. I prefer to use a cutting-edge for these clips, (see Fig. 5,) which will bite into the surface at the end of the tablet by the action of a spring f^6 , so that a permanent mark will be made in the end of the tablet for a guide to reinsert the same in the same position. F^7 is made different in its marking-edge, Fig. 5, for this reason. As the writing commences back at the spur-wheel F^5 and moves forward toward the free end of the cylinder, there will be no special tendency upon the part of the tablet to slip to the front, and a slight end pull will hold it, while rotation independent of the cylinder is prevented by the cutting into the surface by $F^6 F^7$.

In Figs. 6, 6^a, 7, and 7^a I show the tablet which I prefer to use in my machine, and which forms a part of my invention. P^3 represents a tubular foundation of flexible muslin, tough paper, or like substance. This flexible tube is provided with a homogeneous surface of gutta-percha, mixed with resin or like substance, which will make a compound hard and elastic at ordinary temperatures, but soft, plastic, and non-elastic at a temperature of from 110° to 140° Fahrenheit, or thereabout. This composition, applied to the flexible foundation, is then cut through along the axis of the tube at the two opposite sides from end to end down to the muslin or paper foundation, or nearly so. It is then surfaced off to present a surface of approximately even thickness. The tablet will have a surface of perhaps one-twentieth of an inch in thickness of a hard elastic composition, resistant to injury and capable of being flattened, as shown in Fig. 7, and may be readily sprung open and slipped over the cylinder of the machine to which it has been fitted, when the clefts P' and P^3 will be closed and the tablet present a smooth surface. If removed from the cylinder when warm, it will flatten down, as shown in Fig. 6^a, completely, and in either case may be put into an ordinary envelope and sent by mail like a common letter, or may be stored away or kept for future use in a small space.

I prefer to use gutta-percha in the construction of my tablet, because this substance contracts when heated, and this assists in forming a close connection between the tubular tablet and the surface of the cylinder to which it is applied. These tubes I form in considerable lengths, and, if preferred, I use them in the machine of a length to project beyond the free end of the cylinder, (see Fig. 5,) and when a record has been made of the required length I remove the tablet and when flattened cut off the surplus length, whereby I am enabled to economize in the material, and also save weight for mailing or other purposes. The portion cut off serves for another tablet, and so on until all is used.

I do not claim in this application the tab-

let, as hereinabove described, except in specific combination with certain operative elements of the phonograph; but have included the same in a separate application, Serial No. 270,897, filed April 17, 1888, the same having been divided from this application as originally filed.

The clip-marks produced by $F^6 F^7$, Fig. 5, show which end of the tablet is to be applied to the cylinder first and the position it is to occupy when the sounds of a record are to be reproduced from a previously-written tablet, and in such case I raise the plow-point, Figs. 4 and 5, upon its rear pivot m' , and fix it in a position out of contact with the cylinder by the set-screw m^2 in the slot M^2 . This leaves a free surface of the cylinder and its covering-tablet to pass under the styluses $n n'$, Fig. 5, which follow the same elevations and depressions in the hardened surface which they originally produced in the plastic mass. As I use this tablet for receiving indentations while soft and easily acted upon, and afterward reproduce the sounds when the surface is hard and resistant, the simplest means of producing this result is by the use of heat to render the surface soft, and afterward allowing a reduced or ordinary temperature to harden the same until again heated, and this permits the recorded surface when subsequently heated to be smoothed over, if desired, so as to obliterate the former writing and render it susceptible of use for other records.

I prefer to soften my tablet in the machine, and for this purpose I use a detachable heater, as shown in Fig. 2. This may be of solid iron, heated in a stove like a flat-iron; but I use in practice a hollow vessel filled with water, or nearly so. O represents such vessel, and is elongated, with straight sides, to slip in from the front of the machine between the guides $A^7 A^7$, and it is provided with an elevated side extending up partially around and over the cylinder, so that the tablet will revolve nearly in contact with this water-tank for a considerable part of its circumference, and especially just before it reaches the plow-point and indenting-points.

At O' is a screw-nozzle for filling the tank, and a spring-guarded cone-valve O^2 , opening upwardly, will prevent overheating, acting as a safety-valve. A handle O^3 , attached to the tank by the pieces O^4 , enables the same to be inserted or removed at will.

To enable me to ascertain and regulate the temperature of my heating device, I place a small thermometer o at the front end, and I apply this heat by means of a small gas-jet O^8 in a chamber beneath and within the tank, closed by the door O^6 , and supplied with gas through the tube O^{10} , controlled by the stop-cock O^9 . Any lamp may be used instead; or the water may be poured in hot. I prefer to jacket the outside of this tank, as shown at O^{11} , Fig. 2, to prevent waste of heat. In using this device the tank is slipped in from the

front end and extends along the cylinder from end to end. Being properly heated and the arm C raised and pushed back to the rear end, a tablet is pushed over the cylinder back
 5 against the rear end, where it is caught by the clips F⁶ F⁷. The heated tank softens the surface of the tablet at once, and the shaft E being rotated the plow-point M cuts a groove to a previously-adjusted depth in the surface
 10 of the tablet, forming a slow spiral as it traverses from rear to front. Fig. 7^a shows the form of the groove cut by the plow-point and has at the bottom thereof a slight elevation along the middle line, in each of which lateral
 15 grooves traverse one of the duplicate indenting-points *n n'*. When the division-line P², Fig. 2, is reached, the forward indenting-point may drop somewhat at the cleft, but the rear one will carry the record perfectly,
 20 and so the front one will when the rear indenting-point is passing over P². When the record is complete, the tablet is pulled from the cylinder toward the free end, and after cooling is flattened down, the surplus clipped
 25 off, and the latter put into an envelope for mailing.

To reproduce the sounds of the record, the heating-tank O is removed, the tablet stretched open and slipped over the cylinder
 30 cold, the arm C pushed back, the tablet put under the clips F⁶ F⁷ in proper relation, and the plow-point M being raised the styluses traverse the same or similar lines as those produced by them previously and the record
 35 is reproduced in the same articulate sounds as those which produced the record originally.

I do not confine myself to the specific devices shown as regulating bellows or piston, driving mechanism, construction of frame,
 40 heating-tank, gear, diaphragm, indenting-points, plow-point, movable arm, &c., precisely as described, and which have been so described for clearness, but use such well-known modifications as are in use among
 45 mechanics and known in the arts without departing from my invention.

I do not in this application claim the phonograph-tablets herein shown and described as adapted to be used with the phonograph
 50 which forms the subject of my present invention, except when used in combination with the cylinder of my phonograph, as herein claimed, but have embodied the invention relating to the construction, composition,
 55 manufacture, and adaptation of the said tablets for use with phonograph-instruments for receiving, retaining, and reproducing the sound-records thereof in a separate application, filed by me in the United States Patent
 60 Office on the 17th day of April, 1888, Serial No. 270,897, the said divisional application for this part of my invention having been originally made a part of this application and fully claimed herein, but subsequently di-
 65 vided therefrom and embodied in a separate application, as hereinabove stated; but said tablets, as used in combination with the pho-

nographic instrument, which forms the subject-matter of my present application and as a part of the same in use, together with the
 70 description and mode of use of said tablets, I have retained in this application, and have claimed said combination and use in combination with the phonograph described or with
 75 like instruments, claiming the said tablets generically in said divided application.

I do not broadly claim the use, in a phonograph, of a recording-tablet having a surface of plastic material adapted to be softened by heat to receive a record and subsequently
 80 hardened by exposure at ordinary temperatures, as the same has been fully described in long prior publications, among others in the British periodical *Engineering* of April
 18, 1879, volume 27, page 327, in which it is
 85 stated that "the temperature is so arranged as to give the stearine surface the proper degree of hardness to insure the best results," and also in Letters Patent of the United States, No. 200,521, bearing date February 19, 1878, in
 90 which Letters Patent a similar substance is described at the bottom of the first column of page 2 thereof, but not claimed in said Letters Patent, and also in other publications of
 95 long prior date; but I confine myself to the subject-matter herein described and claimed.

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

1. In combination with the cylinders of a
 100 phonograph, a tubular phonograph-tablet made in lengths longer than said cylinder, adapted to be applied so as to project from the free end of said cylinder beyond the forward bearing of the same when used and
 105 having a plastic surface, said tablet adapted to receive a spiral phonographic record commencing at its inner end and completed part way along the length of said tubular tablet, and the surplus adapted to be cut off for subsequent use as a separate tablet, substantially as described.

2. In a phonograph, in combination with a vibrating diaphragm and a recording-tablet moved with relation thereto, two parallel
 115 styluses pivoted to operate independently and both attached to the middle part of said diaphragm, one in rear of the other at its point of contact with said tablet, said styluses adapted to make a duplicate record upon said
 120 tablet, one in rear of and parallel with the other, substantially as and for the purposes described.

3. In a phonograph, in combination with a relatively-fixed arm capable of longitudinal
 125 movement, and a vibrating diaphragm, and a recording-tablet moved beneath the same, a plow-point attached to said fixed arm, adapted to cut a vertical groove in said tablet of a definite character, together with one or more
 130 indenting-styluses independent of said plow-point, said styluses attached to said vibrating diaphragm and adjusted to rest upon the bottom of said groove cut by said plow-point and

indent the bottom surface thereof as the said diaphragm vibrates and the said tablet is moved forward, substantially as described.

4. In a speaking-phonograph having a vibrating diaphragm, one or more indenting-styluses attached thereto and operated thereby and a tablet having a plastic surface moved under said diaphragm, a plow-point attached to the machine independent of said diaphragm, set at a suitable depth and adapted to cut a groove in the surface of said tablet preparatory to the action of said stylus or styluses, said stylus or styluses adapted to traverse said groove and form a record upon the freshly-exposed surface at the bottom thereof, substantially as described.

5. In a phonograph, the plow-point M, adjustable to the tablet P and independent of the diaphragm L, in combination with stylus N, operated by said diaphragm, said plow-point adapted to cut a vertical groove P⁶ in the plastic surface of said tablet, and said indenting-point N adapted to travel along said groove and make a record along the bottom thereof as the said diaphragm vibrates and the said tablet is moved forward, said tablet having a surface soft and plastic when said record is made, but rendered hard and resistant subsequently, the whole so constructed that when said plow-point is raised out of contact with said tablet in a reproducing-phonograph said stylus L will be adapted to follow said hardened groove P⁶ and traverse said record, reproducing the same as often as the same may be repeated, substantially as described.

6. In combination with the cylinder, diaphragm, indenting-stylus, and tubular tablet of a phonograph, the plow-point M, adapted to cut a spiral groove in said tubular tablet by the rotation of said cylinder preparatory to the action of the stylus along the bottom of said groove, and the dish M³, adapted to receive the shavings m³ as turned up and over from the said surface by the said plow-point, substantially as described.

7. In a phonograph, in combination with the arm C, supporting the diaphragm L and adapted to traverse from end to end along the cylinder F, and tablet P, applied thereto as the said cylinder is rotated, the armlet M', attached to the side of the arm C, pivoted at m' and having its forward end adjustable in height, together with the plow-point M, attached to the forward end of said armlet, and the set-screw m², adapted to fix the said plow-point at any desired elevation to cut into said surface P to any desired depth, or to enable the said plow-point to be raised to clear the said tablet P entirely, substantially as and for the purposes described.

8. In combination with the arm C, the armlet M', provided with the plow-point M, and the receiving-dish M³, said plow-point and dish adjustable in height upon said arm C, substantially as described.

9. In combination with the arm C, the ad-

justable plow-point M and transversely-rotating tablet beneath the same, having a plastic surface adapted to be grooved by the said plow-point, the vibrating diaphragm L, vertically adjustable to said tablet and adapted to be fixed at a height to conform to that of said plow-point, said diaphragm provided with a stylus extended down into the groove made by said plow-point and adapted to make a waved or indented path along the bottom of the same, said plow-point and said diaphragm adapted to be set at such relative heights that the said stylus will rest upon the bottom of said groove with any desired pressure as the said plow-point is set to cut more or less deeply, substantially as described.

10. In combination with the arm C, having circular opening C⁵ and inwardly-flanged lip C⁶, the vibrating diaphragm L, fitted within said opening C⁵, and the elastic ring K, resting upon said flanged lip and supporting the outer edge of said diaphragm, together with a circular compressing-ring I, fitted within said circular opening C⁵, bearing upon the diaphragm and adapted to be forced down upon said diaphragm and said elastic ring K to compress the said ring K and raise or lower the said diaphragm as said elastic ring is more or less compressed, substantially as described.

11. The combination of the arm C, having internally-screw-threaded circular opening C⁵, internally-flanged lip C⁶, elastic ring K, and vibrating diaphragm L, resting upon the same, with the externally-screw-threaded ring i, having circular lip I', projecting inward and bearing upon said diaphragm within the line of support of said elastic ring K, and adapted to be screwed down upon said diaphragm and produce a downward thrust of the middle of the same, substantially as and for the purpose described.

12. In a phonograph, in combination with the internally screw-threaded and flanged opening C⁵ C⁶ and the diaphragm L, supported at its edge upon the flanged lip C⁶, the sound-receiving funnel I, having an externally-screw-threaded ring i at its lower part, adapted to be screwed down upon the free edge of said diaphragm to adjust and fix the same, substantially as described.

13. In a phonograph, the conical funnel I, having contracted neck I², narrower than the diaphragm L and expanded below the said contraction at i to extend over the whole surface of said diaphragm, said funnel provided with a bearing-surface at its lower part to compress the edge of said diaphragm, in combination with a circular seat for said diaphragm and an internal lip adapted to support the free edge of said diaphragm, said supporting-seat, diaphragm, and funnel forming a single construction when thus united, substantially as described.

14. In combination with the arm having a circular opening C⁵, internal lip C⁶, diaphragm L, and screw-clamping ring i, the interposed

pad I³, substantially as and for the purposes described.

15. The thin, resonant, vibrating, elastic, corrugated diaphragm L L³ L⁴, in combination with the supporting-holder C⁵, clamp i, stylus N, attached to said diaphragm, and its indenting-point free to describe both a vertical and undulatory line upon said tablet, cylinder F, and recording-tablet P, adapted to move under said diaphragm and receive the record of said indenting-point, substantially as described.

16. In a phonograph, the diaphragm L, consisting of an elastic resonant plate of substantially equal thickness in its vibrating parts, securely fixed over the recording or reproducing tablet, said diaphragm having a series of concentric corrugations adapted to amplify the vertical vibrations and produce lateral and undulatory or gyratory vibrations as sounds act upon the same, in combination with a stylus attached to and operated thereby, said tablet presenting an extended surface at right angles to the axis of said stylus, and said stylus free to be operated by both the direct and undulatory movements of said diaphragm, or conversely, said tablet acting upon said stylus and said corrugated diaphragm to reproduce said vertical and undulatory vibrations thereupon, substantially as described.

17. In combination with the arm C, diaphragm-holder C⁵ C⁶, sound-funnel I, plow-point M, supporting-cylinder F, tablet P, secured to said cylinder and operated thereby, stylus N, and corrugated diaphragm L³ L⁴, substantially as herein shown and described.

18. In a phonograph, the vibrating diaphragm L, having two small central holes transverse to the path of the recording-tablet, in combination with two styluses N N', bearing at their lower ends upon the recording-tablet beneath and provided above with a small pin n² n³ upon each stylus and a shoulder beneath, said pins passing through said holes in said diaphragm, and said diaphragm supported upon said shoulders, substantially as described.

19. In a phonograph, a centrally-perforated diaphragm, in combination with one or more blunt indenting-styluses provided with upwardly-projecting pins entering said holes in said diaphragm, said holes and said pins accurately fitted to each other and adapted to convey from said diaphragm to the recording-tablet of said phonograph both vertical and undulatory movements thereof, substantially as described.

20. The blunt stylus N, seated at its upper end in the diaphragm of a phonograph, adapted to be acted upon by said diaphragm with a vertical or undulatory motion, in combination with an independently-supported plow-point acting upon the plastic surface of a recording-tablet in advance of said stylus and leaving a clean-cut groove in the surface of said tablet to be waved or indented with-

out removal of material by said blunt stylus moving under pressure along the bottom of said groove, substantially as described.

21. In combination with the corrugated diaphragm L³ L⁴, parallel styluses N N', seated therein, adjustable plow-point M, fixed independently of said diaphragm, rotating cylinder F, heater O, adapted to be placed nearly in contact with said cylinder, and the tablet P, having a surface P⁴, adapted to be softened by the heat of said heater O, substantially as and for the purposes described.

22. In a phonograph, in combination with the heating-tank O, a tubular recording-tablet P, having a surface P⁴, normally hard and adapted to be artificially softened by the heat of said tank O for receiving a record in the machine and subsequently hardened for reproducing the same, substantially as described.

23. In combination with a phonographic instrument and a recording-tablet adapted to be softened by artificially-produced heat for receiving a record, the detachable heating-tank O, provided with lamp O⁸, nozzle O', for filling said tank, safety-valve o², handle O⁵, thermometer o, and fluid contents O³, for heating said tablet, substantially as described.

24. In a phonograph, the heater O, having non-conducting jacket O¹¹ upon its exposed sides, substantially as and for the purposes described.

25. In a phonograph, the removable hollow heating-tank O, facing the recording-tablet and containing a heated fluid regulated in temperature and adapted to soften and render plastic the surface of a suitably-prepared recording-tablet when placed in said machine, substantially as described.

26. In a phonograph, the frame A, having guides A⁷ A⁷, cylinder F, and recording-tablet P, surrounding the same, in combination with an elongated internally-concave adjustable heating device adapted to be slid into the machine upon the frame A and between the guides A⁷ A⁷, and having a heated surface extended under and partially around the rear side of said tablet P, substantially as and for the purposes described.

27. In a phonograph, in combination with the recording-tablet thereof having a surface normally hard and adapted to be softened by heat to receive the record of the stylus of said phonograph, an artificially-heated body facing the free surface of said tablet when in place in the machine, substantially as and for the purposes described.

28. In a phonograph, in combination with the driving-shaft E, friction-gear D D' D² D³, cam D⁵ d⁵, governor G G' g' g³ g⁵, spur-wheel D, geared to driving-wheel F⁵, cylinder F, operated thereby, screw-thread F', threaded block C³, arm C, diaphragm L, stylus N, sound-receiving funnel I, the tablet P of a substance adapted to be softened by heat for receiving the impressions of said point N, and a detachable heater O, adapted to be applied to

said tablet and soften the surface of the same when acted upon by said indenting-point, substantially as described.

29. In a phonograph, the frame A, adapted to rest upon a table and having the elongated supporting-bar B attached at its rear end to said frame A and its forward end projecting to the front free of any support, in combination with a hollow cylinder F, surrounding the free end of said bar B, having front and rear bearings and journaled to rotate thereupon, said cylinder free of other support in front and having a recording-tablet surrounding said cylinder and detachable therefrom, together with a vibrating diaphragm and one or more styluses operating above said tablet to make a phonographic record upon the same when the said cylinder is rotated upon its supporting-bar B, said tablet tubular in form and applied to and removed from said cylinder at the free end thereof without interference with the said machine, substantially as described.

30. In a phonograph, in combination with the hollow rotating cylinder F, journaled at B⁷ at its rear end upon the central bar B, and journaled at B⁵ at its front end upon the said bar B, the supporting-bar B, its front end free and unsupported and its rear end rigidly secured to the frame A, said cylinder supported internally by the free portion of said bar B and adapted to rotate thereupon, said cylinder projecting forward, free from other support, adapted to receive a tubular tablet applied from the free end thereof without disturbance of the parts of said machine, together with a recording-diaphragm and indenting-stylus moved longitudinally along said cylinder, and means for rotating said cylinder and simultaneously moving said diaphragm longitudinally along the outer surface of the same, substantially as and for the purposes herein shown and described.

31. The bar B, having cylindrical bearing B⁷, said bar slotted longitudinally in its rear half at B², said slot opening upwardly and slotted longitudinally in its front half at B⁶, said slot opening downwardly and provided with a transverse groove B⁷, extended transversely across slot B² and along the same from front to rear, and a journal B⁵ at the free end of said bar B, in combination with a hollow cylinder F, supported at F³ in front and B⁷ in rear to rotate upon the projecting front half of said bar B, together with a U-shaped arm C, having an upper half extended forward over said cylinder F and a lower half extended forward within said hollow cylinder, said upper and lower halves parallel with each other, said lower half C⁷ sliding longitudinally in said slot B⁶, and the rear bend C⁷ of said U-shaped arm C extended up through said slot B² and provided with cross-pin c, sliding longitudinally in said transverse groove B⁷ and forming a pivoted support for the bend C⁷ of said arm C, the

whole so constructed that as said lower half of arm C is moved along within said cylinder F said upper half will correspondingly be moved along the outer surface thereof, substantially as and for the purposes herein shown and described.

32. In combination with the slotted bar B B⁷ B² B⁶ and hollow cylinder F F³ F⁴, rotating upon the free projecting part thereof, the U-shaped bar C C⁷ C⁷ c, provided with diaphragm L and recording mechanism supported thereupon at its upper end and a downwardly-projected block C² at its lower end, said block having a transversely-screw-threaded lower surface C³, together with the internally-screw-threaded surface F⁷ of said hollow cylinder F, said threaded surfaces C³ and F⁷ engaged with each other and adapted to move said diaphragm and adjacent mechanism along the upper surface of said cylinder as the same is rotated, substantially as described.

33. In combination with the cylinder F, bar B, arm C, and recording mechanism L N, the thumb-hook C⁴ of said arm C, adapted to be seized by the hand to lift said recording mechanism from said cylinder, and at the same time raise the threaded block C² C³ from threaded internal surface F⁷ and slide the arm C to and fro along said cylinder without contact therewith, substantially as described.

34. In combination with the internally-threaded cylinder F and U-shaped arm C, pivoted at its rear in a longitudinal transverse groove B⁷ of the bar B to permit motion to and fro of said U-shaped arm C along said cylinder, but prevent lateral motion of said arm upon said cylinder, the transversely-screw-threaded block C² C³, attached to the lower free end of said arm C and adapted to engage with the internal screw F⁷ of cylinder F, so that the rotation of said cylinder upon its axis will cause the said block to be screwed along to or fro within the said cylinder together with the diaphragm L and stylus N, supported upon the free upper end of said arm C and adapted to produce a phonographic record upon the surface of a soft tablet P, placed upon said cylinder F beneath said diaphragm L and in contact with said stylus N, and also adapted to reproduce the sounds of said record when said phonographic mechanism is applied thereto in a like manner, the whole so constructed that by raising the free end of the arm C upon the rear pivot c the recording or reproducing apparatus will be lifted clear of said tablet, and at the same time the threaded block C² C³ will be raised from the screw-thread F⁷ and the arm C may be pushed back or forth along the said cylinder F without obstruction, and when the free end of the arm C is permitted to drop the threaded blocks C² C³ will engage with the screw F⁷ and the recording or reproducing mechanism be again brought into contact with said tablet P, substantially as described.

35. In combination with the bar B, having

slot B⁶, opening downwardly and closed above at B³, the U-shaped arm C, having lower part C' sliding longitudinally in said slot B⁶, and spring c², attached to the upper side of C' and impinging against the under surface of B³, adapted by its tension to force down the forward ends of said U-shaped bar C, substantially as and for the purposes described.

36. The phonograph-cylinder F, mounted to rotate upon the bar B, said cylinder journaled upon said bar B and having wheel F⁵ attached to and adapted to rotate said cylinder, and said wheel F⁵, geared with and operated by wheel D upon driving-shaft E, said cylinder supported internally and projecting forward freely into space, said arm B attached to frame A at its rear end and by its projecting end extended through said cylinder F and supporting the same upon bearings B⁵ f³, in combination with an arm C, having a free end supported above said cylinder and adapted to be moved to and fro along the same, said arm provided with a recording diaphragm and stylus and at its opposite end with a screw-surface, and said cylinder provided with a screw rotating therewith, said screw of said cylinder and said screw-surface of said arm engaged with each other and adapted to slowly move the said diaphragm and stylus along said cylinder as the same is rotated upon its axis, substantially as described.

37. In combination with the frame A, driving-shaft E, spur-wheel D, opposite spur-wheel F⁵, engaging therewith, hollow internally-screw-threaded cylinder F, recording-tablet P, slotted cylinder-supporting bar B, upon the forward end of which said cylinder rotates, U-shaped arm C, pivoted at its rear by the pin c in the transverse slot B', said arm C having its lower half adapted to enter said hollow cylinder F and provided with transversely-screw-threaded blocks C² C³ at its lower end to engage with threaded internal surface F' of said cylinder and its upper half extended over said cylinder and provided with phonographic funnel I, diaphragm L, and stylus N, the whole constructed to operate substantially as herein shown and described.

38. In combination with the cylinder F and phonograph-tablet P, the duplicate holding-clips F⁶ F⁷, adapted to embed themselves in said tablet and hold the same in place upon said cylinder, said clips F⁶ and F⁷ having each a differently-formed embedding-surface to make a characteristic indentation for each clip and enable said tablet to be subsequently replaced upon said cylinder in the same position as before, substantially as described.

39. In a phonograph, the cylinder F, having a cylindrical surface of equal diameter to support the tubular tablet P, and a conical or tapered free end to enable said tablet to be expanded preparatory to forcing the same back upon the said cylinder, in combination with a vibrating diaphragm and stylus operated thereby, substantially as described.

40. In a phonograph, in combination with

the rotating cylinder F, arm C, diaphragm L, stylus N, funnel I, and screw-block C², adapted to be operated by a screw rotated by said cylinder, and the plow-point M, mounted upon armlet M', pivoted at m' to arm C and its forward-end adapted to be fixed at different elevations by the set-screw m², operating in the elongated slot M², substantially as described.

41. In a phonograph, in combination with the cylinder F, tablet P, arm C, screw-block C³, attached thereto, screw-thread F', rotated by said cylinder, and stylus N, a vibrating diaphragm L and funnel I, seated in the body of the said arm C and partaking positively of the motions of said arm and of the threaded block C³ thereof, the whole so constructed that as the cylinder F is rotated the screw-thread F' will move the said diaphragm L along the outer surface of said cylinder, and said diaphragm will be regulated vertically by the said screw-threaded block C³ and threaded surface F', irrespective of the variable thickness of the body of said tablet P upon said cylinder, substantially as described.

42. In combination with the driving-shaft E and flanged collar D², attached thereto and rotated thereby, the loosely-journaled spur-wheel D, rotated by frictional contact with said collar D² of said shaft E, together with the spur-wheel F⁵, geared to and operated by said wheel D, said spur-wheel F⁵ adapted to operate the phonographic cylinder F, substantially as described.

43. The combination of driving shaft E, having threaded section e, angular section E', cylindrical part E⁴, and journal e' with the screw-collar D⁴, adapted to e, spring D³, acted upon by D⁴, sliding collar D², forced forward by D³, loosely-journaled spur-wheel D, journaled upon E⁴, and friction-pad D', interposed between D and D², said spur-wheel held in place upon said cylindrical part E⁴ and geared to and operating the phonographic cylinder F through spur-wheel F⁵, substantially as described.

44. In combination with the driving-shaft E, loosely-journaled wheel D, operated by frictional contact from said driving-shaft, rotating cam-wheel D⁵, cam-groove d⁵, pin g, extending into and operated by the eccentricity of said cam-groove d⁵ to move to and fro the reciprocating leaf-plate G, operated in an air-tight reservoir G' g', containing fluid, said leaf-plate perforated at g³, or otherwise provided with a vent communicating with the said contained fluid upon each side of said leaf-plate to permit said fluid to change from one side of said leaf to the other in said air-tight reservoir with a regular motion as said leaf is operated by the rotation of said cam-wheel, and so regulate the velocity and movement of said spur-wheel D independently of a greater speed of said driving-shaft E, substantially as described.

45. In combination with the hand-knob E³, shaft E, frictional contact D D' D², spur-wheel D, closed bellows G G' g', variable ori-

fice g^3 , adjusting-cock g^5 , cam-wheel D^5 , having eccentric cam-groove d^5 , pin g in said cam-groove, operating said bellows, the wheel F^5 , cylinder F , longitudinally-moving arm C , vibrating diaphragm L , stylus N , and phonographic tablet P , the whole constructed to operate substantially as and for the purposes set forth.

46. In combination with the loosely-pivoted spur-wheel D , longitudinally-sliding friction-collar D^2 , friction-pad D' , compressing-spring D^3 , collar D^4 , and driving-shaft E , the cam-wheel D^5 , having eccentric cam-groove d^5 presented to the rear, said groove narrowed toward its bottom, together with tapered pin g , fitted in said cam-groove d^5 and prevented from rearward motion, said pin g attached to and operating vibrating leaf-plate in regulating reservoir G G' g' filled with fluid, said spring D^3 operating to force back said cam-groove against said tapered pin and preserve at all times a closely-fitted bearing, substantially as described.

47. In combination with driving-shaft E , rearwardly-acting spring D^3 , frictional contact D^2 D' D , loosely-pivoted spur-wheel D , cam-plate D^5 , secured thereto rigidly and having rearwardly-faced eccentric cam-groove d^5 , and journal e^7 , seated in bearing a^7 of frame A , and one or more washers e^4 , adjusted in number or thickness to regulate the rearward thrust of said cam plate and groove against the conical pin g of regulating apparatus G by said spring D^3 , substantially as and for the purposes described.

48. In combination with the friction-gear D^3 D' D , spur-wheel D , geared to and operating driving-wheel F^5 , the bellows G G' g' , adapted to reduce and regulate the excess of speed of rotation of said spur-wheel D by the movement of the perforated leaf-plate G in the air-tight reservoir of said bellows, said reservoir filled with air under pressure, and the force-pump H , provided with suitable valves H' H^2 and adapted to be operated to compress air in said bellows and maintain said pressure therein, substantially as described.

49. In a phonograph, the combination of a driving-shaft, frictional contact-operating gear-wheel, said gear-wheel geared to and operating cylinder of said phonograph, said gear-wheel regulated by a pneumatic governor having a variably-adjusted perforated leaf-plate reciprocating in an air-tight compartment, the motion of said leaf-plate controlled by the adjusted passage of air through said perforation from one side of said leaf-plate in said compartment to the other, said perforation regulated in size by an external thumb-piece, said air maintained under suitable pressure in said compartment, the whole so constructed that when said driving-shaft is rotated at a greater speed than can be followed by the said reciprocating leaf-plate the said frictional contacts will slide upon each other and the excess of speed produce no effect

upon the speed of rotation of said cylinder, substantially as described.

50. A mechanical sound recording and reproducing phonograph consisting of the driving-shaft E , frictional contacts D D' D^2 , friction-spring D^3 , cam-wheel D^5 , cam-groove d^5 , bellows G G' g' , pin g , operating the middle leaf-plate of said bellows, spur-wheel D , geared to and operating wheel F^5 , hollow cylinder F , rotated by wheel F^5 , slotted bar B , supported in rear and free in front, said cylinder F journaled upon said free end of said bar B , said cylinder F hollow and internally screw-threaded from end to end at F' , U-shaped arm C , having lower half C' adapted to enter rear end of said hollow cylinder F and provided with transversely-screw-threaded block C^3 , adapted to engage with said screw-thread F' , and the upper half of said arm C bent forward over the outer side of said cylinder F and provided above said threaded block C^3 with diaphragm L , stylus N , and funnel I , said arm C pivoted at its rear bend by a transverse pin c in a longitudinal transverse slot B' of said bar B and adapted to slide to and fro therein, said arm C adapted to be moved slowly along said cylinder as the same is rotated and to have its free ends in front raised simultaneously upon the rear pivot c to clear the screw-thread F' and cylinder F and its tablet P , said arm when thus raised adapted to be pushed to and fro along said cylinder without contact, and to engage with said screw-thread F' and said tablet P when said free ends of arm C are allowed to drop into place, the whole constructed to operate substantially as herein shown and described.

51. In combination with the sound-concentrating funnel I , stylus N , and recording-tablet P , said recording-surface having a transverse position with reference to the axis of said stylus, and said stylus adapted to produce an indented record upon the flat surface thereof, the concentrically-corrugated diaphragm L^3 L^4 , substantially as described.

52. In a phonograph, in combination with the circularly-corrugated diaphragm L^3 L^4 , the stylus N , fixed to the center of said corrugations at n^2 , the loosely-pivoted lever supporting said stylus, and plastic tablet P , the whole constructed to reproduce upon said tablet the transverse undulations of said diaphragm produced by laterally-acting waves of sound upon the corrugations of the same through said indenting-point, substantially as described.

53. A flexible tubular and collapsible tablet for phonographs, having a foundation P^3 of fabric or the like, a surface P^4 of composition adapted to be made soft and plastic and subsequently hardened, and a series of parallel spiral grooves P^6 , cut to a certain considerable depth in said surface, and a record made by the stylus of a phonograph along the bottom of said grooves when soft and plastic and the same subsequently hardened, in combination with the reproducing stylus

and diaphragm of a phonograph adapted to reproduce the sounds thereof from the hardened record at the bottom of said grooves, substantially as described.

- 5 54. The tubular phonograph-tablet P, having transverse parallel grooves P⁶ cut in a spiral in the surface thereof, said grooves divided at their bottom into two slighter parallel channels P⁸ P⁹, each of said channels
10 having a phonograph-record produced by the same instrument at the same time, said duplicate records substantially alike, but one

slightly in rear of the other, in combination with the diaphragm of a reproducing-phonograph and duplicate styluses, attached thereto, one slightly in rear of and alongside the other, said styluses adapted to follow and reproduce the said duplicate record simultaneously in articulate sounds, substantially as herein shown and described. 15

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