(No Model.) 6 Sheets—Sheet 1.

C. S. TAINTER.

APPARATUS FOR RECORDING AND REPRODUCING SPEECH AND OTHER SOUNDS.

No. 375,579. Patented Dec. 27, 1887.

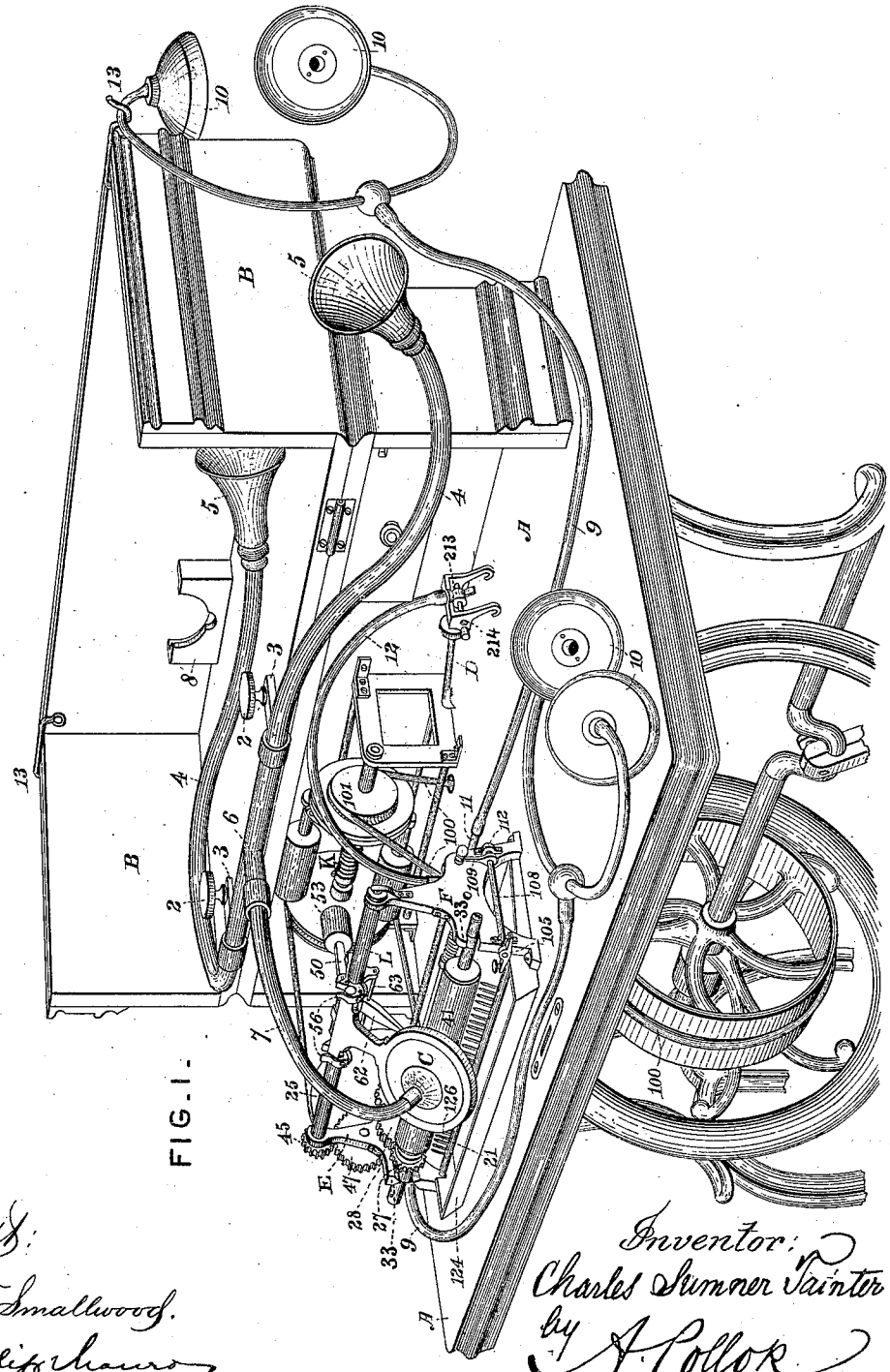

FIG. 1.

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(No Model.) 6 Sheets—Sheet 2.

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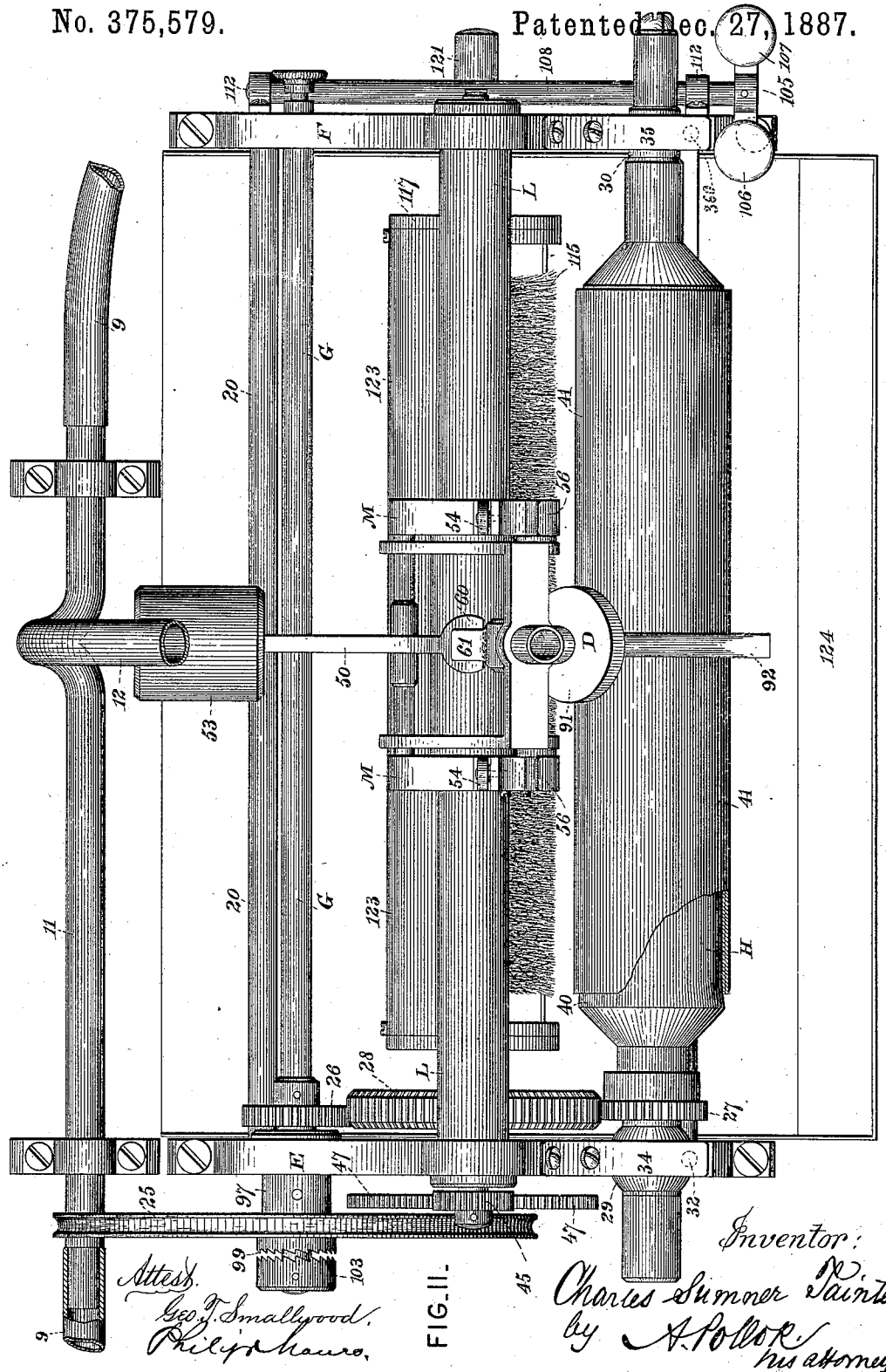

FIG. II.

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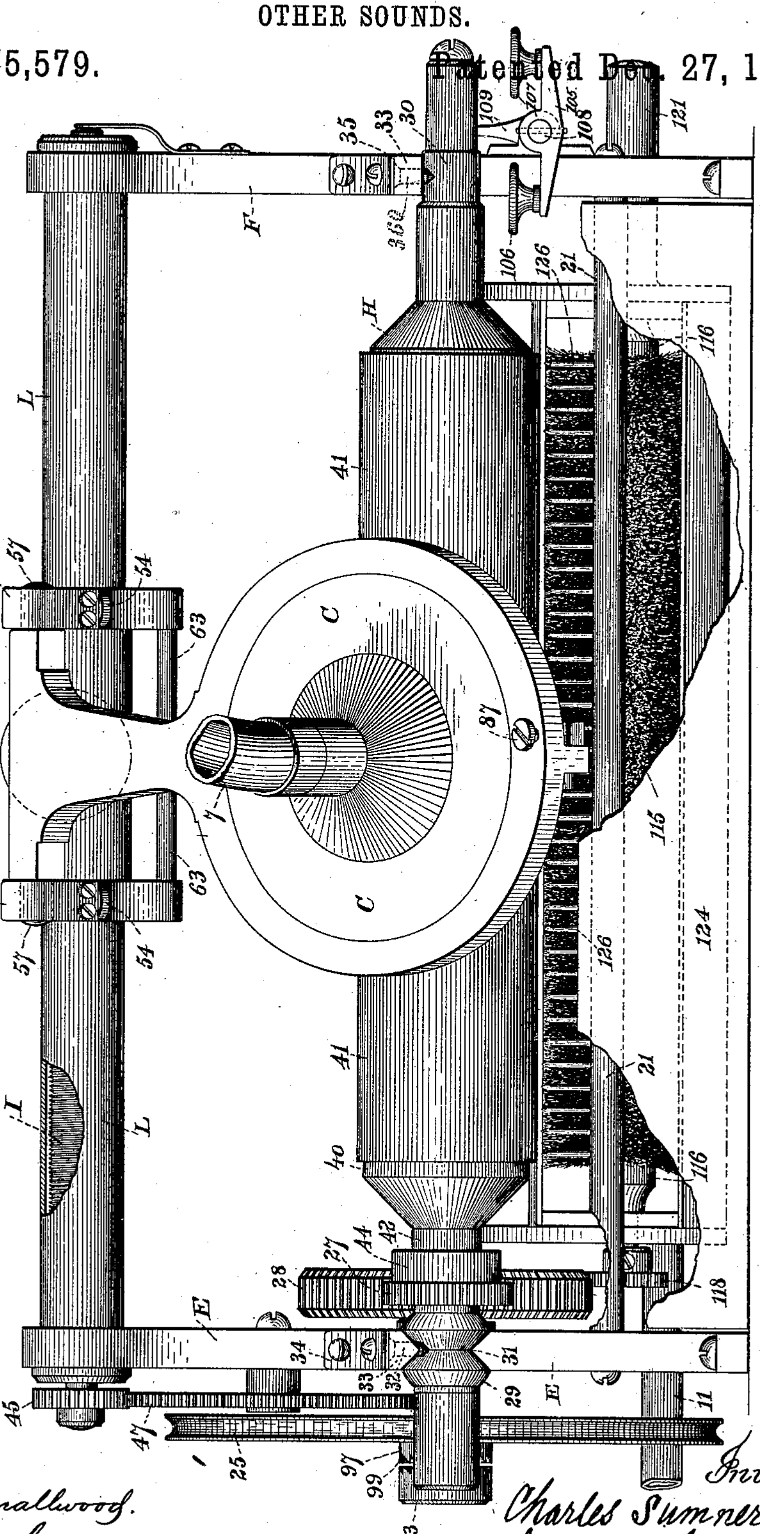

FIG. III.

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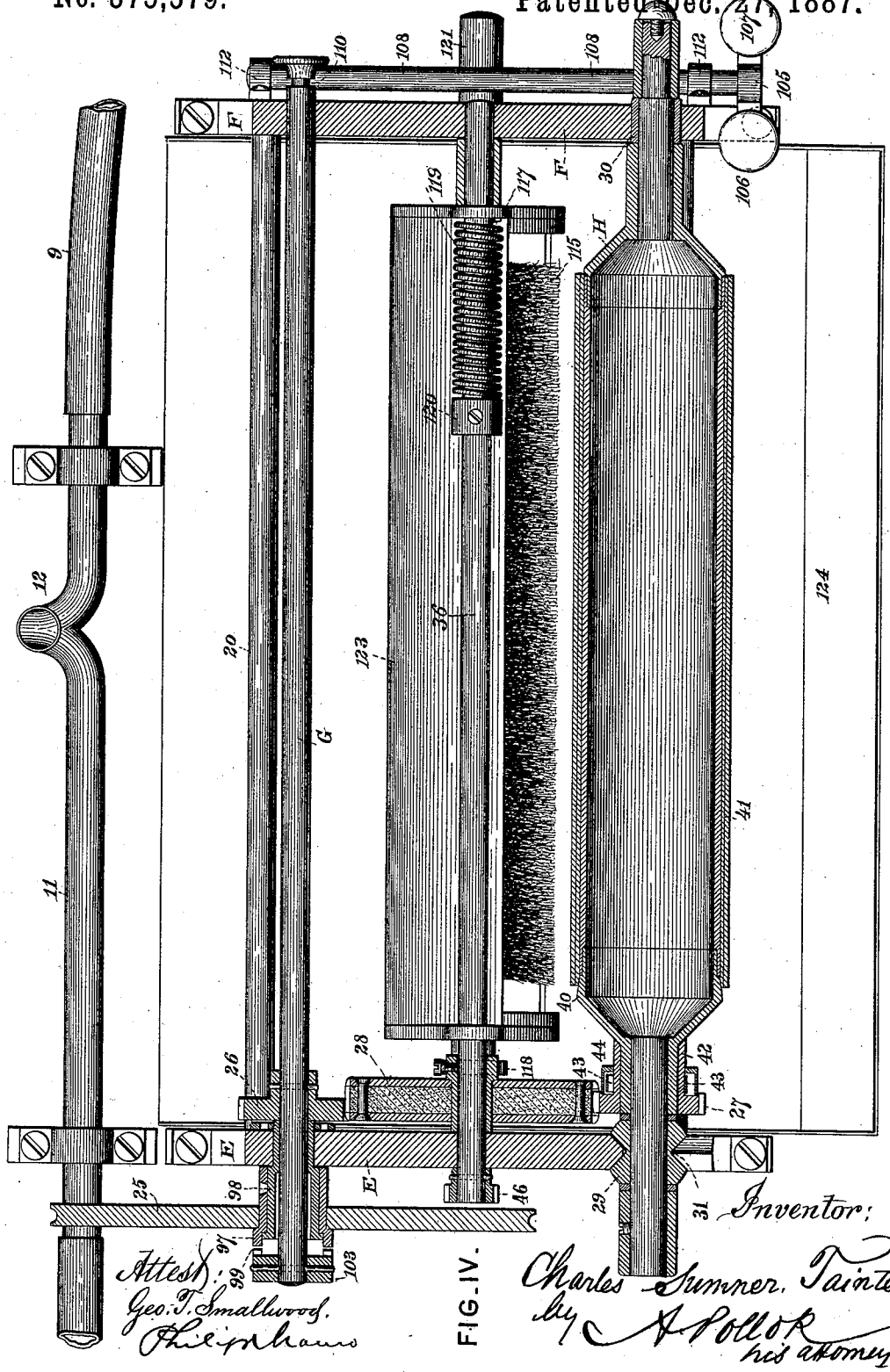

FIG. IV.

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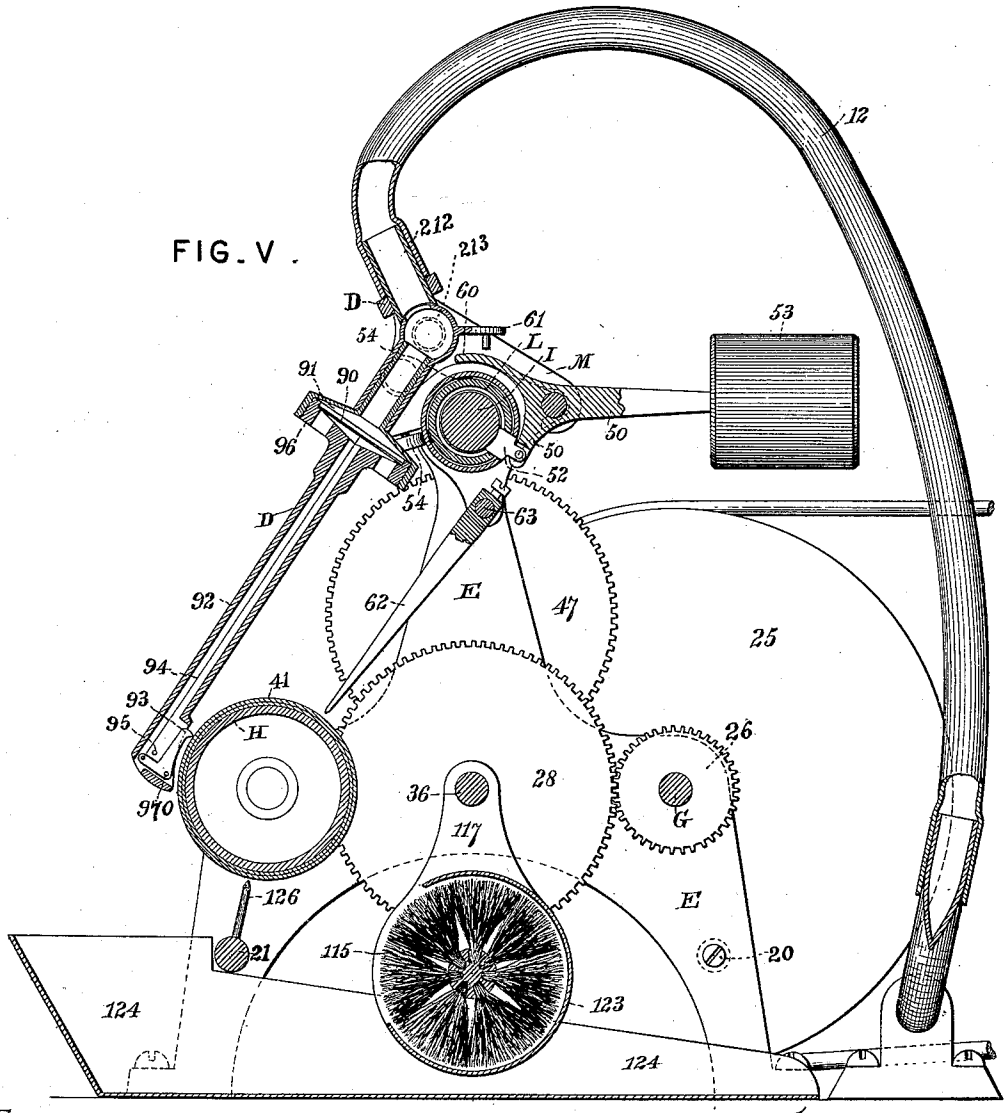
APPARATUS FOR RECORDING AND REPRODUCING SPEECH AND OTHER SOUNDS.

No. 375,579. Patented Dec. 27, 1887.

FIG. V.



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(No Model.) 6 Sheets—Sheet 6.

C. S. TAINTER.

APPARATUS FOR RECORDING AND REPRODUCING SPEECH AND OTHER SOUNDS.

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FIG. VII.

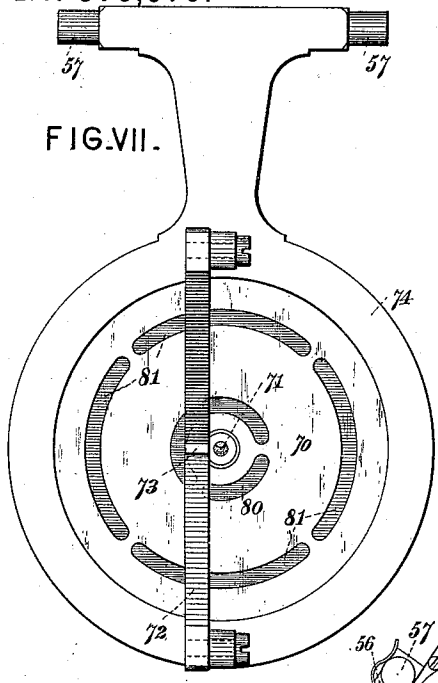


FIG. VIII.

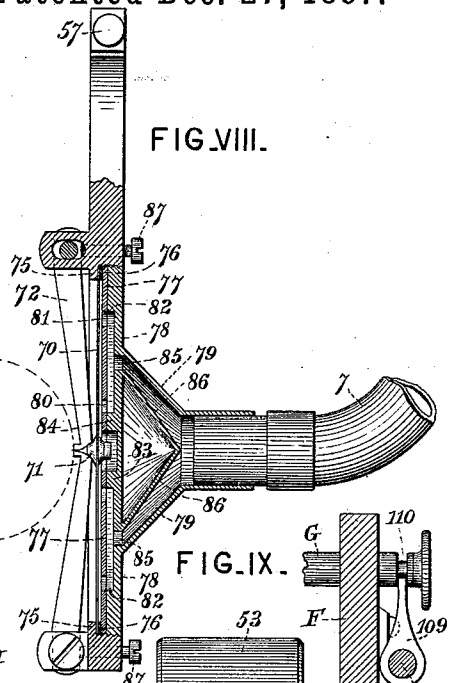


FIG. IX.

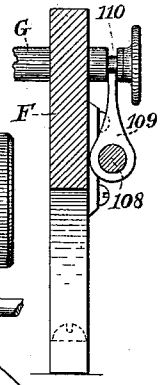
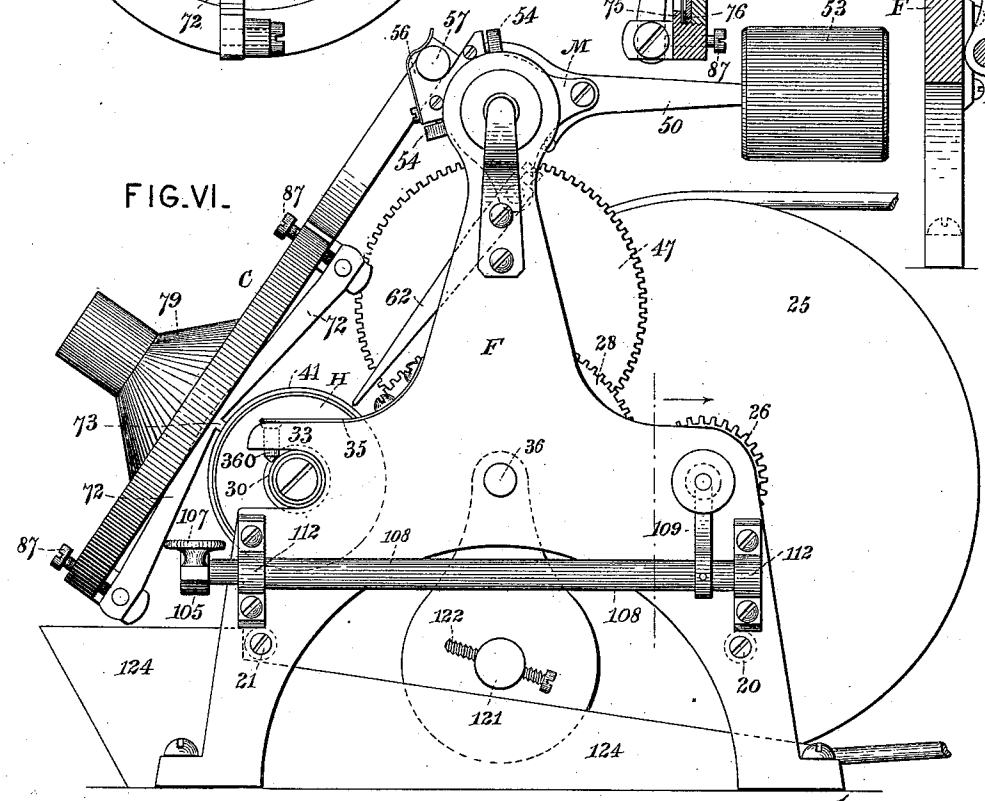


FIG. VI.



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UNITED STATES PATENT OFFICE.

CHARLES SUMNER TAINTER, OF WASHINGTON, DISTRICT OF COLUMBIA.

APPARATUS FOR RECORDING AND REPRODUCING SPEECH AND OTHER SOUNDS.

SPECIFICATION forming part of Letters Patent No. 375,579, dated December 27, 1887.

Application filed July 7, 1887. Serial No. 243,601. (No model.)

To all whom it may concern:

Be it known that I, CHARLES SUMNER TAINTER, a resident of Washington, in the District of Columbia, have invented a new and useful Improvement in Apparatus for Recording and Reproducing Speech and other Sounds, which improvement is fully set forth in the following specification.

This invention relates more particularly to apparatus for recording and reproducing speech and other sounds, known as "graphophones," and comprises certain improvements upon the apparatus described in Letters Patent No. 341,288, granted to me May 4, 1886, and upon instruments of the same type. As described in said patent, the record or "phonogram" is cut or graved by a cutting-style in a tablet, consisting of a paper tube or cylinder provided with a coating of wax or wax-like composition, the tablet being mounted on a rotating cylinder or tablet-holder and the recorder or style being advanced lengthwise of the tablet-holder by means of a feed-screw, so as to trace on the tablet a spiral line.

The present invention has for its object to simplify and improve the construction of the apparatus, to render it more complete and convenient for practical use, and to increase its efficiency in point of accuracy and distinctness in recording and reproducing speech and other sounds.

The apparatus is mounted upon a stand or table, and is adapted to be driven by foot-power, or by a small water, spring, electric, or other suitable motor. Upon the stand or table are clamped two or more flexible tubes, terminating in mouth-pieces. At the other end the tubes communicate through a socket and single tube with the recorder. This arrangement is convenient for recording a conversation between two or more persons, as in taking depositions of witnesses. A bracket or holder is provided for receiving the recorder, which can be readily detached from its carriage. Hooks are also provided for hanging the hearing-tubes when not in use. These arrangements conduce greatly to the convenience of the apparatus in practical use.

Heretofore the tablet-holder was on the main shaft. It was provided with a ball-bearing at one end and detachably held in its bearing at the other, so that it could be tilted up to remove and replace the tablet. In the present invention the tablet-holder is on an independent shaft and is driven from the main shaft by positive gearing. This simplifies the construction of the apparatus. It also enables the tablet-holder to be readily removed bodily from the machine, which is desirable both to give access to other parts and to enable a fresh tablet to be inserted with the least possible delay.

As this improvement is carried out herein, forked supports are provided in the front of the frame in which the tablet-holder can be readily inserted. The latter has loose collars, one at each end, which fit in the supports and constitute journal-boxes for the shaft. Spring-latches on the frame hold these collars in place, and one of the collars is grooved for engagement with the support, which is beveled to an edge, whereby end motion of the holder is prevented. As the spiral lines formed by the recorder are very close together, it is of the utmost importance to prevent the least endwise movement of the tablet-holder. The tablets are designed to fit the holder accurately, and heretofore they have been simply slipped on, being held in place by friction. As the tablets are apt to vary somewhat in size, it is preferred to make them a trifle larger than the holder and to make the latter at one end increasing gradually to a little larger diameter, so that the tablet can be pressed toward that end sufficiently to insure a tight fit.

In using ordinary spur-gearing to rotate the holder it is found that the motion of the latter is not absolutely uniform, but proceeds by jerks as one tooth strikes the next. Though this irregularity is very minute and not ordinarily observable, it becomes manifested in the operation of the graphophone. This difficulty is entirely overcome by connecting the driven gear of the tablet-holder with its shaft by a yielding connection. In practice a tolerably stiff spring has been used with excellent results.

Heretofore the carriage of the reproducer and recorder rested directly on the feed-screw. The latter therefore served as a way or track for the carriage. To this construction a lateral shaking or wabbling was incident, which, though actually very slight, it is desirable to avoid. The carriage is now mounted on a

smooth way or track independent of the feed-screw. Preferably the way or track is a fixed tube and the feed-screw is placed within it. The carriage carries a nut which engages and is driven by the thread of the feed-screw. The connection between the nut and carriage is a lever-arm passing through a longitudinal slot in the tubular track. The lever carries a weight which serves both to press the nut against the screw and also to counterbalance the weight of the recorder or reproducer and its accessories. The carriage in the present invention is a permanent part of the apparatus, being used with both recorder and reproducer. Preferably the carriage has small anti-friction rollers in contact with the cylinder, and these are arranged relatively to the nut to insure the greatest freedom of motion to the carriage. The lever-arm, carrying the nut and weight, and the tail-piece of the reproducer have each a finger-piece, which, when the reproducer is in place, are in such position as to be simultaneously operated to raise the nut from the screw and the style from the record, enabling the carriage to be moved back or forward, as desired. To insure accurate setting, an indicator-finger with its point close to the surface of the tablet-holder is attached to the carriage.

As heretofore made the recorder did not act as efficiently in recording sounds of high pitch as in recording sounds of lower pitch. This is believed to be due to the fact that when the sound-waves impinge directly against the center of the diaphragm the latter does not act as a unit, for if the sounds are sufficiently high two or more waves in opposite phases may, owing to the length between the center and circumference of the diaphragm, be acting upon it at the same time, and a differential effect is the result instead of the full force of the wave. This difficulty may be overcome by constructing the sound-conveying passage to the diaphragm in such manner that the atmospheric vibrations will act simultaneously upon the whole surface of the diaphragm. The best embodiment of this principle would be to construct a large air-chamber of conical form in front of the diaphragm, communicating at its apex with the mouth-piece; but this plan is not feasible, because the vibratory air-space in front of the diaphragm must be made very thin, or otherwise a disagreeable hollow quality is manifested in the reproduced sound. The object sought, however, may be practically attained without dispensing with the thin air-space, which is found to be advantageous, by dividing the sound-conveying passage as it approaches the diaphragm into a number of branches equal in length and communicating with different points on the surface of the diaphragm, whereby the latter is caused to vibrate with practical uniformity in every part, even with sounds of high pitch. This improvement obviously permits the use of a larger diaphragm than could heretofore be used with advantage, and it is applicable to other apparatus employing a diaphragm operated by sonorous vibrations.

Successful reproduction from graphophonic records which have been properly made depends largely upon the sensitiveness of the reproducing-style and its ability to follow closely the irregularities of the record, bearing always on it with uniform pressure and not skipping from one elevation to the next, as is the tendency. The elevations and depressions of the sound-record being so minute, and following in such rapid succession, make it difficult to insure that the point of the reproducing-style shall descend fully into each depression.

Heretofore the standard of the reproducer has been pivoted at one end and at the other provided with the diaphragm and style, the reproducer resting by its own weight upon the record, and being thus left free to follow its irregularities. To assist, further, its action a light spring has been arranged to bear upon the style and insure its quick return after passing an elevation in the record. It is found in practice that the weight of the diaphragm and mountings upon the free end of the reproducer-standard is too great to secure the best results, and that the device is rendered more efficient in action by reducing this weight. To this end the diaphragm is now placed nearer the other end of the standard, and therefore falls mainly on the fulcrum of the standard, instead of on the record, and it is connected with the style by a thread.

The style itself consists of a lever on one arm of which is the point that rests on the record, and to the other arm of which the thread leading from the diaphragm is attached. By this construction the pressure of the reproducer on the record is greatly reduced and the style is made to follow the record more accurately. Moreover, when the lever constituting the style rests upon the record, the diaphragm through the thread is pulled toward the style, and thereby held under tension. This tension increases as the style ascends a ridge and reacts to compel it to enter the succeeding depression. As before, the style is made flexible laterally to enable it readily to follow the grooves in the bottom of which the record is formed.

For convenience in stopping and starting the machine without interrupting the operation of the motor a clutch mechanism is combined with the main shaft. The clutch can be operated by a key-lever conveniently placed near the front of the machine. This contrivance is of great utility in transcribing from the record on a type-writer, for instance, it being, of course, difficult for the operator to transcribe as rapidly as the record is reproduced. By means of the clutch mechanism the machine can be stopped after a sufficient number of words have been reproduced until the latter have been transcribed or repeated to another person, when the machine can be instantly started again.

Heretofore the fine wax thread or shaving

removed by the cutting-style has been brushed off by hand, and its entire removal has been further insured by attaching a small brush to sweep over the record in front of the reproducer. In the present apparatus a rotary brush is employed having on its shaft a pinion which can be engaged with one of the gears at the same time that the brush touches the surface of the tablet. The brush is preferably made a permanent part of the machine, being carried by a swinging frame attached to one of the shafts. When the record has been cut, the brush can be swung into contact with the tablet, and, by a slight endwise movement, a pinion carried by the brush-spindle is thrown into gear with one of the spur-wheels, and the brush is thereby rapidly rotated while the tablet revolves, completely removing the wax shavings, which fall into a tray placed under the machine. The wax thread or shaving has a tendency to wrap itself around the tablet as the latter revolves, thereby interfering somewhat with the operation of the apparatus. This is now prevented by a comb or saw-toothed plate placed lengthwise of the tablet, with its teeth in close proximity to the surface of the latter.

In addition to the improvements above indicated the invention includes certain new details of construction and combinations of parts, which will be hereinafter fully pointed out.

Having now explained the general principle of the invention, the best mode contemplated of carrying the same into effect will now be described in connection with the accompanying drawings, which form part of this specification.

Figure I is a perspective view of the apparatus arranged upon a stand or table, the recorder being shown in its operative position; Fig. II, a plan view of the graphophone proper; Fig. III, a front elevation with parts of the tray broken away to show the parts behind. Fig. IV is a sectional plan view; Fig. V, a vertical section in elevation looking to the left and showing the reproducer in place. Fig. VI is an elevation of the right end, Fig. II, of the machine, showing the recorder in place. Fig. VII is a bottom view of the recorder. Fig. VIII is a central longitudinal section thereof, and Fig. IX is a detail view of a portion of the clutch mechanism.

Referring to Fig. I, A is the stand or table upon which are placed the working parts of the apparatus. The stand A has a hinged lid, B, which in use is thrown back, forming a shelf. To the front edge of this shelf are attached by clamp-screws 2 the holder 3 for flexible tubes 4. Two tubes are shown, but a greater number could be applied in the same way. At their outer ends the tubes 4 terminate in mouth-pieces 5, and at the other ends they connect with a hollow bifurcated socket, 6, connected by a tube, 7, with the recorder C. At the rear of the shelf B is a bracket, 8, in which the recorder C is placed when not in use, so that, with its attachments, it is entirely out of the way while reproducing. The arrangement is found to be of great utility in recording conversations and in taking depositions. The reproducer D is in like manner provided with two hearing-tubes, 9, terminating in ear-pieces 10, such as described in the Letters Patent aforesaid. These tubes 9 connect with opposite ends of a metal tube, 11, screwed to the stand A, from which a flexible tube, 12, leads to the reproducer D. Hooks 13 are pivoted to the back of lid B, and upon them the tubes 9 are hung when not in use. These hooks can be turned inside the lid B when the latter is to be closed.

The motor for driving the graphophone may be located beneath the stand or table A, and may be a treadle, for example. Power is transmitted from such motor by a belt, 100, to the pulley 101 of a speed-regulator, K. The latter may be of any suitable construction, and, as it forms no part of the present invention, need not be particularly described. Its object is to prevent the graphophone from being driven beyond a determined maximum speed, regardless of the speed of the motor.

Referring now to Figs. II to IX, which show the graphophone proper, the frame-work of the apparatus consists of two uprights or standards, E F, and tie-rods 20 and 21. The main shaft G is supported in bearings in the uprights E F. It is driven by the pulley 25, through which it is rotated from a suitable motor by a belt, and it carries a spur-gear, 26, which transmits motion to the other working parts. The tablet-holder H has a gear, 27, which is driven by gear 26 through an intermediary, 28, on shaft 36. The gear 28 is formed of a disk of leather or other suitable material clamped between two metal disks, the object being to prevent noise in operation. Tablet-holder H is detachably supported in a forked support in the front of uprights E F. It has at the ends loose collars 29 and 30, which, when the tablet-holder is in place, are in contact with the frame, and they constitute the bearings or journal-boxes in which the holder revolves, being held stationary in operation. Collar 29 is formed with a groove, 31, and the recess in which it rests is provided with an edge that enters this groove and prevents end motion of the tablet-holder. The pin 32 passes through a hole in the projection 33 of the upright E, and is pressed down by a leaf-spring, 34, which holds the pin against the collar 29 with sufficient pressure to keep the tablet-holder in place. A similar spring-latch, composed of the spring 35 and the pin 360, (see Fig. VI,) is arranged on the upright F to act upon the collar 30. The surface of the latter is smooth. The construction shown permits the tablet-holder to be instantly removed bodily from the machine and as quickly put back in place, thereby avoiding any considerable delay in the use of the machine when a fresh tablet has to be inserted. The tablet-holder increases at one end to a slightly-larger diameter, as shown

at 40, Figs. III and IV, so that the tablet 41, being pressed toward that end, will be held sufficiently tight to prevent slipping, even though the tablet fits quite loosely with respect to the main portion of the holder.

The gear 27 is fixed not directly to the tablet-holder H, but to a collar, 42, mounted loosely on the spindle of said holder. This collar is connected with the holder by a curved spring, 43, so that the connection between the holder and its gear is a yielding one. The curved spring 43 extends more than half-way around the collar, being fastened at one end to the latter and at the other to the tablet-holder, the collar 42 being cut away to permit this connection to be made. The object of this is to prevent minute vibrations being imparted to the tablet from the toothed gearing and to insure absolute uniformity of motion. Such vibrations are absorbed or taken up by the spring 43. The spring is covered by the sliding cap 44.

The feed-screw I is placed near the top of the apparatus and is supported in bearings in uprights E F. It carries a pinion, 45, which is driven by the main shaft through gear 26, intermediary 28, pinion 46 on the same shaft, 36, that carries the gear 28, and spur-gear 47. The feed-screw I is thus driven at a much lower speed than the tablet-holder H.

Feed-screw I, Fig. V, is inclosed in a hollow tube, L, which forms the guide way or track for the carriage M. To the latter is pivoted a lever-arm, 50, which extends to the rear of tube L. This tube has a slot therein which extends lengthwise of the sleeve to the limits of the movement of the carriage in both directions. The arm 50 carries at its end the segment of a nut, 52, having threads corresponding in pitch to those of the feed-screw I, which it engages. The nut 52 is held in engagement with the feed-screw by the pressure of weight 53, which is also carried by lever-arm 50.

The carriage M is designed to slide freely on the guide tube or way L, which it surrounds. It carries four small anti-friction wheels or rollers, 54, which are in contact with the surface of the tube L, the carriage itself not being in contact with the tube at all. The upper and lower pairs of wheels 54 are placed about one hundred degrees apart with respect to the circumference of the tube L, and they are about equidistant from nut 52, so that the bearing-points of the carriage are nearly equidistant and its pressure evenly distributed around its axis, thereby reducing friction to a minimum.

The thread of the feed-screw may be cut away at the right-hand end to stop the carriage when it reaches the end of its movement.

The carriage has in front a pair of sockets, 56, adapted to receive the trunnions 57 of the recorder C or reproducer D. The carriage M is a permanent part of the apparatus, being used with both recorder and reproducer. As the weight 53 is at the rear of the carriage, it not only acts to keep the nut 52 in engagement with the feed-screw, but also serves to counterbalance the weight of the recorder or reproducer, whichever happens to be in use.

The forward projection of the lever-arm 50 has a finger-piece, 60, Fig. II, by pressing upon which the nut 52 can be lifted out of engagement with the feed-screw and the carriage can be slid to any desired point. The reproducer D has also a finger-piece, 61, which overlaps the finger-piece 60. Thus, by pressing upon the part 61, the style of the reproducer is lifted from the record at the same time that nut 52 is disengaged from the feed-screw. This arrangement permits the carriage and parts connected with it to be moved back and forward—as, for instance, if it be desired to repeat any portion of the recorded speech or sound.

When the recorder or reproducer is in place, it is difficult to set its style accurately at any desired point. To obviate this difficulty the carriage M has a finger or pointer, 62, carried by a rod, 63. The point of the finger 62 approaches close to the surface of the tablet, and said point is in the same vertical plane transverse to the axis of the tablet as the style of the recorder or reproducer when in place in the carriage. Consequently, by means of the finger 62, the carriage can be set accurately at the desired point, and the recorder (or reproducer) then put in place.

The manner of constructing and mounting the carriage M, in addition to other advantages, prevents lateral vibration or wabbling, and one result of this is that the spiral lines of the record can be made closer together than was practicable heretofore. With the apparatus as described the relative speeds of the feed-screw and tablet-holder are so timed that the recorder traces one hundred and fifty-four lines to an inch on the tablet, thus largely increasing the capacity of the tablets.

The recorder C (see Figs. III, VI, VII, and VIII) is in most respects the same as in my Patent No. 341,288. It has the diaphragm 70, of mica, to the center of which is attached the cutting-style 71 and the adjustable bar or bridge-piece 72, having a smooth-surfaced enlargement, 73, at its middle for resting on the surface of the tablet and regulating the depth of the cut to be made by the style 71. It is attached to the carriage, as already explained, by placing the trunnions 57 in the sockets 56, from which it hangs downward and rests by gravity on the tablet 41.

The frame of the recorder consists of a metal ring, 74, with an internal shoulder or flange, 75, at its lower edge, upon which flange the mica diaphragm 70 is placed. Upon the diaphragm is a washer, 76, of yielding material—such as thick paper or card-board—and upon this is placed the metal disk 77, forming a thin air space or chamber in front of the diaphragm. These parts are held in place by the top piece, 78, which is screwed into the ring 74. The top piece, 78, has a central cone, 79, terminating in a socket at its apex for the at-

tachment of a speaking-tube or mouth-piece. The disk 77 has a series of openings or passages, 80 81, for the sonorous vibrations. These are shown as slots arranged in two concentric rings. These rings are disposed so as to affect equally as nearly as possible all parts of the diaphragm, the distance between the openings 80 and 81 being equal to the distance from the latter to the edge of the diaphragm and to the distance across the inner ring, 80.

The object is to divide the sound-passage, so that the sonorous vibrations will act simultaneously against different parts of the diaphragm, instead of being concentrated at its center, and thus cause it to vibrate uniformly over its entire surface. To carry out this principle it is important that all the sound-passages should be of the same length, which is secured by the construction of the top piece, 78. This is provided at its lower side with an annular shoulder, 82, which bears upon and clamps the edge of disk 77, and with a plate or disk, 83, which extends across it and forms an annular air-chamber in front of the disk 77. Disk 83 has shoulder 84 at its center, which bears upon the disk 77 between the first series of slots, 80, and the center. Disk 83 has a single series of openings or slots, 85, arranged in a ring midway between the series 80 and 81 of the disk 77. The openings 85 communicate with air-passages formed between the outer cone, 79, and an inner deflecting-cone, 86. Thus it will be seen that the sonorous vibrations after reaching the apex of the cone 86 are propagated through a number of passages, all of the same length, but communicating with different points on the surface of the diaphragm. Upon the same principle the number of sound-passages may be multiplied by increasing the number of perforated disks interposed between the top piece and the diaphragm. The set-screws 87, passing through the frame 74, are for adjusting the position of the bridge-piece 72, and thus regulating normal depth of penetration of the style 71 into the wax coating of the tablet.

The reproducer D is best shown in Fig. V. It is hung in the carriage M in the same manner as the recorder, and the point of the rubbing-style rests by gravity upon the tablet 41, as heretofore.

The diaphragm 90 is inclosed in a case or chamber, 91, near the upper end of the reproducer-standard 92, or the end away from that which carries the style 93. The style is thus partially freed from the weight of the diaphragm and its mountings and rests more lightly on the tablet. The style 93 is an elbow or bell-crank lever pivoted at 970 in the end of the hollow standard 92, with its point projecting slightly beyond the end thereof. The style is made preferably of spring metal, so that while rigid in the direction of its normal movement it is flexible laterally, and is therefore not liable to slip out of the groove in the tablet.

The inner arm of the lever 93 is connected by a thread, 94, with the center of the diaphragm 90, the thread being inclosed in the hollow standard 92. The pin 95 acts as a stop to limit the extent to which the point of the style projects beyond its casing. The plate 96, which covers the rear of the diaphragm and to which the hollow standard 92 is attached, is perforated, so that the space behind the diaphragm is in communication with the outer air, whereby interference, which would to a certain extent result from reverberation, is prevented. All the working parts of the reproducer are thus inclosed and protected from damage that might result from careless handling. When the reproducer is in place, with the point of style 93 resting upon the record, the weight is sufficient to turn the style slightly on its pivot, pulling on the thread, and thus putting the diaphragm under tension. The tendency of the diaphragm to return to its normal position when pulled out by the motion of the style assists in causing the latter to follow closely the irregularities of the record and to descend fully into the depressions thereof.

One advantage of using a lever as the reproducing-style is that by making the inner arm shorter than the outer, as shown in the drawings, the motion of the diaphragm can be reduced, which, though it involves a slight loss in loudness, is found to produce a more than compensating gain in distinctness of enunciation.

The end of the flexible sound-conveying tube 12 fits over the upper end of a tube, 212, which is fixed in the frame of the reproducer D, and whose lower end, though not in contact, is in close proximity to the socket-piece 213, around the opening in the periphery of said piece for the passage of the sound-waves into the tube 12. The advantage of this construction is that the socket-piece may turn or vibrate on its pivots 214 without friction. It is found that there is no appreciable loss of loudness in the sounds reproduced, with a space of, say, two one-thousandths of an inch all around.

The apparatus can be started and stopped at will by means of clutch mechanism, which will now be described. (See Figs. II, III, IV, and IX.) The driving-pulley 25 is mounted not directly on the main shaft G, but on a stud, 98, fastened to upright or standard E, through which the shaft passes. The hub 97 of the pulley 25 has a serrated edge, 99, constituting one member of a clutch. The boss 103, which is fast on the main shaft G, has a corresponding serrated edge and constitutes the other member of the clutch. The main shaft G can be moved lengthwise in its bearings sufficiently to engage and disengage the member of the clutch, and thereby stop or start the machine, as desired.

For greater convenience in operating the clutch a key-lever, 105, with two buttons, 106 and 107, is placed at the front of the upright F and fixed on the end of a rock-shaft, 108,

having bearings in brackets 112, screwed to upright F. The rock-shaft at its rear end carries an arm, 109, whose point takes into a groove, 110, (see Fig. IX,) in the main shaft. By pressing on button 107 the main shaft is shifted to the right, the members of the clutch thrown into engagement, and the machine started. By pressing on button 106 the shaft is moved to the left, and the pulley 25 thereby disengaged from the shaft and allowed to revolve idly, the shaft coming to rest.

The cylindrical brush 115 is mounted on a spindle, 116, which has bearings in the swinging brackets 117, and carries on one end a pinion, 118, Fig. III. The brackets 117 hang loosely from shaft 36, so that, except when the brush is actually in use, it hangs clear of the other parts of the apparatus. A spiral spring, 119, encircles shaft 36 and bears at one end against a collar, 120, on said shaft, and at the other against bracket 117, and therefore tends to keep the brush in such position that the pinion 118 is out of the plane of gear 28. To use the brush, the operator swings it forward by grasping the stud 121, which is on the end of the brush-spindle 116, and at the same time pushes the brush to the left, thereby throwing the pinion 118 into engagement with gear 28, rapidly rotating the brush against the surface of the tablet, which is also in motion, and clearing it of all the cuttings of wax, which fall into the tray 124. When the brushing is complete, the operator releases it, and it falls by gravity to its normal position, the spring 119 throwing the whole frame to the right and moving pinion 118 out of the plane of rotation of gear 28. The brush 115 is inclosed for the greater part of its periphery in a casing, 123, which acts as a guard to prevent scattering of the shavings, and also partly as a frame to hold the parts together.

The screw 122, Fig. VI, passes through the stud 121. When the brush is raised, its point strikes the under side of upright F, thus limiting the motion of the brush in the direction of the tablet. The screw 122 can be adjusted to secure the proper pressure of the brush against the tablet.

The comb 126, Figs. III and V, extends across the machine below the tablet-holder, being mounted on tie-rod 21. Its teeth approach to within, say, one thirty-second ($\frac{1}{32}$) of an inch of the surface of the tablet 41. The teeth of this comb will catch the fine wax shaving cut by the recording-style and prevent its winding itself around the tablet.

A thin plate having a saw-tooth edge may be substituted for the comb with equally good effect and will be less expensive in construction.

The tablet 41 is preferably such as described in my application for Letters Patent No. 236,304, filed April 27, 1887.

It is obvious that modifications may be made without departing from the spirit of the invention, and that some of the improvements may, if desired, be used without others.

Having now fully described the said invention and the manner in which the same is or may be carried into effect, what I claim is—

1. In an apparatus for recording and reproducing sounds, the combination, with the recorder, of a flexible tube or tubes provided with mouth-pieces and communicating with the space in front of the diaphragm of said recorder, and clamps or holders for attaching said tubes to the stand or table, substantially as described.

2. The combination, in a sound recording and reproducing apparatus, of the recorder, a tube leading to the diaphragm thereof, two flexible tubes connected with said first-named tube by a two-armed socket, and clamps or holders for said tubes detachably secured to the stand or table, substantially as described.

3. The combination of the recorder, a flexible tube or tubes communicating with the space in front of the diaphragm of said recorder, clamps or holders for attaching said tubes to the stand or table, and a bracket or holder for said recorder when not in use, substantially as described.

4. The combination, in a graphophone, of the frame, the main shaft supported in bearings therein, the tablet-holder removably supported in said frame, and gearing for rotating said tablet-holder from the main shaft, substantially as described.

5. The combination of the frame provided with forked supports, the spring-latches, and the tablet-holder having collars, one at each end, for insertion in said supports, said collars constituting the journal boxes or bearings for the tablet-holder, substantially as described.

6. The combination of the frame having forked supports, the cylindrical tablet-holder, the collars thereon adapted to rest in said supports, one of said collars being grooved, and the spring-latches for holding the tablet-holder in said supports, substantially as described.

7. The cylindrical tablet-holder increasing at one end to a larger diameter than the main portion of the holder, substantially as described.

8. In a graphophone, the combination, with the main shaft, of the tablet-holder, a gear-wheel connected therewith by a yielding connection, and gearing for driving said tablet-holder from said main shaft, substantially as described.

9. The combination of the main shaft, the tablet-holder, a gear mounted on a collar loose on said holder, a spring connecting said collar and holder, and intermediate gearing between said shaft and holder, substantially as described.

10. The combination, with the recorder and reproducer, of the carriage having sockets for supporting the same, a stationary track or way on which said carriage slides, a feed-screw, and a nut carried by said carriage and engaging said screw, substantially as described.

11. The combination of the fixed tube having a longitudinal slot, the feed-screw within

said tube, the carriage sliding on said tube, the arm attached to said carriage, and the nut carried by said arm and engaging said screw, substantially as described.

12. The combination of the fixed tube, the inclosed feed-screw, the carriage sliding on said tube, and the nut engaging said screw, and the pivoted arm carrying said nut, whereby the latter may be disengaged from said screw, substantially as described.

13. The combination of the fixed tube, the inclosed feed-screw, the carriage, the anti-friction wheels on said carriage in contact with the surface of said tube, the lever-arm, and the segment of a nut carried thereby and engaging said feed-screw, said wheels and nut, which constitute the bearing-points of the carriage, being arranged at approximately equal distances apart with respect to the axis thereof, substantially as described.

14. The combination, with the fixed tube, the carriage sliding thereon, and the feed-screw, of a lever-arm pivoted to said carriage, a nut on said arm, and a weight for holding said nut in engagement with said feed-screw, substantially as described.

15. The combination of the fixed tube, the carriage sliding thereon, the feed-screw, the nut engaging therewith, the lever carrying said nut and pivoted to said carriage, and the reproducer pivoted in said carriage and having a projection overlapping the end of said lever, so that by pressing on said projection the style is lifted from the record and the nut simultaneously disengaged from the feed-screw, substantially as described.

16. The combination, with the tablet-holder, of the sliding carriage for the recorder and reproducer, said carriage being provided with an indicator-finger having its point close to the surface of the tablet-holder, substantially as described.

17. In a sound recording or transmitting device, the combination, with a diaphragm responsive to sonorous vibrations, of a disk forming an air-chamber in front of said diaphragm, said disk being provided with a number of apertures arranged in series, dividing the diaphragm into rings of equal width, and said apertures being connected with a common mouth-piece, substantially as described.

18. The combination, with the diaphragm and a sound-conveying tube, of a conical deflector having its apex in the axis of said tube, a casing or top piece, and a perforated disk or disks interposed between said top piece and the diaphragm, the perforations of said disks being so disposed as to constitute sound-passages all of the same length, but leading to different points on the surface of the diaphragm, substantially as described.

19. In a graphophone, the combination, with the tablet-holder and feed-screw, of the sliding carriage provided with sockets and a recorder having trunnions for resting in said sockets, whereby it can be readily placed on and removed from said carriage, substantially as described.

20. The combination, with the diaphragm of the reproducer, of the rubbing-style consisting of a lever having the rubbing-point formed on one arm and the other connected with said diaphragm, substantially as described.

21. In a reproducer adapted to rest by gravity on the record, the combination, with the standard, of a style supported in the free end thereof, a diaphragm mounted near the other end thereof, and a connection between the style and diaphragm, substantially as described.

22. The combination of the standard, the style consisting of a lever pivoted at one end thereof, the diaphragm supported near the other end, and a thread connecting one arm of said lever with the diaphragm, substantially as described.

23. The combination of the hollow standard, the diaphragm mounted therein, the style pivoted in the end thereof, and the thread inclosed in said hollow standard and connecting the style and diaphragm, substantially as described.

24. The combination, with the diaphragm, of the pivoted style, said style being connected with the diaphragm at a point nearer its fulcrum than the point that rests on the record, substantially as described.

25. In a graphophone, the combination, with the main shaft, the feed-screw and tablet-holder, and gearing for driving the same from said main shaft, of a clutch for starting and stopping said shaft at will, substantially as described.

26. In a graphophone, the combination, with the main shaft, the feed-screw and tablet-holder, and gearing for driving the same from said shaft, of a wheel or pulley for driving said shaft, mounted loosely thereon, and a clutch for engaging said shaft with said pulley or wheel when desired, substantially as described.

27. In a graphophone, the combination, with the main shaft, driving-pulley, tablet-holder, and carriage for the recorder or reproducer, operated from said main shaft, of the clutch mechanism for connecting and disconnecting said shaft and pulley and the key-lever carried by a rock-shaft connected at one end with said main shaft for operating said clutch mechanism, substantially as described.

28. The combination, with the tablet and tablet-holder and driving mechanism for the latter, of a rotating brush having a pinion on its spindle adapted to engage one of the gears of the machine when the brush is brought against the surface of the tablet, substantially as described.

29. The combination, with the tablet, tablet-holder, and driving mechanism, of the cylindrical brush having bearings in a swinging frame, so as to hang normally free of said tablet, but adapted to be brought into contact therewith and simultaneously thrown into gear with

said driving mechanism, substantially as described.

30. The combination, with the tablet, tablet-holder, and driving mechanism, of the brush having bearings in a swinging frame hanging clear of the tablet, a pinion for engaging one of the gears, and a spring for moving the frame laterally to hold said pinion normally out of the plane of rotation of said gear, substantially as described.

31. The combination of the tablet-holder, the wax-coated tablet, the cylindrical brush carried in a swinging frame, and the tray beneath the brush and tablet, substantially as described.

32. The combination, with the tablet and tablet-holder, of the toothed plate or comb lengthwise of said tablet and having the points of its teeth in close proximity to the surface thereof, substantially as described.

33. The combination, with the pivoted reproducer having a suitable socket-piece provided with a sound-opening on its periphery, of a sound-conveying tube having its end in close proximity to the said socket-piece around the said opening, leaving a small space, so as to avoid friction, substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHARLES SUMNER TAINTER.

Witnesses:

ROBINSON WHITE,

C. J. HEDRICK.