

Nov. 16, 1926.

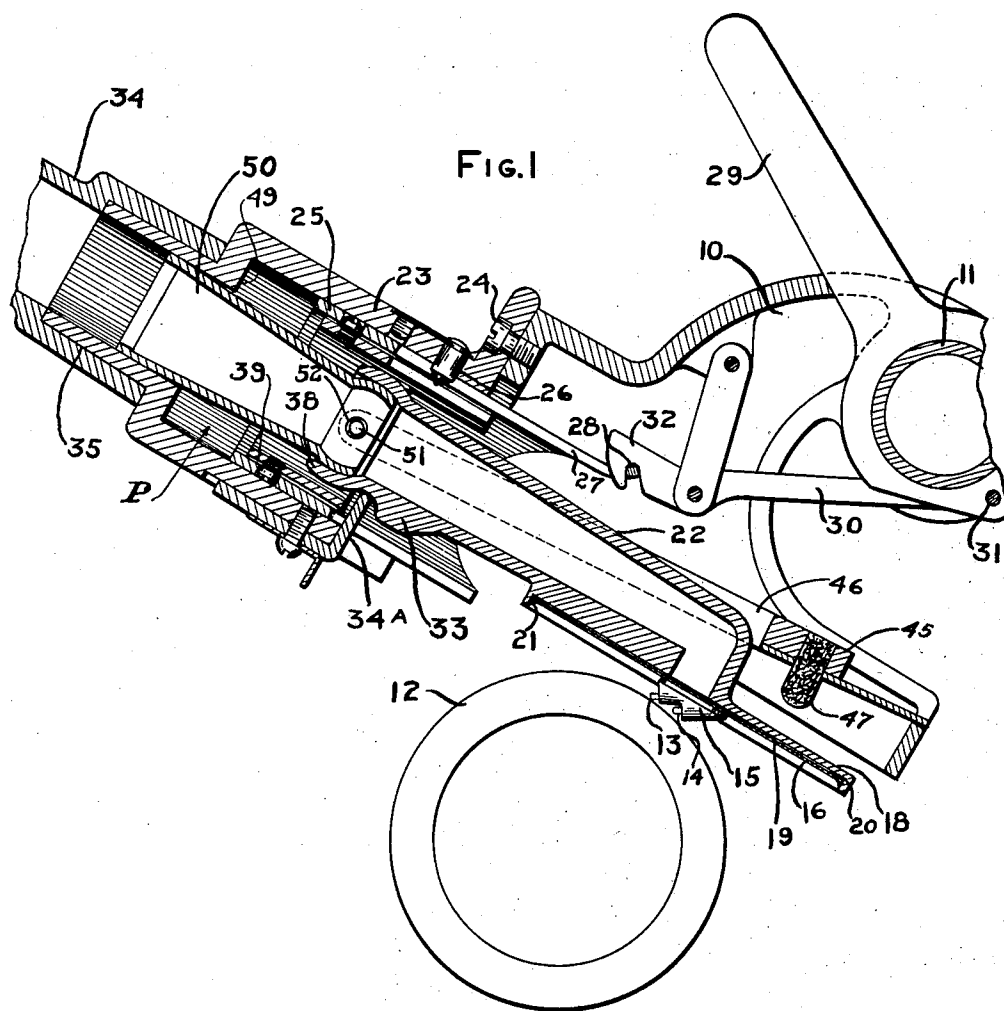
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A. V. BODINE ET AL

ACOUSTICAL DEVICE

Filed May 24, 1924

2 Sheets-Sheet 1



WITNESS

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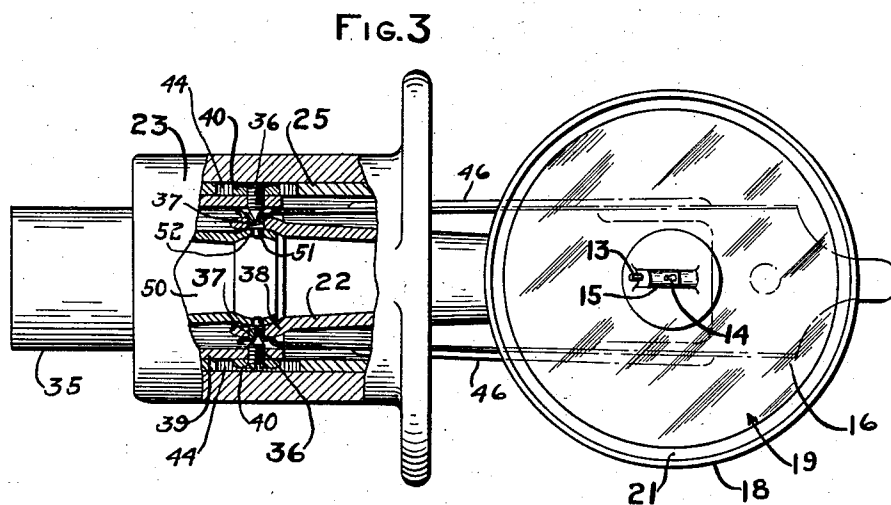
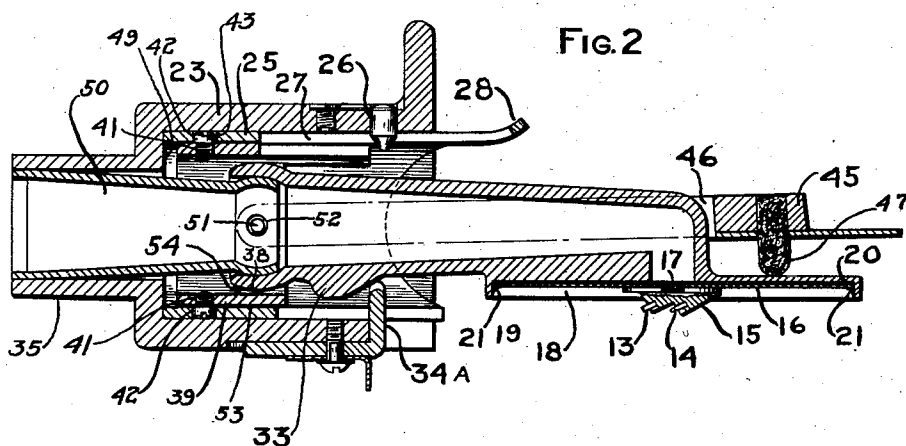
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UNITED STATES PATENT OFFICE.

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ACOUSTICAL DEVICE.

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This invention relates to improvements in sound recording, sound reproducing, and sound recording and reproducing mechanisms, for phonographs, et cetera.

One embodiment of the invention, shown as applied to dictation machines, is illustrated in the accompanying drawings, in which—

Figure 1 is an end view, partly in section, of an improved sound recording-reproducing mechanism for a dictating machine, made in accordance with this invention, showing the parts in the positions they occupy when recording.

Fig. 2 is a sectional view of the speaker-head, with the parts in positions they occupy when reproducing.

Fig. 3, is a bottom plan view of the speaker-head, with the casing broken-away to show the details of construction.

In the form shown in the accompanying drawings, the recording and reproducing mechanism comprises a carriage 10, Fig. 1, slidably mounted on a guide 11 to travel over a record 12 which is rotated coincidentally with the traveling movement of the carriage 10 so that the knife-like recording stylus 13 produces a spiral groove in the surface of the record and records the sound therein. This may then be reproduced by engagement of a ball-like reproducing stylus 14 in the spiral groove, all in the usual and common manner.

The recording stylus 13 and reproducing stylus 14 are mounted in a holder 15 secured to a diaphragm 16 by a screw 17 passing through a perforation in the diaphragm. The diaphragm, which is preferably a mica disk, is mounted in a casing 18 having a dished-portion 19 to receive it. Spacing the diaphragm from the face of the dished-portion is a spacing-washer or annulus 20 against which the diaphragm is held by a fillet 21 of plastic material such as bees' wax engaging the casing 18.

The diaphragm casing or speaker 18 is provided with a tube 22 extending into a housing 23 which is secured by screws 24 to the carriage 10, and is mounted, as herein-after described, for longitudinal movement substantially tangentially of the record, in a

tube 25, itself slidably mounted in the housing 23. This tube 25 is held against turning movement in the housing 23 by a pin 26 mounted in a hole in the latter and passing through a slot 27 in the tube 25.

To move the tube 25, and with it the speaker 18, for the purpose of shifting from recording position to reproducing position or vice versa, or to an intermediate position where neither of the styli engages the record, a manually operable control lever 29 is provided. This lever 29 is mounted on the carriage and has a link 30 pivotally mounted thereon at 31 and having at its other end a hook 32 engaging the end wall 28 of the slot 27. The rocking movements of the lever 29 are transmitted to the sliding tube 25 in the form of reciprocatory movements which cause the position of the tube to be changed as desired to bring either the stylus 13 or the stylus 14 to record-engaging position when the lever is in its respective extreme forward or backward position.

In its intermediate position, the speaker 18 is held elevated with respect to the record-surface, with neither of the styli 13 or 14 engaging the record, by the engagement of a cam-surface 33 on the speaker with an abutment 34^a on the housing 23. Further, the cam 33 and abutment 34^a serve to lift the styli on the speaker away from the record as soon as the speaker starts to move from either of its operating positions, and this avoids damage being done to the record by the sliding movement of the styli over its surface.

In addition to the movement above referred to, the recorder-reproducer mechanism is also movable vertically to accommodate itself to records of various sizes, depending upon the extent to which they have been previously used and shaved, and to permit slight vertical movements in operation due to eccentricity of the record on its support. It is also necessary, in reproducing, to provide for slight lateral movement of the reproducing stylus so that it will follow with freedom the grooves previously made in the record surface, without damaging the side walls of the grooves by undue pressure on either side.

Thus, it will be seen, the recorder-reproducer moves longitudinally, laterally and vertically.

This universality of movement of the speaker with relation to its mounting is provided for by a gimble mounting comprising a horizontal pivot to allow vertical movement, a vertically pivoted support for the horizontal pivot to allow horizontal movement, and slidable means for supporting the vertically pivoted support.

The horizontal pivot, it has been found may advantageously comprise a pair of pivot pins or cone-point screws 36, Fig. 3, engaging centers provided in brass or other suitable bushing 37 driven into apertures in an enlarged end 38 of the tube 22, which tube is preferably made of aluminum for lightness. The cone-point screws 36, engage the end 38 at diametrically opposite points and allow only vertical movements of the speaker 18; they do not pass into the sound passage of the tube 22 and, therefore, in no way interfere with the sound transmission. The screws 36 are threaded into a tubular support 39 surrounding the enlarged end 38 of the tube 22 and can be adjusted therein to accurately engage and support the speaker 18, being locked in adjusted position by lock-nuts 40.

The horizontal movement of the speaker 18 is permitted by providing the tubular support 39 with a pivotal connection to the sliding tube 25. This connection comprises a pair of trunnion-screws 41 (Fig. 2) threaded into the tubular support 39 and having round bearing-heads 42 fitting openings 43 provided in the sliding tube 25. These trunnion screws 41 are located diametrically opposite each other and at right angles to the screws 36.

The trunnion screws 41 when so provided are applied from the outside of the assembled unit comprising the speaker 18 and sliding tube 25 and this arrangement has been found to facilitate the assembling of these parts. Likewise, and with similar advantage, the screws 36, also may be applied and adjusted from the outside of the assembled unit, the sliding tube 25 having an opening 44 adjacent each screw into which the end of the screw 36 extends and in which the lock nut 40 is located.

For the purpose of applying sufficient weight to the speaker 18 during reproducing, so that the wave-like surface of the record-groove in which the sound is recorded will not merely cause the speaker 18 to oscillate, but will properly cause the diaphragm to vibrate, a weight 45 mounted between arms 46 is adapted to bear against the upper surface of the speaker-casing 18 through a sound-deadening plug 47 of leather. The weight-arms 46 are mounted upon the ends of the bushing 37 and are

confined between the end 38 of the tube 22 and the tubular support 39.

The sound to be recorded is conveyed to the speaker housing 23 by a tube 34 engaging a nozzle 35 provided on the housing 23, Fig. 1.

Heretofore, it was found expeditious to have the support 39 closely fit the sliding tube 25 on one side, and the end 38 of the speaker-tube 22 on the other side, so as to avoid the loss of a substantial part of the sound energy received by the nozzle 35, which would result in making a weak record. Even the closest fit commercially practicable, was found to allow the escape of so much sound energy that, in many instances a very thin, sensitive diaphragm had to be employed to satisfactorily record the sound ultimately reaching the diaphragm. Such diaphragms were not acoustically correct and the best results were not obtainable, because the diaphragm's natural vibration period was much higher than the vibratory periods of the sounds ordinarily desired to be recorded. Moreover, a space or pocket P was produced between the sliding tube 25, the speaker and connected parts, and the wall 49 of the housing 23, when the parts were in recording position (Fig. 1), and this pocket P acting as a resonator changed the character of the sound, giving a "tubby" effect in many instances.

To avoid these disadvantages and to reduce the cost of manufacture of the recorder-reproducer, this invention provides a tube 50 directly interconnecting the nozzle 35 and the speaker-tube 22. The nozzle-end of the tube 50 slides upon the internal surface of the nozzle 35 and maintains its connection therewith in all positions of the speaker 18. At its speaker end the tube 50 snugly fits within the enlarged end 38 of the speaker-tube 22 and is held therein by engagement with studs or trunnions 51 provided on the ends of the bushings 37, holes 52 being provided in the tube 50 to engage the trunnions 51. These are sufficiently large to permit some free movement of the tube 50 relative to the tube 22 of the speaker to allow horizontal movement of the speaker tube 22.

The diameter of the passage of each of the parts, the connecting tube 50 and the tube 22 of the speaker, gradually reduces from the nozzle 35 to the diaphragm 16 so that the sound is confined as it passes to the diaphragm; and it is to an appreciable extent intensified by this confining action.

With this provision, any desired clearance or space 53 may be provided between the sliding tube 25 and the tubular support 39. Also any desired clearance 54 between the tubular support 39 and the end 38 of the speaker-tube 22 may be provided, and thus the tolerances (that is to say, the permis-

sible departure from stated requirements) in the manufacture of the mountings may be materially increased with an accompanying saving in time and labor in the manufacture of the parts.

While there has been herein described in detail one embodiment of this invention, it should be understood that other embodiments will suggest themselves to those skilled in the art, and that variations and modifications may be made within the scope of the appended claims, and portions of the improvements may be used without others.

Having now described the invention, what is claimed as new, and for which Letters Patent is desired, is:

1. In combination, a diaphragm-carrying member made of light-weight relatively soft material; a carrier for the member; cone-shaped studs in the carrier for pivotally supporting the member; and relatively hard, wear-resisting bushings inserted in the member, adapted to be engaged by the cone-shaped studs for pivotally supporting the member.

2. In combination, a diaphragm-carrying member; a carrier for the member; means in the carrier for pivotally supporting said member; bushings inserted in the member adapted to be engaged by the means for pivotally supporting the member; a weight-member adapted to engage the diaphragm-carrying member; and means on the bushings to pivotally support the weight-member.

3. In combination, a tubular diaphragm-carrying member; a carrier for the member; means in the carrier for pivotally supporting the member; bushings inserted in the member adapted to be engaged by the means for pivotally supporting the member; a tubular sound-conductor extending within the tubular diaphragm-carrying member adjacent its point of support; and studs on the bushings to connect the tubular sound-conductor to the tubular diaphragm-carrying member.

4. In combination, a tubular diaphragm-carrying member; a carrier for the member; means in the carrier for pivotally supporting the member; bushings inserted in the member adapted to be engaged by the means for pivotally supporting the member; a weight-member adapted to engage the diaphragm-carrying member; shoulders on the bushings adapted to pivotally support the weight-member; a tubular sound-conductor connecting with the tubular diaphragm-carrying member adjacent its point of support; and studs on the bushings to connect the tubular sound-conductor to the diaphragm-carrying member.

5. In combination, a sound-conductor; a carrier for the sound-conductor; means in the carrier for pivotally supporting the

sound-conductor; bearing means in the sound-conductor adapted to be engaged by the means for pivotally supporting the sound-conductor; an auxiliary sound-conductor extending within the first-named sound-conductor adjacent its point of support; and means on the bearing means adapted to connect the auxiliary sound-conductor to the first-named sound-conductor.

6. In combination, a sound-conductor; a carrier for the sound-conductor; means in the carrier for pivotally supporting said sound-conductor; bearing means in said sound-conductor adapted to be engaged by the means for pivotally supporting the sound-conductor; a weight-member adapted to engage the sound-conductor; means on the bearings adapted to pivotally support the weight-member; an auxiliary sound-conductor connecting with the first-named sound-conductor, adjacent its point of support; and means on the bearings adapted to connect the auxiliary sound-conductor to the first-named sound-conductor.

7. In a phonograph, a member, means permitting said member to have lateral play; means permitting said member to have vertical play, said member carrying a diaphragm provided with a recording-stylus and a reproducing-stylus and having a sound-conduit leading to the diaphragm; a housing in which said member is mounted; sound-receiving means on said housing; and means for conveying the sound received by sound-receiving means to the sound-conduit of said member in a confined path irrespective of the position of said member.

8. In a phonograph, a member to carry a diaphragm; longitudinally movable means to pivotally support said member; a housing for carrying said longitudinally movable means and comprising sound-receiving means; and means engaging said housing and said diaphragm-carrying member, to provide a confined path from the one to the other, in all longitudinal or pivotal positions of said member.

9. In combination, a member having sound-passage therefor; a diaphragm at one end of the sound-passage; said sound-passage having an enlarged end at the other end of the sound-passage; a housing in which said member is mounted for longitudinal and lateral movement, said housing having a sound-receiving orifice, the enlarged end of said member being movable to and from said orifice; and a tube in intimate contact with said orifice and extending into the enlarged end of said member, to provide a closed and continuous path for the sound from said orifice to said enlarged end of said member.

10. In combination, a sound-conducting means; a carrier therefor; means for pivotally supporting said means on said car-

rier for movement in one plane; a support for the carrier; means for pivotally supporting the said support for movement in a plane common to the first named plane; a housing in which said support is mounted; sound-receiving means at a part of the housing removed from the sound-conducting means; and means for directly transmitting sound from said sound-receiving means to the sound-conducting means.

10 11. In combination, sound-conducting means; a carrier therefor; means for pivotally supporting said means in said carrier for movement in one plane; a support for the carrier; means for pivotally supporting the support for movement in a plane common to the first named plane; means for guiding the last-named means for longitudinal movement; sound-receiving means on the
20 last-named means, remote from the sound-

conducting means; and means for directly transmitting sound from said sound-receiving means to the relatively movable sound-conducting means.

12. In combination, sound-conducting 25 means; a carrier therefor; means for pivotally supporting said means in said carrier for movement in one plane; a support for the carrier; means for pivotally supporting the said support for pivotal movement in 30 a plane common to the first named plane; a casing in which said support is mounted; sound receiving means at a part of the casing removed from the sound-conducting means; and means for directly transmitting 35 sound from said sound-receiving means to the sound-conducting means.

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