May 11, 1943. B. A. PROCTOR 2,318,627

SOUND RECORDING AND REPRODUCING

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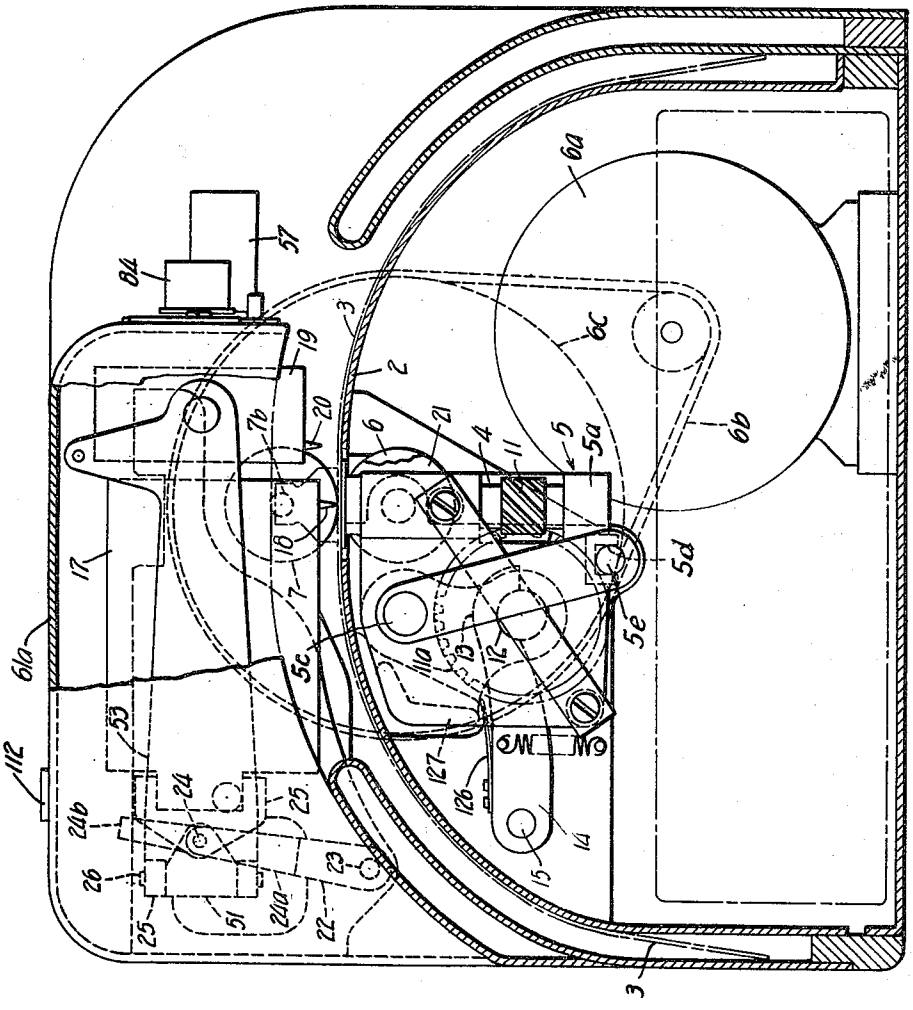


Fig. 1.

1

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SOUND RECORDING AND REPRODUCING

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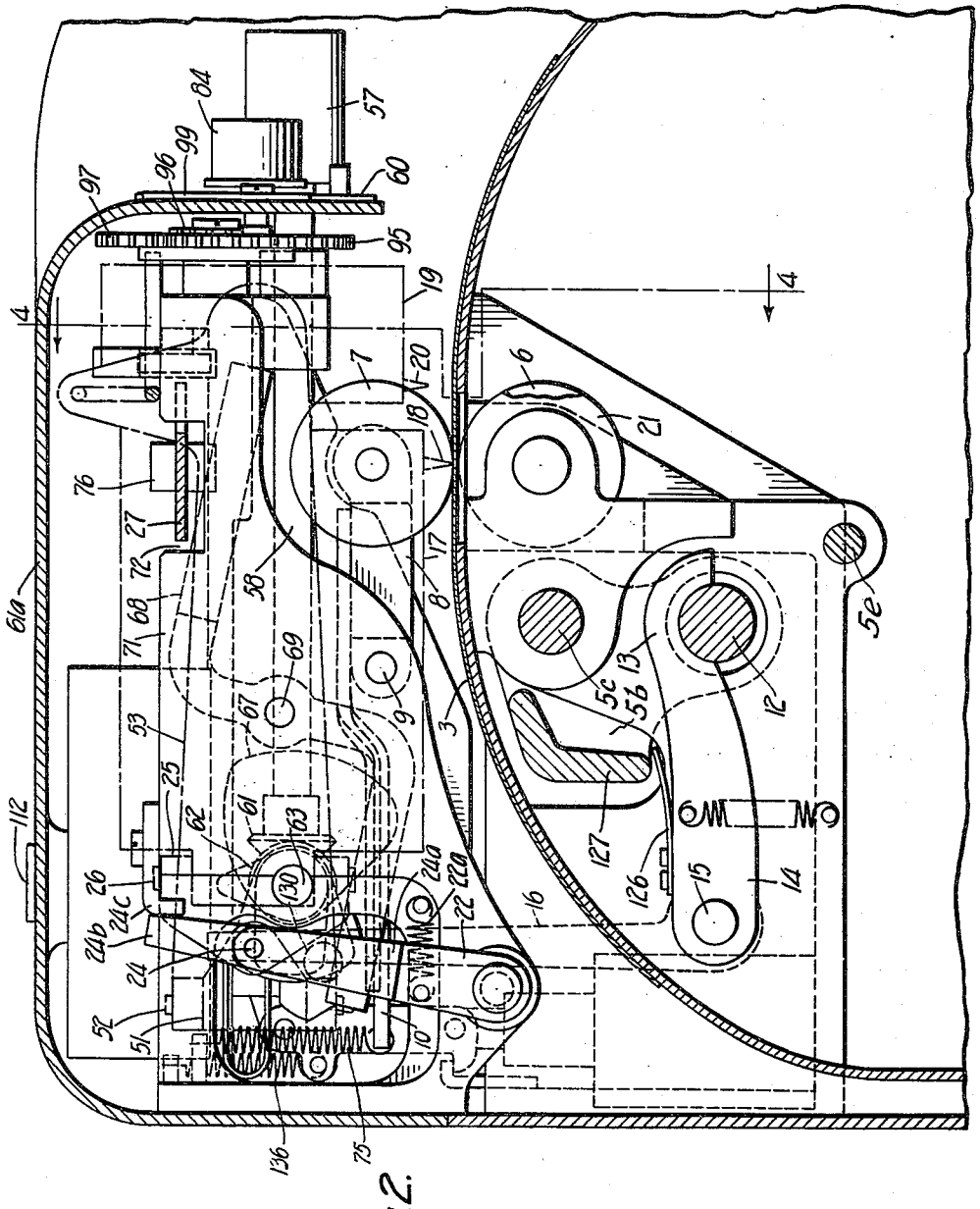


Fig. 2.

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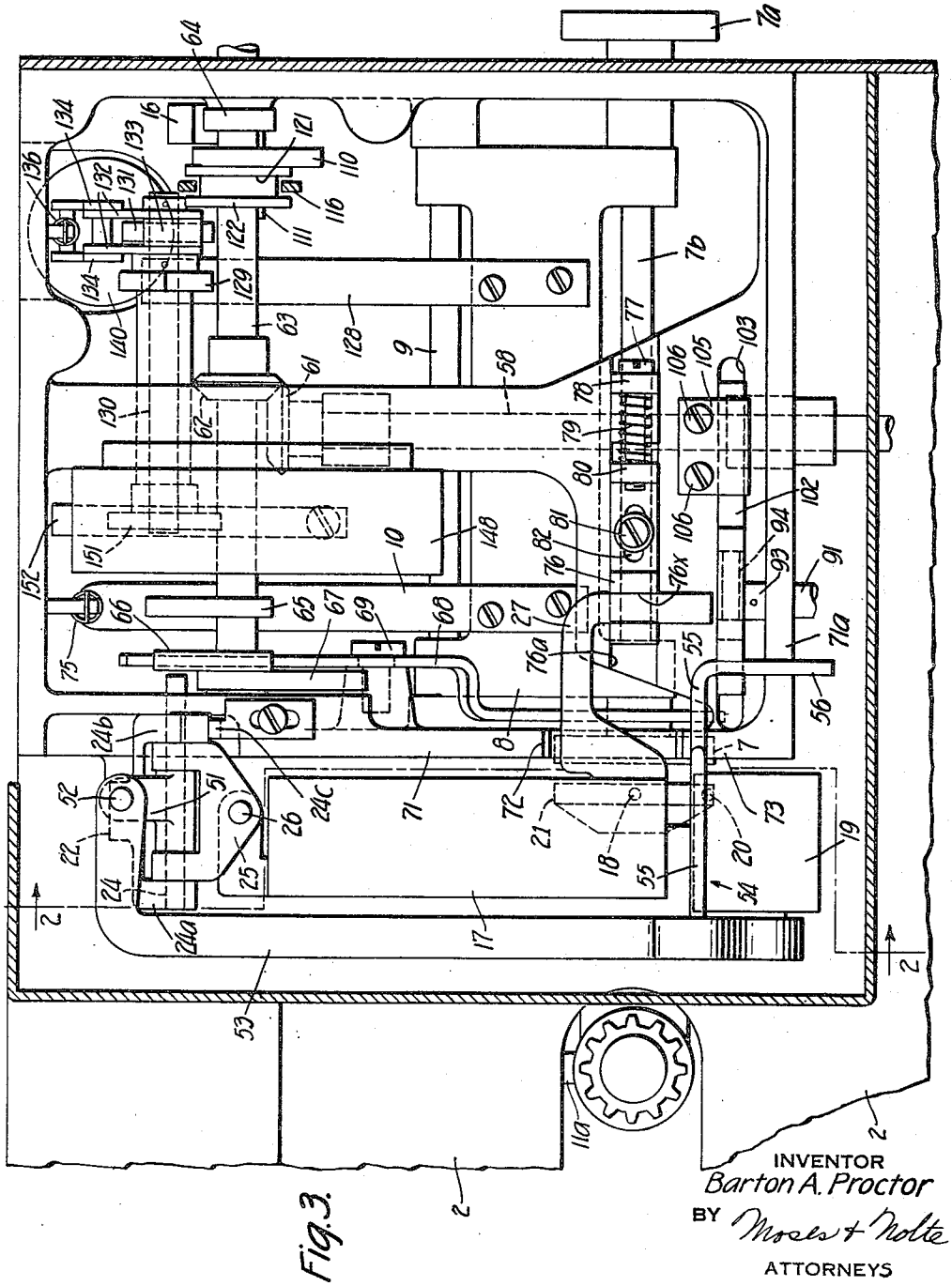


Fig. 3.

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SOUND RECORDING AND REPRODUCING

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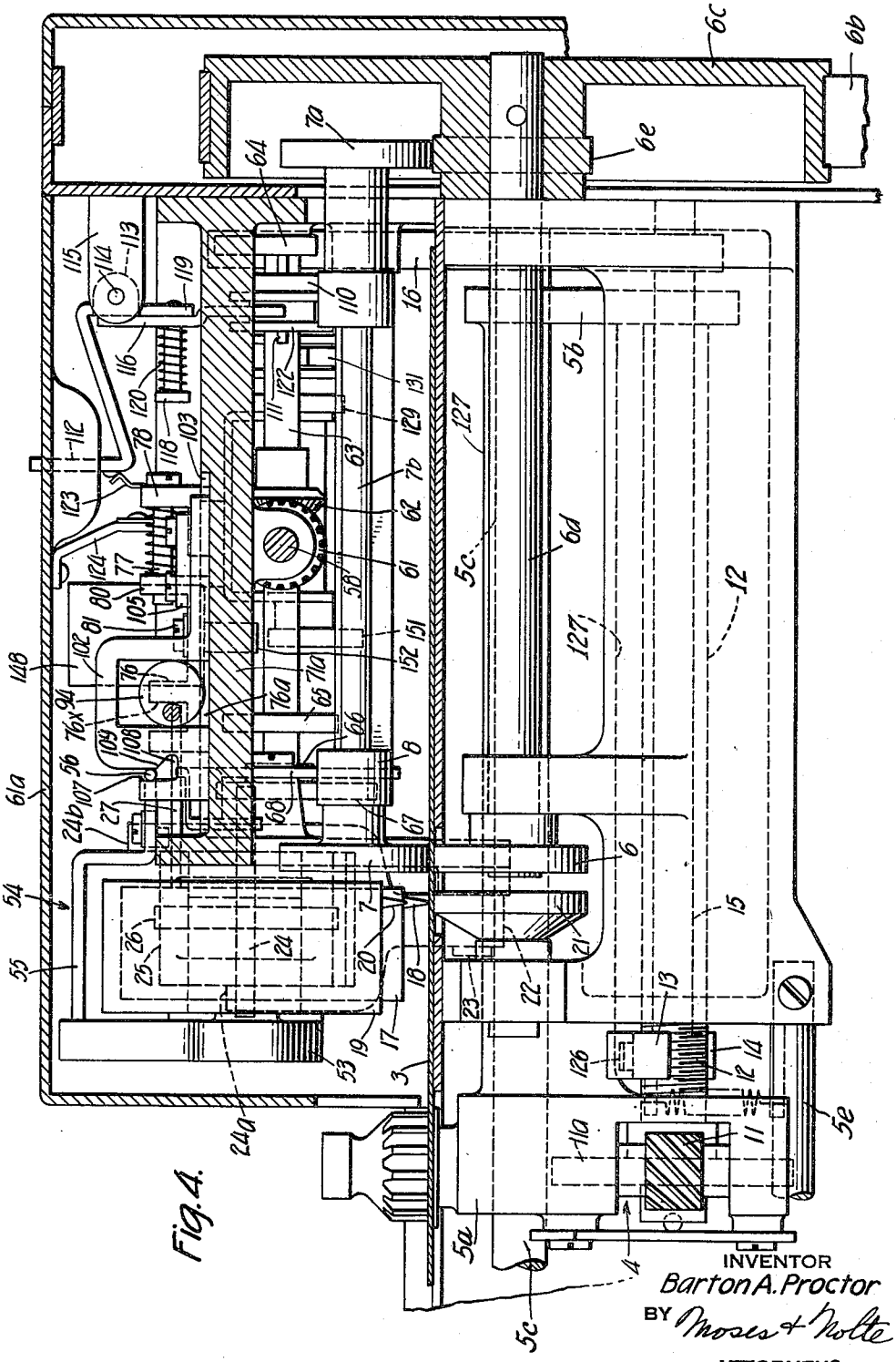


Fig. 4.

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SOUND RECORDING AND REPRODUCING

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Fig. 5.

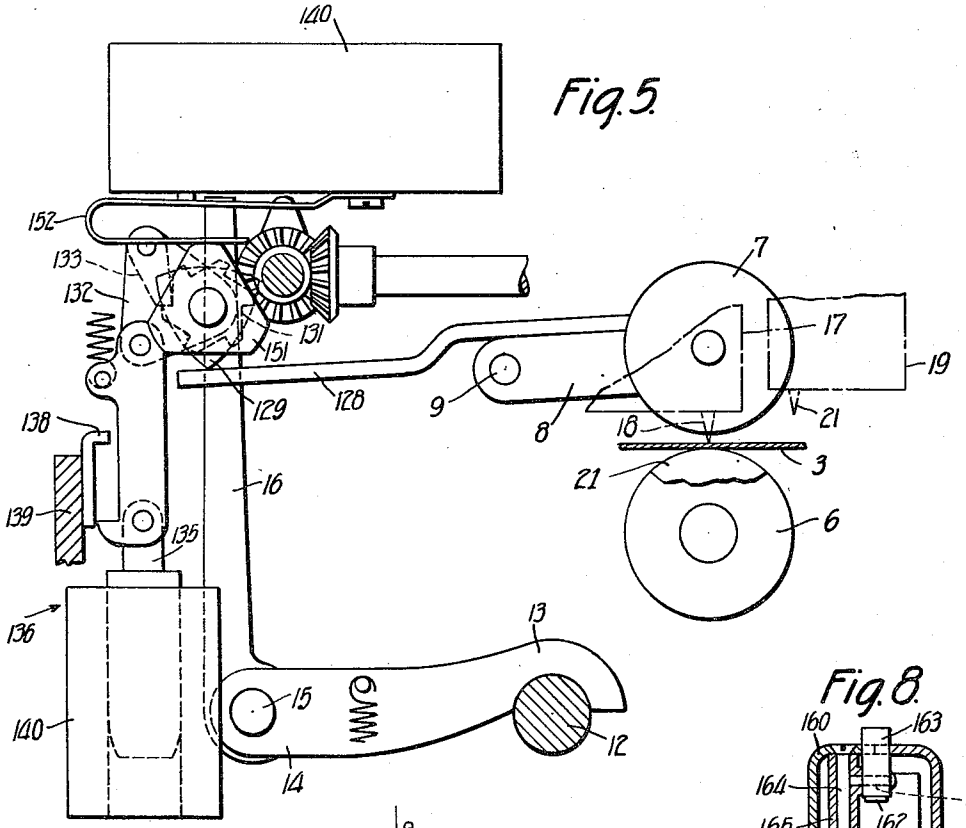
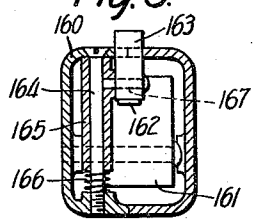


Fig. 8.



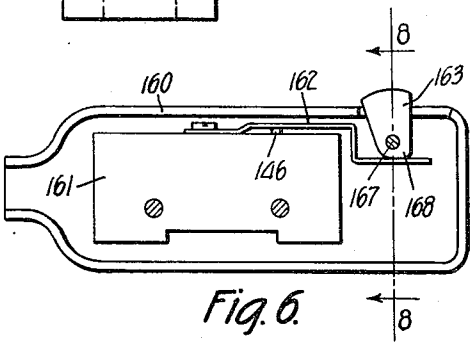


Fig. 6.

Fig. 9.

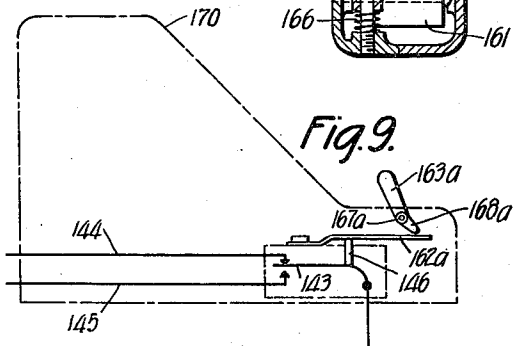
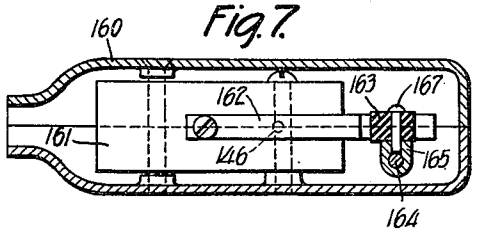


Fig. 7.



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Fig. 10.

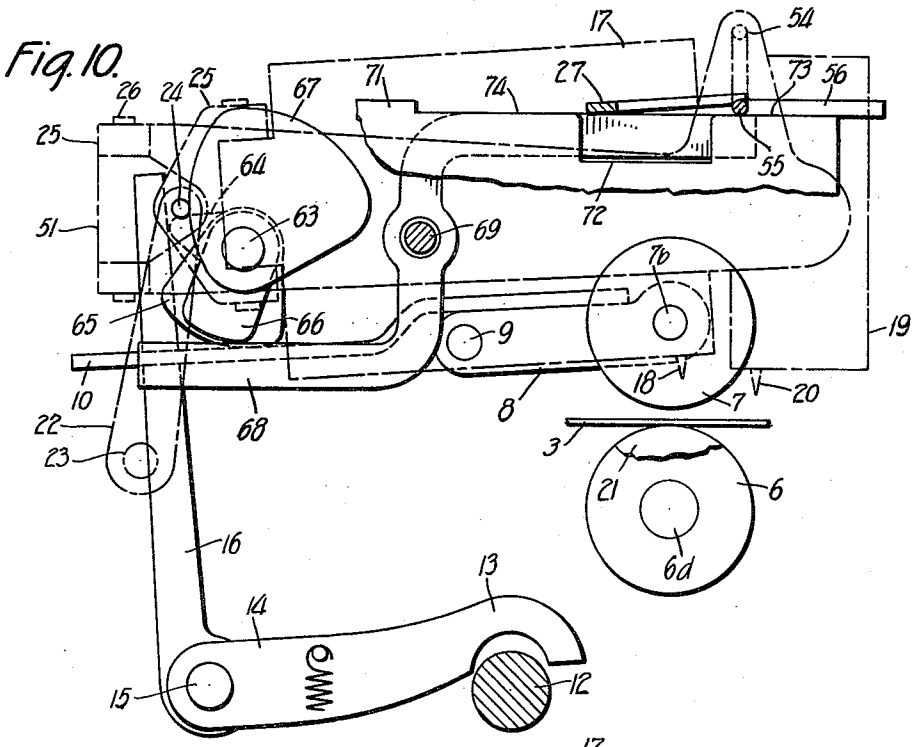
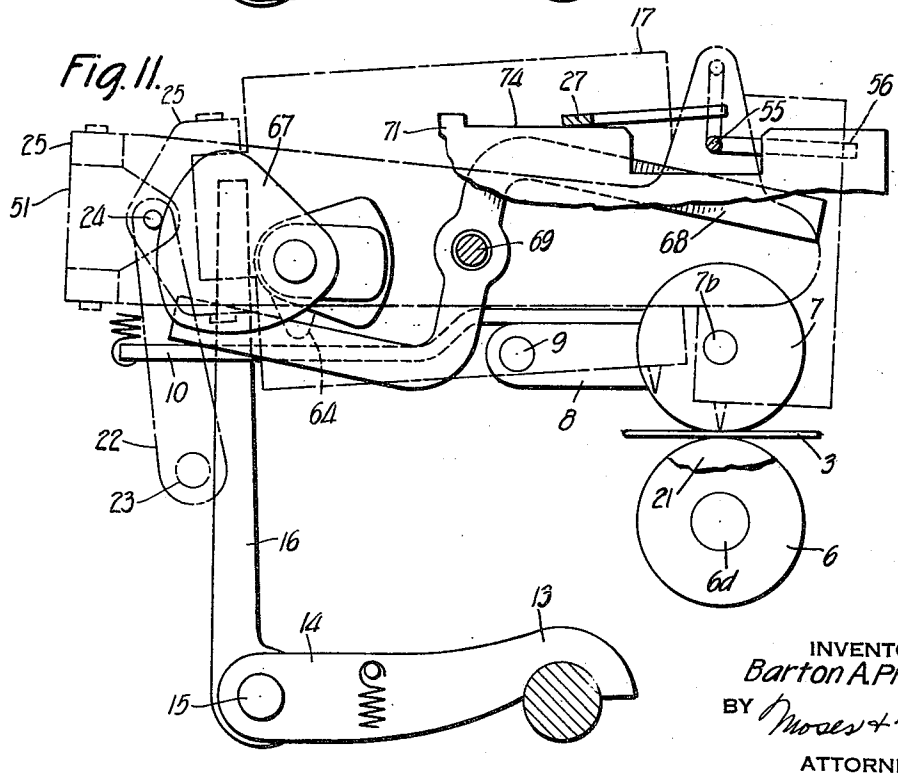


Fig. 11.



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Fig. 12.

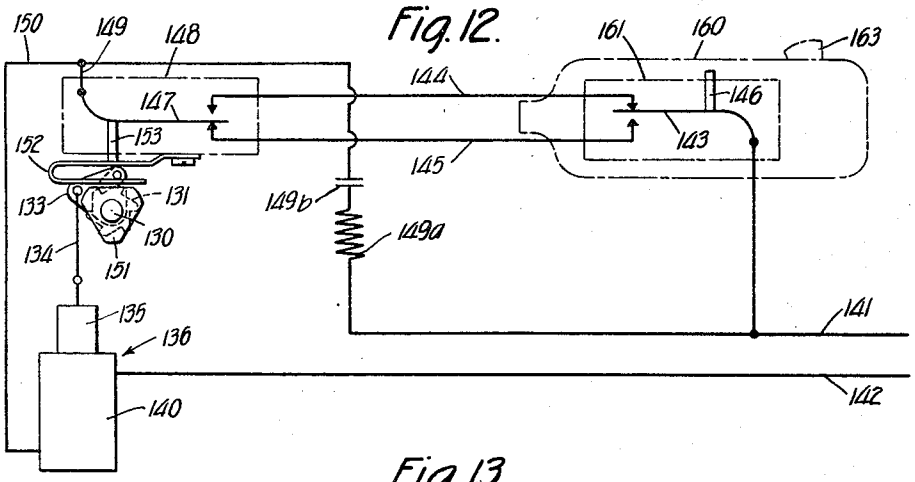


Fig. 13.

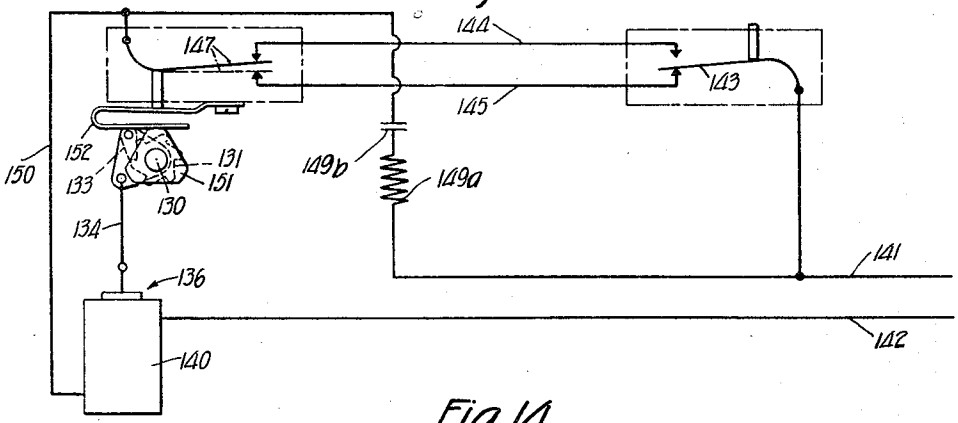
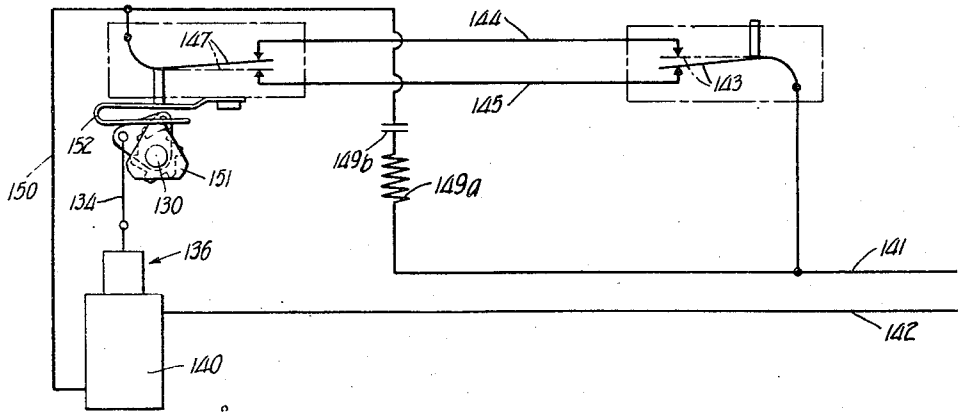


Fig. 14.



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SOUND RECORDING AND REPRODUCING

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Fig. 15.

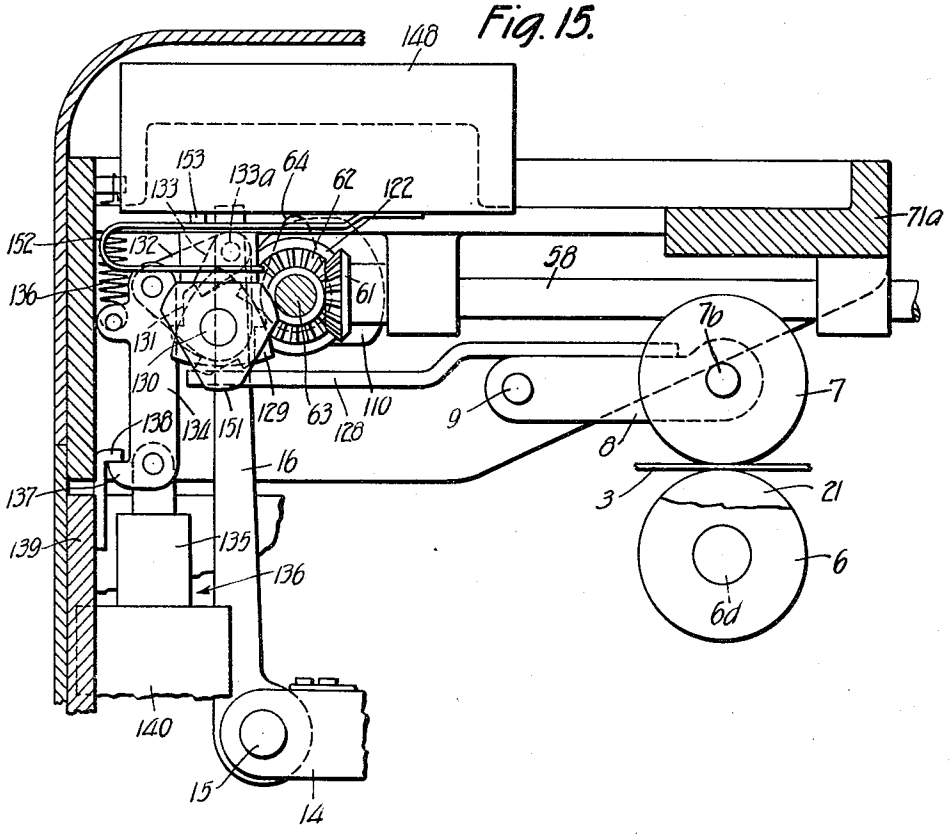
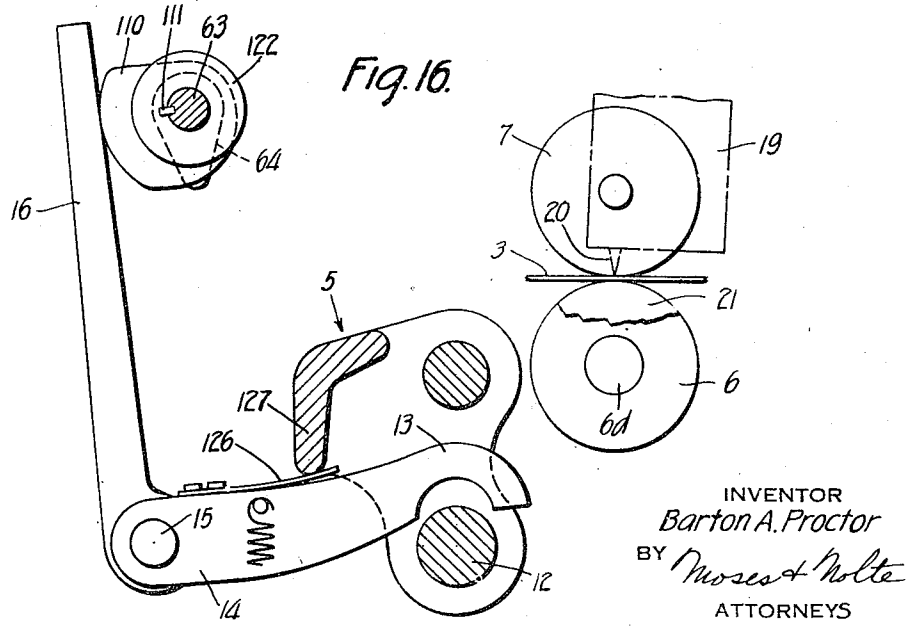


Fig. 16.



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SOUND RECORDING AND REPRODUCING

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Fig. 17.

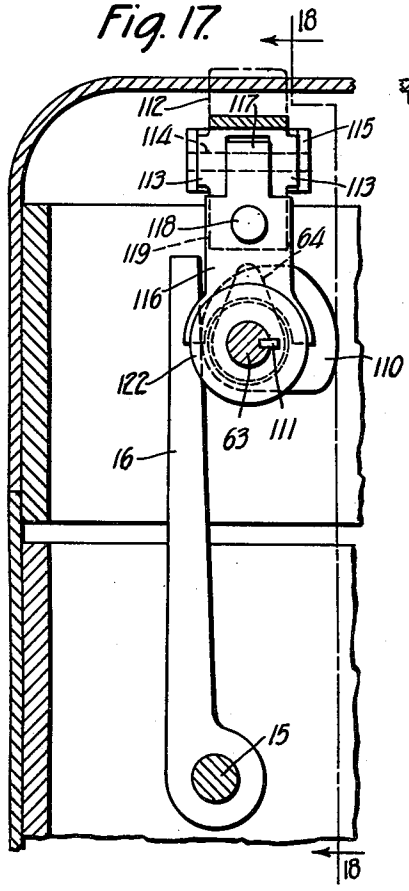


Fig. 18.

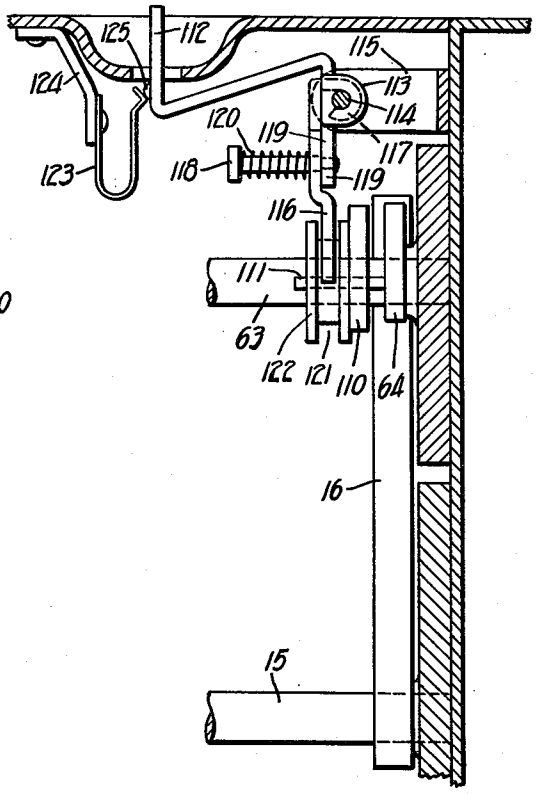


Fig. 19.

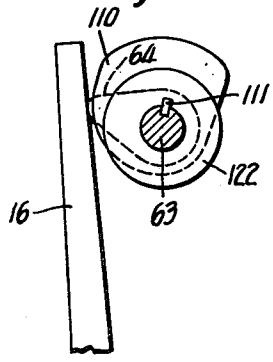
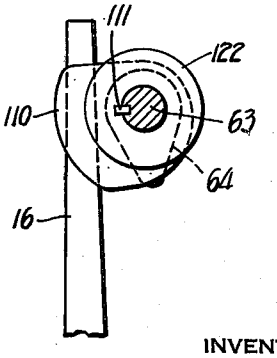


Fig. 20.



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Fig. 21.

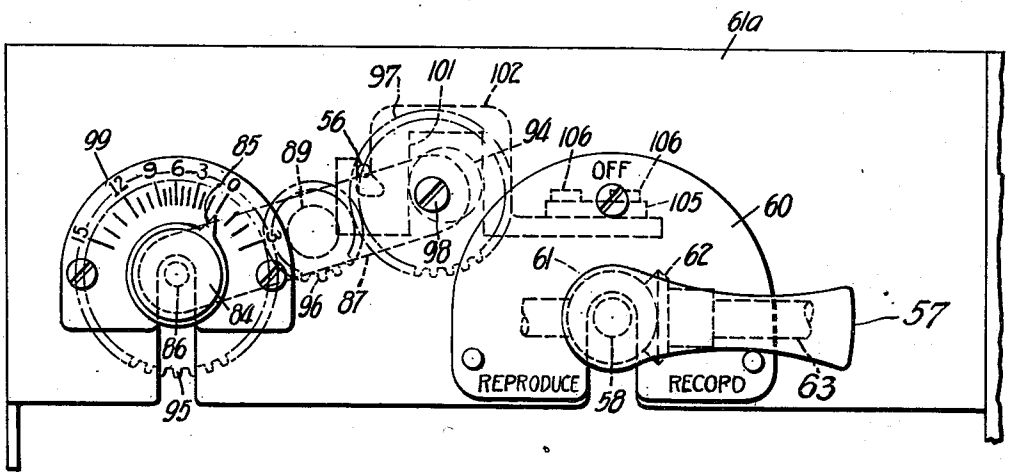
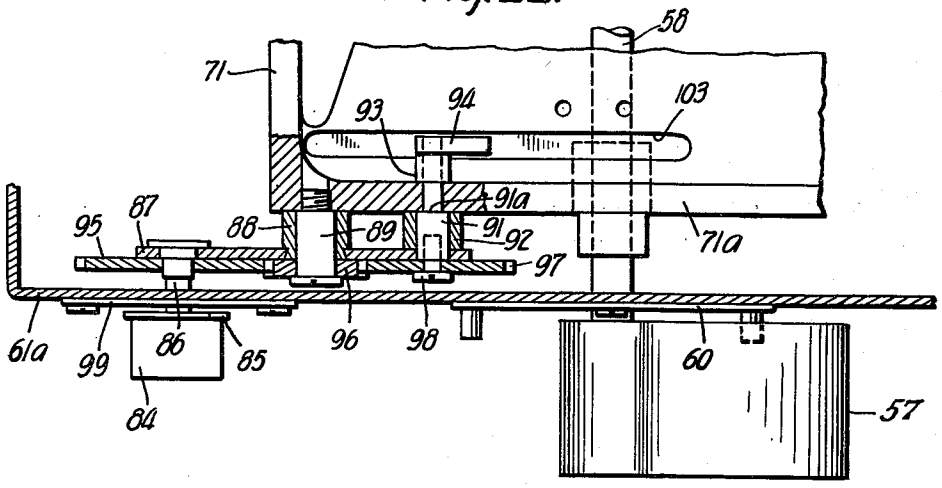


Fig. 22.



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Patented May 11, 1943

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UNITED STATES PATENT OFFICE

2,318,627

SOUND RECORDING AND REPRODUCING

Barton A. Proctor, Larchmont, N. Y., assignor to B. A. Proctor Company, Inc., New York, N. Y., a corporation of New York

Application June 29, 1939, Serial No. 281,811

5 Claims. (Cl. 74—206)

This invention relates to recording and reproducing machines, and more particularly to machines used in the dictation and transcription of letters, memoranda and other writings. The invention has to do with improvements upon a dictation machine of the kind disclosed and claimed in the pending application Serial No. 218,082, of Barton A. Proctor and Ferdinand C. W. Thiede, filed July 8, 1938, for Sound recording and reproducing.

In the machine referred to, provision is made for recording sound upon, and reproducing sound from, thin, flexible, disc records. The record is mounted upon a turtle back support and impaled upon a center spindle. Rotation is imparted to the record through a pair of friction wheels, one of which is shiftable into and out of engagement with the record. The record interfits with the center spindle so that rotation of the record imparts rotation to the spindle. Rotation of the spindle, in turn, is converted into a linear feed of the spindle, such feed being in a direction to carry the center spindle bodily, directly away from the point at which the record is engaged by the feed wheels.

The machine is equipped with a recording unit which includes a stylus, and with a reproducing unit which also includes a stylus. Control mechanism is provided which may be set in a neutral position, both to interrupt the feed of the record and to hold the recording and reproducing styluses out of engagement with the record. Operation of the control mechanism in one direction from neutral shifts the recording stylus over the record engaging point and then lowers it onto the record. Operation of the control mechanism in the opposite direction from neutral position shifts the reproducing stylus over the record engaging point and then lowers it into engagement with the record.

The machine also includes a mechanism for imparting a back spacing movement to the reproducing unit when the reproducing stylus is out of engagement with the record. It further includes start and stop mechanism for enabling the record drive to be interrupted and reestablished at the will of the operator without removing the active stylus from the record.

An important object of the present invention is to provide improved and simplified means for mounting the recording and reproducing units so that the styluses may be alternatively located in engagement with the record at a common record-engaging point.

To this end it is a salient feature of the invention that a common support is provided upon which the rear ends of both the recording and the reproducing units are pivotally mounted for swinging movement in a common vertical plane. A lifter, engageable with both units, is provided for lifting either unit whose stylus is in record-engaging position away from the record. Provision is further made of means for shifting the common unit support horizontally when both units are raised, and of means for locking one unit or the other in elevated position according to the horizontal disposition of the units, so that a selected one of the styluses will be lowered against the record when the lifter is lowered.

In accordance with a practical and advantageous embodiment of the invention, the control means comprises a cam shaft having a plurality of cams fast upon it. When one of the styluses, say the recording stylus is active, operation of the control means to the neutral position will serve first to interrupt the drive of the record, and second to lift the recording unit for separating the stylus of that unit from the record. If, now, it is desired to lower the reproducing stylus onto the record, the control means will be operated from the neutral position to the reproducing position. This serves first, to shift both the recording and reproducing unit horizontally to locate the reproducing stylus in substantially the same vertical line which was previously occupied by the recording stylus. By the same movement the recording unit will have been locked or detained in its raised position, and the reproducer unit will have been unlocked. The next effect of operating the control means to the reproducing position will be to lower the lifter and thereby cause the reproducing stylus to be set upon the record. Finally, the movable feed wheel will be restored to engagement with the record unless it is detained against such operation by the start-stop mechanism hereinafter referred to.

A further important object of the present invention is to provide improved back spacing mechanism for the reproducing unit. Besides being mounted with capacity for rocking movement and for horizontal bodily movement in a vertical plane, the reproducing unit is also mounted with capacity for swinging movement in a horizontal plane to carry the reproducing stylus toward and from the center of the record. The reproducing unit includes an arm with which a back spacing member cooperates in the back spacing operations. The back spacing member is formed with a vertical slot for receiving the arm, the slot having a lateral extension at the

lower end thereof, which extends away from the center of the record. In normal reproducing operation the record is concurrently rotated and moved bodily so that its center travels away from the point of engagement with the reproducing stylus. As a consequence, the arm of the reproducing unit which is located in the slot of the back spacing member normally retains a position in line with the vertical portion of the slot.

When the reproducer unit has been back spaced, however, the ensuing rotation of the record for back spacing reproduction does not involve any movement of translation of the center of the record, but on the contrary the carriage of the center spindle is held against bodily movement. As the back spacing reproduction occurs, therefore, the reproducing stylus is carried by the record groove away from the center of the record and the arm of the reproducing unit which is located in the slot of the back spacing member travels horizontally away from the center of the record into the lateral extension of the slot.

When it is desired to restore normal reproduction or to return to recording, the control mechanism for the recording and reproducing units is operated to neutral position, thereby carrying the reproducing unit upward to lift the reproducing stylus off the record. A cam formation of the slot in the back spacing member causes the arm of the reproducing unit to be guided into the vertical portion of the slot, whereupon the back spacing unit may be restored to its normal position to shift the stylus of the reproducing unit to its normal vertical plane. The control mechanism may thereafter be operated to lower the recording or the reproducing stylus into engagement with the record for the resumption of normal recording or reproducing.

An important feature of the invention has to do with the means for interrupting the bodily drive of the record during back spacing reproduction. The center spindle acts through spiral gearing whenever it is rotated to turn a feed screw. Translational movement of the center spindle is produced by engagement of the feed screw with a half nut. The half nut is immovable axially of the feed screw, but may be swung at right-angles to the feed screw axis into and out of engagement with the feed screw. The half nut is carried by or formed upon a lever which is adapted to be engaged and swung by a cam on the cam shaft to carry the half nut out of action whenever the control mechanism is operated to neutral position. Normally the half nut reengages the feed screw as soon as the control mechanism is operated away from neutral position to either recording or reproducing position.

In order that this reengagement of the half nut with the feed screw may be prevented when desired, the cam shaft is provided with a second cam for engaging the half nut lever. This second cam is keyed to the cam shaft so that it invariably rotates in unison with the cam shaft, but is mounted with freedom for movement axially of the cam shaft.

The second cam may be shifted into lever engaging position when the control mechanism is in the neutral position and thereafter the operation of the control mechanism to reproducing position will be ineffective to restore the half nut to engagement with the feed screw for the reason that the second or movable cam is formed with a dwell portion for detaining the nut lever in the inactive position.

Should the operator seek to align the movable cam with the nut lever when the parts are in recording position or normal reproducing position, the lever would obstruct the cam. In accordance with an advantageous feature of the invention, the member provided for shifting the movable cam into lever engaging position is yieldingly connected to the cam so that it may be operated, and locked in operated position, despite the obstruction to the shifting of the cam. When the operator thereafter shifts the control means into neutral position, however, the nut lever will be shifted to a non-obstructing position, and the cam, because of the bias placed upon it, will be caused to shift into alignment with the nut lever for the purpose already indicated.

No claim is made herein to the mechanism for operating the recording and reproducing units to and from operative positions nor to the novel backspacing mechanism, these features being claimed in my divisional application, Serial No. 453,202, filed August 1, 1942, for Sound recording and reproducing.

It is desirable that the operator have it in his power to interrupt the driving of the record instantaneously, regardless of whether there is to be any shift between recording and reproducing. The dictator, for example, may want to take time to think of what he is going to say next, or the transcriber may want to take time to catch up with the reproduction which has already occurred.

In accordance with the present invention, improved means are provided for effecting the instantaneous starting and stopping of the record.

In accordance with a practical and advantageous embodiment of the invention, a manually controlled cam shaft is provided, which is advanceable step by step to shift one of the record engaging feed wheels into and out of engagement with the record at alternate steps. This cam shaft is desirably driven step by step by means of pawl and ratchet mechanism under the influence of an electromagnet. The electromagnet is desirably placed under the manual control of the operator through a manually operable circuit closing member.

An important feature of the invention has to do with the electromagnet control means. This control means includes a source of electrical energy and parallel alternative circuit sections adapted to be connected to the source of energy alternatively by the actuation and restoration of the manual control member. A cam on the cam shaft controls the alternate connection of these sections to the electromagnet. When the manual member is in its normal position the electromagnet is connected to the first of the parallel circuit sections, but that section is not connected to the source of electrical energy. Immediately upon actuation of the manual member the circuit is completed through the first parallel section to the electromagnet and causes the electromagnet to advance the cam shaft one step. Such advance, however, breaks the circuit between the electromagnet and the first of the parallel sections and establishes connection between the electromagnet and the second of the parallel sections. In this condition of the parts the drive to the record is interrupted.

Restoration of the manual member to its normal position establishes the circuit to the electromagnet through the second of the parallel sections and causes a single step advance of the cam shaft. This disconnects the electromagnet from the second parallel section and connects it

with the first section. At the same time it restores the drive of the record.

The arrangement is such that whatever circuit is made it will be maintained only long enough to produce a single step advance of the cam shaft and will then be broken, so that there is no danger of burning out the electrical connections, nor any necessity for the operator to time his operations otherwise than to suit his own convenience.

Provision is further made of means for locking the manual member in its actuated position when desired, so that the feeding of the record can be interrupted without the necessity of any continued action on the part of the operator to maintain the interruption. To this end the manual member is mounted with capacity both for bodily and rocking movement. The arrangement is such that when the manual member is simply moved bodily it will be restored by a spring to its normal position as soon as it is released. When the manual member is rocked, however, it will be caused to lock in its actuated position and will be required to be rocked in the opposite direction by the operator in order to effect its release.

Other objects and advantages will hereinafter appear.

In the drawings forming part of the specification and illustrating a practical and advantageous embodiment of the invention—

Figure 1 is a view in sectional side elevation of a dictation machine embodying features of the invention;

Figure 2 is a fragmentary view in sectional side elevation, taken substantially on the line 2—2 of Figure 3;

Figure 3 is a fragmentary, detailed plan view, partly in section, illustrating novel features of the invention;

Figure 4 is a fragmentary, transverse, vertical, sectional view taken upon the line 4—4 of Figure 2;

Figure 5 is a fragmentary, vertical sectional view partly illustrating features of the start-stop mechanism;

Figure 6 is a detailed side view in sectional elevation illustrating a start-stop control device;

Figure 7 is a detailed view in horizontal section of the mechanism illustrated in Figure 6, the section being taken upon the line 7—7 of Figure 6 looking in the direction of the arrows;

Figure 8 is a sectional view taken upon the line 8—8 of Figure 6 looking in the direction of the arrows;

Figure 9 is a detailed view, largely diagrammatic, of an alternative form of control device for a start-stop mechanism incorporated in a microphone unit;

Figure 10 is a detailed view in side elevation illustrating some of the parts shown in Figure 2 in neutral position;

Figure 11 is a view similar to Figure 10 illustrating the parts in reproducing position;

Figures 12, 13 and 14 are diagrammatic views illustrating different phases of operation of the start-stop mechanism;

Figure 15 is a fragmentary view in sectional side elevation illustrating the start-stop mechanism with the parts in the same position as in Figure 2;

Figure 16 is a sectional detailed view illustrating the parts in position for back space reproduction;

Figure 17 is a fragmentary detailed view in sectional side elevation illustrating the parts in recording position;

Figure 18 is a fragmentary sectional view taken upon the line 18—18 of Figure 17 looking in the direction of the arrows;

Figure 19 is a fragmentary detailed view in side elevation showing the parts in neutral position;

Figure 20 is a view similar to Figure 19 but showing the parts in the normal reproducing position;

Figure 21 is a fragmentary, detailed view in front elevation illustrating particulary the back space setting means and the control means for the recording and reproducing units; and

Figure 22 is a fragmentary, horizontal, sectional view of the parts illustrated in Figure 21.

The illustrative machine is generally like the machine disclosed and claimed in Serial No. 218,082 which has been previously referred to.

It comprises a frame structure 1 which carries a turtle back support 2 upon which a thin, flexible, disc record 3 may be mounted. The record 3 is impaled upon and interfitted with a center spindle 4, which spindle is mounted on a carriage 5. The record 3 is driven rotatively by a fixed feed wheel 6 and a cooperative feed wheel 7. The feed wheel 7 and its shaft 7b are revolubly supported in a rocker arm or frame 8, Figures 2, 3 and 4, the arm 8 being rockably mounted upon a shaft 9 and provided with a tail extension 10 which may be lowered and raised to carry the feed wheel 7 away from and toward the record.

A motor 6a is connected through a belt 6b to drive a pulley 6c, fast on the drive shaft 6d of the feed wheel 6. A hub portion 6e of the pulley 6c is adapted to engage and drive a disc 7a fast on the shaft 7b of the feed wheel 7 when the wheel 7 is in record-engaging position.

Rotation of the record is transmitted to the center spindle 4, and thence through spiral gears 11 and 11a to a feed screw 12 which is mounted in the carriage 5 and serves as the driving element for the carriage. The feed screw 12 is engageable with a half nut 13. The half nut 13 is carried at the forward end of an arm 14 fast on a shaft 15.

Briefly the carriage comprises a left end member 5a (Figs. 1 and 4) in which the center spindle 4 and the center spindle shaft are mounted, a right end member 5b (Figs. 2 and 4) and a connecting web 127 (Figs. 2 and 4). The end members 5a and 5b encircle a fixed guideway and supporting rod 5c, the carriage being slidable longitudinally of the rod. The left end member 5a is formed at its lower end with a channeled portion 5d which partially embraces a fixed guide rod 5e (Figs. 1 and 4).

The shaft 15 also has fast upon it an upwardly extending arm 16, which may be actuated to cause the half nut 13 to be rocked out of engagement with the feed screw 12 and into engagement with the feed screw 12. The nut arm 14 is immovable axially of the feed screw 12, and hence when the half nut 13 is engaged with the feed screw, rotation of the feed screw causes the feed screw and its carriage to move in the direction of the axis of the feed screw and to carry the center spindle away from the point at which the feed wheels engage the record. As a result of the compound motion imparted to the record, a stationary recording stylus is caused to form a spiral groove in the face of the record 3 which

progresses outward from the center as the sound groove is scribed on the record by the stylus.

As in the case of the machine disclosed in Serial No. 218,082, it is desirable that a recording unit 17 including a recording stylus 18 be provided for forming the sound track on the record, and that a separate reproducing unit 19, including a reproducing stylus 20, be provided for enabling the scribed sound track to be translated into sound.

An important feature of the present invention has to do with the mounting and control of the recording and reproducing units to enable the styluses 18 and 20 to be alternatively located at the same record-engaging point opposite a revoluble platen 21.

A yoke 22, Figures 1, 2, 3 and 4, is rockably mounted upon a transverse horizontal shaft 23 and extends upward to form arms 24*a*, 24*b* through which a pivot pin 24 extends. The pin 24 forms a common pivotal support for the rear ends of the recorder unit 17 and the reproducer unit 19. A yoke 25 journaled on the pin 24 carries a vertical pivot pin 26 upon which the recorder unit 17 is mounted with capacity for transverse adjustment. The recorder unit 17 includes a bent arm 27 which extends rightward from the unit and thence forward, Figures 2, 3 and 4.

An arm 51, Figures 1, 2 and 3, is journaled upon the pin 24 between the ears of yoke 25 and carries a vertically disposed pivot pin 52 upon which an angle arm 53 is journaled. The angle arm 53 has the reproducer unit 19 fixedly mounted upon its forward or free end. The arm 53 has also affixed to its forward end an arm or rod 54, which includes a shank portion 55 that extends toward the right, in Figures 3 and 4, from the arm 53, and an end portion 56 that extends toward the front of the machine. The arm portion 56 performs an important function in connection with back space reproduction, as will be subsequently pointed out. For the present the description will be confined to those features having to do with the selective location of the styluses 18 and 20 in record-engaging position.

As seen in Figures 1 and 2, the parts are in recording position with the recording stylus 18 engaging the record 3. The yoke 22 is held forward by a spring 22*a* with the arms 24*b* in engagement with an adjustably mounted stop 24*c*.

The selector or control mechanism comprises an operating finger piece 57, Figures 1, 2, 21 and 22, fast upon the forward end of a shaft 58. The finger piece may be operated to any one of three positions indicated, respectively, as "Record," "Neutral" and "Reproduce." These legends are provided upon a suitable scale member 60 affixed to a cover plate 61*a*. The shaft 58 has fixed to it a beveled pinion 61 which, through a meshing beveled pinion 62 fast on a cam shaft 63 serves to operate the cam shaft.

The cam shaft 63 has fast upon it four cams 64, 65, 66 and 67. Upon movement of the control knob 57 from the "record" position to the "neutral" position, the cam 65 comes into play, and by engagement with the tail member 10 of the arm 8 serves to carry the feed roller 7 out of engagement with the record 3, as in Figure 10, so that the driving of the record is immediately interrupted. The cam 66 next engages the tail portion of a lifter lever 68 which is rockingly mounted upon a fulcrum shaft 69. The cam 66 depresses the tail portion of the lever 68 and causes a forwardly extending portion of the lever at the opposite side of the fulcrum to be raised. The forward end of the lifting lever engages the under faces of the arm 27 which is affixed to the recording unit 17, and thereby lifts the recording stylus 18 off the record, as indicated in Figure 10. At its upward limit of movement the forward end of the lifter lever also engages the under side of the portion 55 of arm 54. When the forward end of the lifter lever 68 has attained this uppermost position, the parts are in "neutral" position and the record is stopped. The cam 64 has, in the meantime, been carried into engagement with the arm 16 to rock the shaft 15 and the nut arm 14 in a counter-clockwise direction, as viewed in Figure 5 and as illustrated in Figure 10.

Thus in the "neutral" position the feed wheel 7 has left engagement with the record, both the recording and reproducing units are held up, as in Figure 10, away from the record, and the feed nut 13 has been carried out of engagement with the feed screw 12.

If it is next desired to shift the parts to the position for reproducing, the control or selector member 57 is operated to the "reproduce" position. The cam 67 which has not up to now performed any function comes into engagement with the pivot pin 24.

The cam 67 pushes the pivot pin 24 to the rear, swinging the yoke 22 about the pivot pin 23, see Figure 11, and causing the recording unit 17 and the reproducing unit 19 to be carried rearward. As a consequence of this movement, the stylus 20 is located over the record in the same vertical line previously occupied by the stylus 18. During this rearward movement, the lifter lever 68 engages the under-face of the arm 27, and the under-face of the portion 55 of the arm 54, so that both the recording unit 17 and the reproducing unit 19 are maintained in elevated positions by the lifter lever.

Both the arms 27 and 54 extend across a stationary plate 71, of a frame member 71*a*, which has a notch or recess 72 formed in it. When the pivot pin 24 is in its forward position, the arm portion 55 of the arm 54 is disposed in advance of the notch 72 in position to be held up by the portion 73 of the plate 71 in front of the notch, and the arm 27 is over the notch or recess 72, as in Figure 10. When the pivot pin 24 has been shifted to the rear as just described, however, the arm portion 55 is carried over the notch 72, and the arm 27 is carried over the portion 74 of the plate 71, which lies to the rear of the notch 72. The cam 67 is formed with a dwell so that during the continued shifting of the control member 57 toward "reproduce" position the pivot pin 24 is held stationary.

Such continued movement, however, is effective to turn the cam 66 out of engagement with the lifter lever 68, as in Figure 11, so that the reproducing uniti is lowered to set the stylus 20 into engagement with the record, the recording unit 17 being at the same time held in elevated position by engagement of the arm 27 with the portion 74 of the plate 71. The cam 64 is carried downward by the cam shaft to a position permitting reengagement of the half nut 13 with the feed screw 12, as in Figure 11. Finally, the cam 65 is carried to a position permitting the tail member 10 of the arm 8, which carries the feed wheel 7, to be actuated by a return spring 75, so that the feed wheel 7 is lowered against the record, and the normal driving of the record occurs.

It has been mentioned that the recording unit 17 is mounted for horizontal adjustment about the axis of the vertical pivot pin 26. It is for the purpose of effecting such adjustment that the forwardly extending portion of the arm 27 is provided. This portion of the arm 27 extends through a vertical slot or notch 76x of an adjustable slide 76 located in a groove 76a in the frame member 71a. Adjustment of the slide 76 effects adjustment of the recording unit 17 with its stylus 18 to carry the stylus to the right or left in Figure 3. A headed bolt 77, Figures 3 and 4, has its shank passed freely through a stationary ear 78, the shank being surrounded by a compression spring 79. The bolt is threaded into an ear 80 formed on the slide 76. Rotation of the bolt 77 is effective to adjust the slide 76, the spring 79 serving to urge the ears 78 and 80 away from one another and hence to maintain the head of the bolt 77 in engagement with the ear 78. When the bolt 77 has been adjusted, the slide 76 is locked in adjusted position by means of a binding screw 81 which passes freely through a slot 82 of the slide 76 and which is threaded into the stationary frame member 71a.

There are times when it is desirable for the user of the machine to be able to go back a short distance and hear the last of the matter recorded on the record before continuing with the dictation or transcription. Provision is accordingly made for displacing the reproducing stylus 20 a measured distance to the left from its normal position, Figures 3 and 4, while the units 17 and 19 are in a neutral position. The provision for back spacing further includes means for permitting the rotation of the record while preventing translation of the record during the limited reproduction secured by back spacing, so that the record carriage will be held immovable during the back spacing operation and during back space reproduction. The back spacing must, of course, be performed at a time when the stylus 20 is out of engagement with the record in order not to produce an objectionable scratching of the record. The back spacing mechanism will first be described, therefore, on the assumption that the control member 57 has been operated to neutral position.

A back spacing knob 84, together with an indicator member 85, is affixed to a shaft 86 journaled in a plate 87, Figures 21 and 22. The plate 87 is secured to a bushing 88 which is mounted on a headed stub shaft 89, the stub shaft being threaded into the stationary frame member 71a. The plate 87 also surrounds a shaft 91 which is journaled in the frame member 71a. A spacer sleeve 92 surrounds the shaft 91 and, together with the bushing 88, serves to maintain the plate 87 at a fixed distance from the frame member 71a. The shaft 91 is formed with a shoulder 91a adjacent the frame member 71a, the rear end portion of the shaft which is journaled in the frame member 90 being of reduced diameter. A hub 93 of an eccentric 94 is affixed to the shaft 91 to the rear of the collar 93.

The shaft 86 has fast upon it a gear 95 which meshes with a gear 96 revolubly mounted on the stub shaft 89. The gear 96 in turn meshes with a gear 97, the latter gear being fixed to the shaft 91 by means of a headed screw 98. Rotation of the knob 84 is effective to carry the index pointer 85 across a graduated dial member 99 which is affixed to the cover plate 61a. Rotation of the knob is also effective, through the gears 95, 96 and 97, to rotate the shaft 91 and the eccentric 94. The eccentric 94 is disposed within a slot or notch 101 of a back spacing slide 102, Figures 3, 4, and 21. The slide 102 is set in a depression or guideway 103 of a frame member 104, being guided for right-line movement along the guideway. A rabbeted hold-down block 105 is secured to the frame member 71a by screws 106 and maintains the slide in the guideway 103.

The slide 102 is formed with a vertically extending slot 107, Figure 4, in which the forwardly extending portion 56 of the arm 54 is received. The slot 107 extends vertically, but has a lateral extension 108 at its lower end which extends toward the right. When the control member 57 is in its neutral position, the reproducing unit is elevated and hence the arm portion 56 is in the vertical portion of the slot 107. At this time, operation of the knob 84 toward the left will be effective to carry the reproducing unit toward the left, the extent of leftward movement being indicated by the scale on the graduated dial 99.

If, after the reproducing unit has been shifted to the left by operation of the knob 84, the control member 57 is operated to the "reproduce" position, the record would be turned, but it would be at the same time translated as usual. When the reproduction secured by back spacing had been thus effected, it would not be possible to restore the back spacing mechanism and the reproducing stylus to the normal position corresponding to zero on the scale of dial 99 without skipping as many spaces or track turns on the record as were reproduced as a result of the back spacing operation.

If the record carriage is held stationary, however, during the back space reproduction, the record will be rotated without translation and the arm portion 56 will simply be carried into the lateral extension 108 of the slot 107 at back space reproduction. Provision is made for holding the record carriage against translation during back space reproduction, as will be presently described. When the back space reproduction has been performed with the carriage thus held stationary, the operator returns the control member 57 to the neutral position. A cam formation 109, Figure 4, just above the lateral extension 108 of the groove 107 causes the arm member 56 to be carried back into the upper, vertical slot portion 107 as an incident of the lifting of the reproducing unit. The back spacing knob 84 may now be turned clockwise to the zero point on the scale of dial 99, thereby restoring the stylus 20 to its normal neutral position. The recording or reproducing may now be resumed normally with the recording and reproducing styluses in their normal relation to one another.

The mechanism for causing the record to be turned without translation at back space reproduction comprises a cam 110, Figures 15 to 20, which is mounted on the cam shaft 63 and interfitted with a rib or key 111 on the shaft 63. The cam 110 is free to move lengthwise of the shaft 63, but the cam and the shaft are constrained by the rib or key 111 to turn in unison. The normal position of the cam 110 is that illustrated in Figures 17 and 18, in which position the cam is out of line with the arm 16. The arm 16, it will be remembered, is fast upon a shaft 15, which shaft also has fast upon it the nut arm 14. As has already been mentioned, a cam 64 fast with the shaft 63 is constantly in line with the arm 16 and is effective when the control member 57 is operated to neutral position to rock the arm

16 rearward and thereby to lift the half nut 13 out of engagement with the feed screw 12.

When the control member 57 is in the "reproduce" position, the arm 16 stands across the face of the cam 110, as illustrated in Figure 20, so that the cam 110 could not be operated longitudinally of the shaft 63 into transverse alignment with the arm 16. Control mechanism including a finger piece 112, Figures 17 and 18, is provided for the cam 110 whereby the cam 110 can be operated into transverse alignment with the arm 16 when the control member 57 is in neutral position or can be biased when the control member 57 is in the "reproduce" position to spring into transverse alignment with the arm 16 upon the operation of the control member 57 to the neutral position.

The finger piece 112 is operated only when back space reproduction is to be performed. By virtue of the arrangement just referred to, however, it may be operated either before or after the control member 57 has been operated to neutral position.

The finger piece 112 is affixed to ears 113 which are journaled upon a shaft 114 carried by a frame bracket 115. A clutch shifting fork 116 is affixed to an ear 117 which is also journaled upon the shaft 114. A headed pin 118 affixed to the lower end portion 119 of the finger piece 112 extends freely through the clutch shifting fork. A compression spring 120 surrounds the shank of the headed pin 118, bearing at one end against the head of the pin 118 and at the other end against the clutch shifting fork 116. The spring constrains the arm 119 and the fork 116 to move in unison, but permits separation of the arm 119 from the fork 116 when movement of the cam 110 is obstructed. The bifurcations of the fork 116 are received in a groove 121 of a cam shifting collar 122. The collar 122 is fast with the cam 110. A detent spring 123, affixed to a stationary frame bracket 124, coacts with a tooth 125 on the finger piece 112 to prevent restoration of the finger piece to an elevated position when it has been depressed.

Assuming that the machine is in the "reproduce" position, depression of the finger piece 112 causes the lower end 119 of the finger piece to be swung toward the right, or counter-clockwise, as viewed in Figure 18. Since the cam 110 is obstructed by the arm 16, the fork 116 is not free to follow the arm 119, and the arm 119 is separated from the fork 116, the spring 120 being put under stress. The finger piece 112 is locked in its depressed position by the tooth 125 and the spring 123 to maintain the desired condition of the finger piece. When the control member 57 is now operated to neutral position, the arm 16 is pushed out of obstructing relation to the cam 110 by the cam 64, as in Figure 19, and the spring 120 forces the cam 110 toward the right and into transverse alignment with the arm 16.

When the back space knob 84 has been operated and the control member or handle 57 is again operated to place the reproducing stylus 20 in engagement with the record and to reestablish contact of the feed wheel 7 with the record, the cam 110 will prevent forward movement of the arm 16, and hence will prevent engagement of the feed nut 13 with the feed screw 12.

Not only will the cam 110 prevent the arm 16 from shifting forward when the reproducing stylus 20 is lowered against the record, but it will actually shift the arm 16 farther to the rear, as in Figure 16. As will be seen in Figure 19, the portion of the cam 110 which lies adjacent the arm 16 in the neutral position is of less radius than the high part of cam 64, but the portion of the cam 110 which engages the lever 16 in the back space reproducing position is of greater radius than the high part of the cam 64.

As a consequence of this arrangement, the cam 110 serves to raise the nut arm 14 higher than it is normally raised by the cam 64, with the result that a brake spring 126 affixed to the nut arm is pressed firmly against a carriage bar 127, Figure 16, to hold the carriage frictionally against unintended, longitudinal movement.

When the back space reproduction has been performed, the control member 57 is operated to neutral position as already described, and the back space knob is turned clockwise to restore the indicator 85 to the zero point on the scale of dial 99. The finger piece 112 is then pulled upward to restore the cam 110 to the position illustrated in Figure 18. The parts are now reconditioned for normal recording or reproducing upon operation of the control member 57 to either the "record" or the "reproduce" position.

As has been pointed out, there are times when it is desirable simply to stop the record drive briefly, or for an indefinite period, without interrupting the engagement of the active stylus with the record, and without interrupting the engagement of the feed nut 13 with the feed screw 12. It is desirable that start-top mechanism be provided under the convenient control of the operator's hand or foot without the loss of time which would be entailed in reaching over to engage the control member 57. Start-stop mechanism is desirably embodied in the present invention for producing this desirable mode of operation. The start-stop mechanism herein disclosed is of such character that it lends itself conveniently to remove control of the machine, there being no limitation upon the distance which may separate the machine from the dictator or the transcriber.

The sole object of the start-stop mechanism is to lift or lower the arm 8 which carries the feed roller 7, and this result is secured by providing mechanism for operating upon another tail portion 128 of the arm 8, Figures 3 and 15. A cam 129, having alternate high and low portions equally spaced about its periphery, is fast upon a cam shaft 130. The cam 129, as illustrated, has three high points and three low points. The shaft 130 has fast upon it a six-toothed ratchet wheel 131, which is operable to advance the shaft step by step so that the tail portion 128 of the arm 8 is raised and lowered at alternate steps.

A pair of triangular levers 132 are journaled upon the shaft 130 with freedom to rock relative to the shaft. A pawl 133 for coacting with the ratchet wheel 131 is rockably mounted upon a pin 133a carried by said levers 132. The pawl 133 is urged toward the ratchet wheel 129 by gravity, although a spring may be used for this purpose. Links 134 are pivotally connected at their upper ends to the levers 132 and at their lower ends to the core or armature 135 of an electromagnet 136. The links are drawn upward by a spring 136, being limited in their upward movement by engagement of a stop projection 137 formed integral with one of the links, and a stationary abutment member 138 which is carried by a frame member 139.

Energization of the coil 140 of the electromagnet 136 is effective to impart a single step of ro-

tation to the shaft 130 and the came 129 through the pawl 133 and the ratchet wheel 131. As soon as the flow of current to the coil 140 is interrupted, the spring 136 returns the link 134 to the upper limit of movement and thereby carries the pawl backward one tooth space relative to the ratchet wheel 128.

Important features and objects of the invention have to do with the means for controlling the delivery of current to the electromagnet.

Suitable line conductors 141 and 142 are connected to opposite terminals of a source of electrical energy. The conductor 141 is connected with a conductive, resilient switch member 143, Figure 12, which is adapted normally to contact with one terminal of a circuit section or conductor 144. When the switch member 143 is depressed and put under stress, it is disconnected from the circuit section 144 and connected with a parallel circuit section 145. An actuating pin 146 engages the switch member 143 for operating said member.

A second resilient switch member 147 is contained in a suitable housing 148 and is disposed to make contact either with a terminal of the circuit section 144 or with a terminal of the parallel circuit section 145. Normally, the switch member 147 makes contact with the circuit section 145. When it is pressed upward and put under stress, it makes contact instead with a terminal of the circuit section 144. The switch member 147 is connected through a conductor 149 with a conductor 150, the latter conductor being connected with the coil 140 of the electromagnet 135. A resistance 149a and a condenser 149b are interposed between the conductors 141 and 149 for preventing sparking.

With the two switches 143 and 147 in the positions illustrated in Figure 12, no current will flow through the electromagnet 140. Upon depression of the switch member 143 into contact with a terminal of the circuit section 145, current is caused to flow through the coil 140 of the electromagnet 136 and thereby to produce a single step advance of the shaft 130 equal substantially to one-sixth of a revolution.

The shaft 130 has fast upon it a cam 151 which has three high spots and three low spots occurring in alternation, and at equal intervals. A spring member 152, supported on the housing 148, is arranged to extend across the upper side of the cam 151, and this spring is adapted to engage an actuating pin 153. In the position of Figure 12 a low spot of the cam 151 is opposite the spring 152, so that the switch member 147 is permitted to be in contact with a terminal of the circuit section 145.

When the shaft 130 is advanced a tooth space of the ratchet wheel 128, however, a high portion of the cam 151 comes under the spring 152, as seen in Figure 13, and this causes the switch member 147 to be raised out of engagement with the terminal of circuit section 145 and into engagement with a terminal of the circuit section 144. Thus, as soon as the single step advance of the cam has been accomplished, the electromagnet is deenergized and the link 134 is restored by the spring 136, Figure 15, to its raised position. The feed wheel 7 will be maintained inactive by the cam 129 so long as the switch member 143 is maintained depressed.

Upon restoration of the switch member 143 from its position in Figure 13 to its raised or normal position, current will be caused to flow through the circuit section 144, through the switch member 147 and then through the winding 140 of electromagnet 135, and this again will cause the shaft 130 to be advanced one-sixth of a turn to the position in Figure 13, whereupon the switch member 147 will be restored to its lower position as illustrated in dot-and-dash lines in Figure 13.

The switch member 143 is mounted in a casing 160, Figures 6, 7, 8 and 12, which can be conveniently held in the hand, but which might be made of any other suitable configuration, as, for example, one adapting it to be placed on the floor for convenient operation when the electromagnetic circuit is to be controlled by the foot. A block 161 fixed in the casing 160 serves as a housing and support for the switch member 143. A spring 162 is affixed to the upper side of the block 161 in position to overlie the actuating pin 146 of the switch member 143. A finger piece 163 is provided for engaging and actuating the spring member 162. This finger piece 163 is so mounted that it can be thrust bodily downward to depress the spring 162, or so that it may be rocked to depress the spring 162. In the former case, the finger piece will be restored to normal position and the spring member 162 will be permitted to rise immediately upon release of the finger piece 163. In the latter case, the finger piece 163 will be detained in actuated position so that the spring member 162 will be held depressed until the finger piece 163 has been rocked back to the position illustrated in Figure 6.

A headed screw 164 extends through the top of the casing 160 and is threaded into the bottom wall of the casing. A sleeve 165 is slidably mounted upon the screw 164 and is normally maintained at its upward limit of movement by a coil spring 166 which surrounds the shank of the screw and bears against the lower end of the sleeve. A headed pivot stud 167 is threaded into one side of the sleeve 165 and forms a bearing support for the finger piece 163. It will be seen that a straight downward thrust of the finger piece 163 will simply be opposed by the spring 166, as well as the spring 162 and will have no tendency to lock the finger piece or the sleeve 165 in a depressed position.

When the finger piece 163 is rocked in a clockwise direction from the position illustrated in Figure 6, however, a corner or high point 168 formed at the lower right-hand edge of the finger piece will be carried to or slightly beyond the vertical plane of the axis of pivot stud 167. In that position there will be no force tending to return the finger piece 163 in a counter-clockwise direction, and hence the spring member 162 will be maintained depressed and the switch member 143 will be maintained in contact with a terminal of the circuit section 145 until the finger piece 163 is engaged and swung counter-clockwise by the operator.

Thus the operator has it within his power either to stop the machine and maintain it stopped against a bias which tends to restore it to operating condition, or to stop the machine and lock it against starting up again. The member 163 has been referred to as a finger piece for convenience. It could, of course, be operated by the sole of the shoe in the manner described.

It will be evident that the circuit control mechanism described is very simple and convenient from the standpoint of the operator, that it is economical of current consumption, and that it safeguards the electrical parts against burning

out or overheating which might result from prolonged maintenance of a closed circuit.

In Figure 9, disclosure is made of a modified form of apparatus for controlling the circuit to the winding 140 of electromagnet 135. This form is similar to the form already described with the following exceptions: The circuit controlling mechanism is mounted in the frame of a microphone unit 170. A finger piece 163a is pivoted upon a stationary bearing 167a mounted in the microphone casing. The lower portion 168a of the finger piece 163a coacts with a spring 162a which is the same in mounting and construction as the spring 162 of Figure 6. The other parts of the control mechanism are the same as already described so that no further detailed description is deemed necessary. Corresponding reference numerals have been applied to corresponding parts with the subscript a added in each instance.

I have described what I believe to be the best embodiments of my invention. I do not wish, however, to be confined to the embodiments shown, but what I desire to cover by Letters Patent is set forth in the appended claims.

I claim:

1. In a dictation machine including a record support and a feed wheel for frictionally driving a record, in combination, control means operable step by step to engage the feed wheel with the record and to disengage the feed wheel from the record at alternate steps, and means under the control of the operator for actuating the control means step by step comprising an electromagnet, a cam shaft driven thereby, and electrical circuit means including a pair of parallel conductors through either of which the electromagnet may be energized, a first switch means under the control of the operator for connecting the respective parallel conductors with a source of electrical energy at alternate operations of such switch means, a second switch means for connecting the respective parallel conductors with the electromagnet at alternate operations of the second switch means, and control means for the second switch means operated by the cam shaft at each step of cam shaft advance to disconnect the electromagnet from the parallel conductor which is then connected to the source of electrical energy by the first switch means and to set it in connected relation with the parallel conductor which is not then connected to the source of electrical energy by the first switch means but which will be connected to the source of electrical energy by the next operation of the first switch means operator for energizing the electromagnet, and switch means under the control of the cam shaft for making different portions of said circuit means alternatively operative.

2. In a dictation machine including a record support and a feed wheel for frictionally driving a record, in combination, control means operable step by step to engage the feed wheel with the record and to disengage the feed wheel from the record at alternate steps, and means under the control of the operator for actuating the control means step by step comprising an electromagnet, a cam shaft driven thereby, a cam on the shaft having alternate lifts and depressions for controlling the feed wheel in the stated manner, and electrical means under the control of the operator for energizing the electromagnet at will.

3. In a dictation machine including a record support and a feed wheel for frictionally driving a record, in combination, control means operable step by step to engage the feed wheel with the record and to disengage the feed wheel from the record at alternate steps, and means under the control of the operator for actuating the control means step by step comprising an electromagnet, a cam shaft driven thereby, a cam on the shaft having alternate lifts and depressions for controlling the feed wheel in the stated manner, and electrical means under the control of the operator for energizing the electromagnet at will including a source of electrical energy, an electric circuit including parallel alternate sections, a manually operable switch including a finger piece for connecting the source of energy to the first of said sections when the finger piece is actuated and to the second of said sections when the finger piece is restored to normal position, a cam on the cam shaft, and a second switch under the control of said cam for disconnecting the electromagnet from the first of the parallel circuit sections and connecting the electromagnet to the second of said sections when energy has been transmitted through the first section for stepping the cam shaft forward, and for disconnecting the electromagnet from the second of the parallel circuit sections and connecting it to the first of said sections when energy has been transmitted through the second section for stepping the cam shaft forward.

4. In a dictation machine including a record support and a feed wheel for frictionally driving a record, in combination, control means operable step by step to engage the feed wheel with the record and to disengage the feed wheel from the record at alternate steps, and means under the control of the operator for actuating the control means step by step comprising an electromagnet, a cam shaft driven thereby, a cam on the shaft having alternate lifts and depressions for controlling the feed wheel in the stated manner, and electrical means under the control of the operator for energizing the electromagnet at will including a source of electrical energy, an electric circuit including parallel alternate sections, a manually operable switch including a finger piece for connecting the source of energy to the first of said sections when the finger piece is actuated and the second of said sections when the finger piece is restored to normal position, a cam on the cam shaft, and a second switch under the control of said cam for disconnecting the electromagnet from the first of the parallel circuit sections and connecting the electromagnet to the second of said sections when energy has been transmitted through the first section for stepping the cam shaft forward, and for disconnecting the electromagnet from the second of the parallel circuit sections and connecting it to the first of said sections when energy has been transmitted through the second section for stepping the cam shaft forward, and means for locking the finger piece in actuated position at will.

5. In a dictation machine including a record support and record driving means, control means under the control of the operator for causing the record drive to be interrupted and resumed at will comprising mechanical control means advanceable step by step, an electromagnet for advancing the control means step by step, manually operable means for closing the circuit of the electromagnet at will, and means responsive to a single step advance of the mechanical control means to break the circuit of the electromagnet.

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