

Sept. 20, 1949.

J. A. DAVIS ET AL
AUTOMATIC PHONOGRAPH

2,482,659

Filed Oct. 6, 1941

24 Sheets-Sheet 1

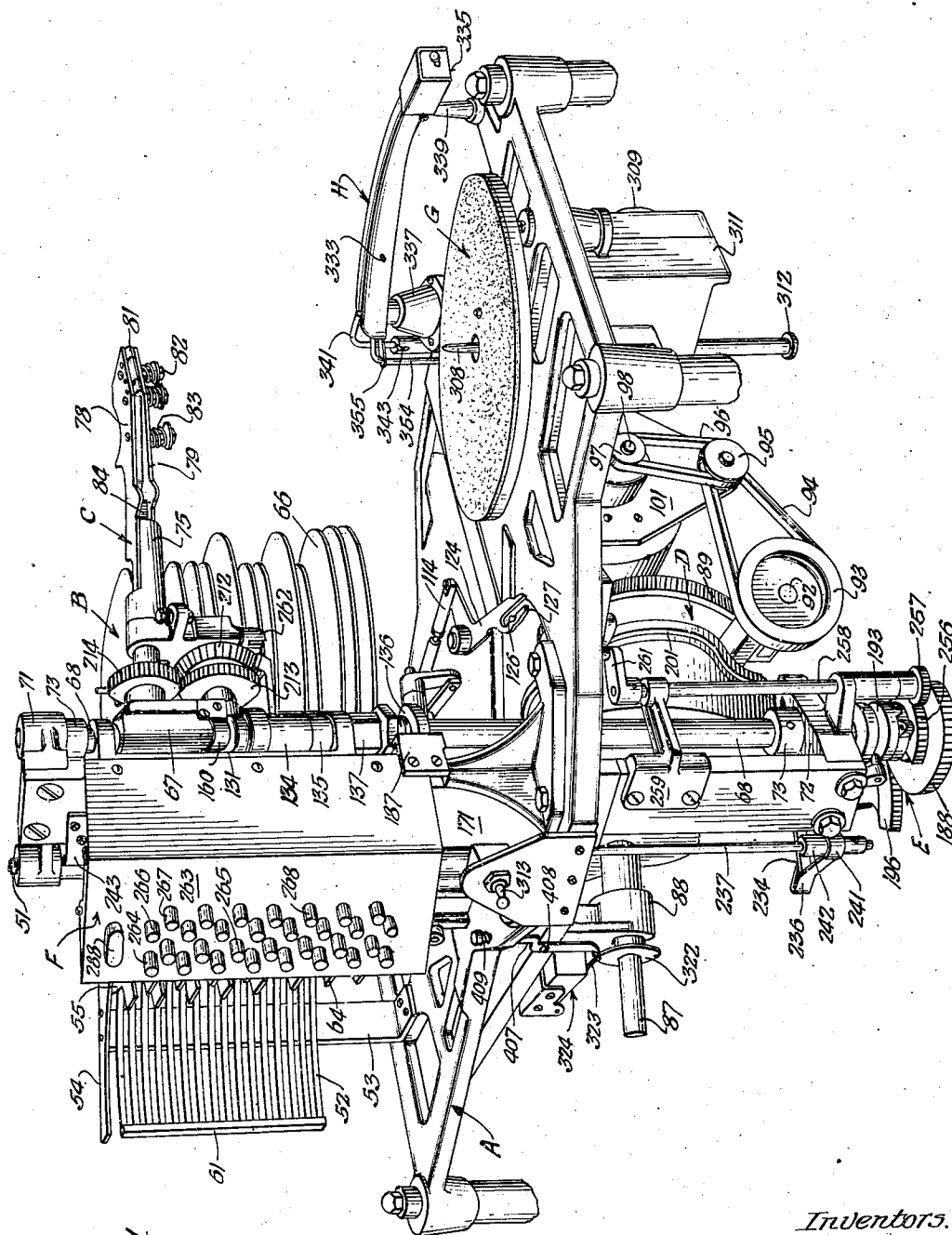


Fig. 1

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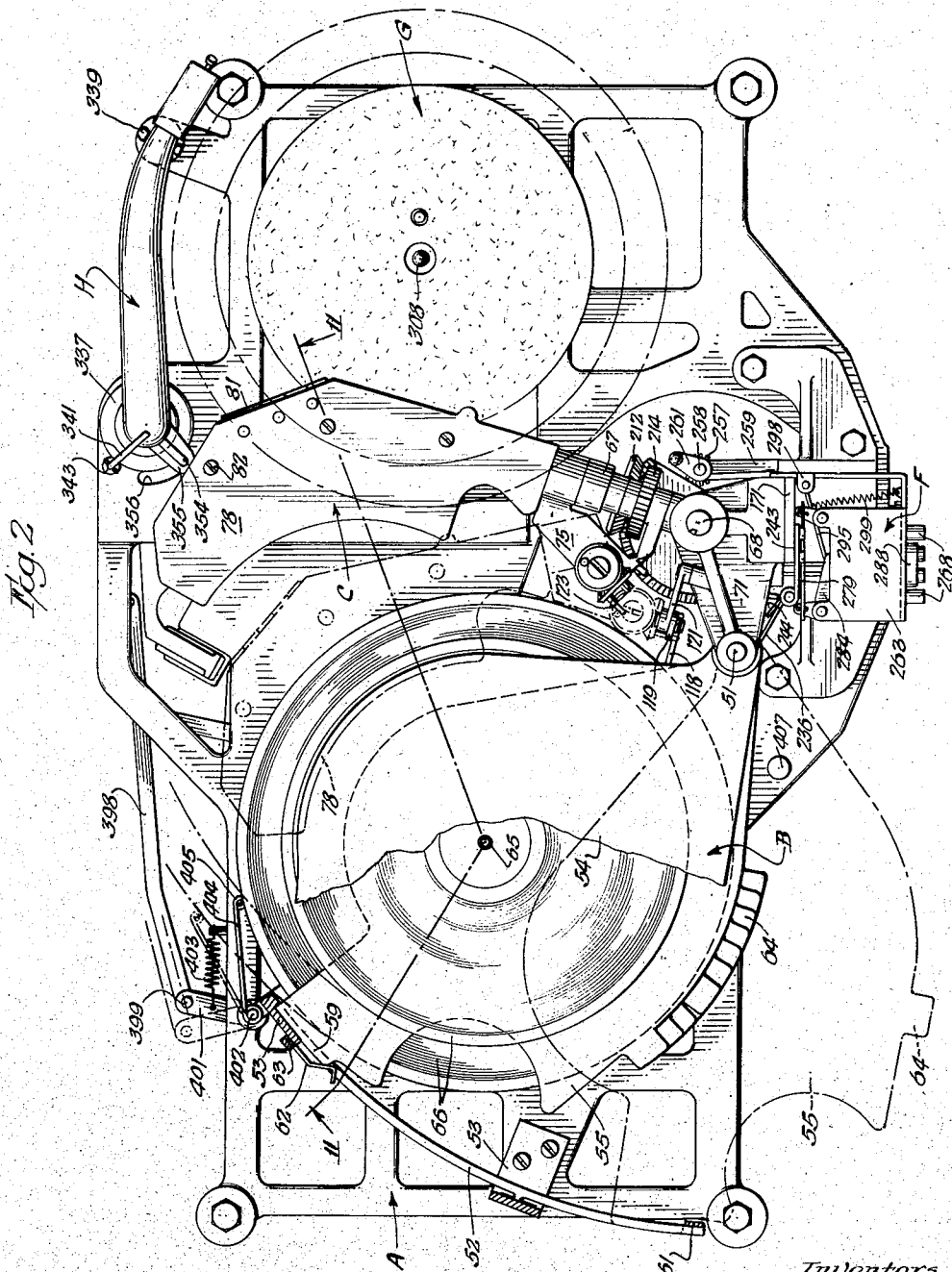
J. A. DAVIS ET AL

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24 Sheets-Sheet 2

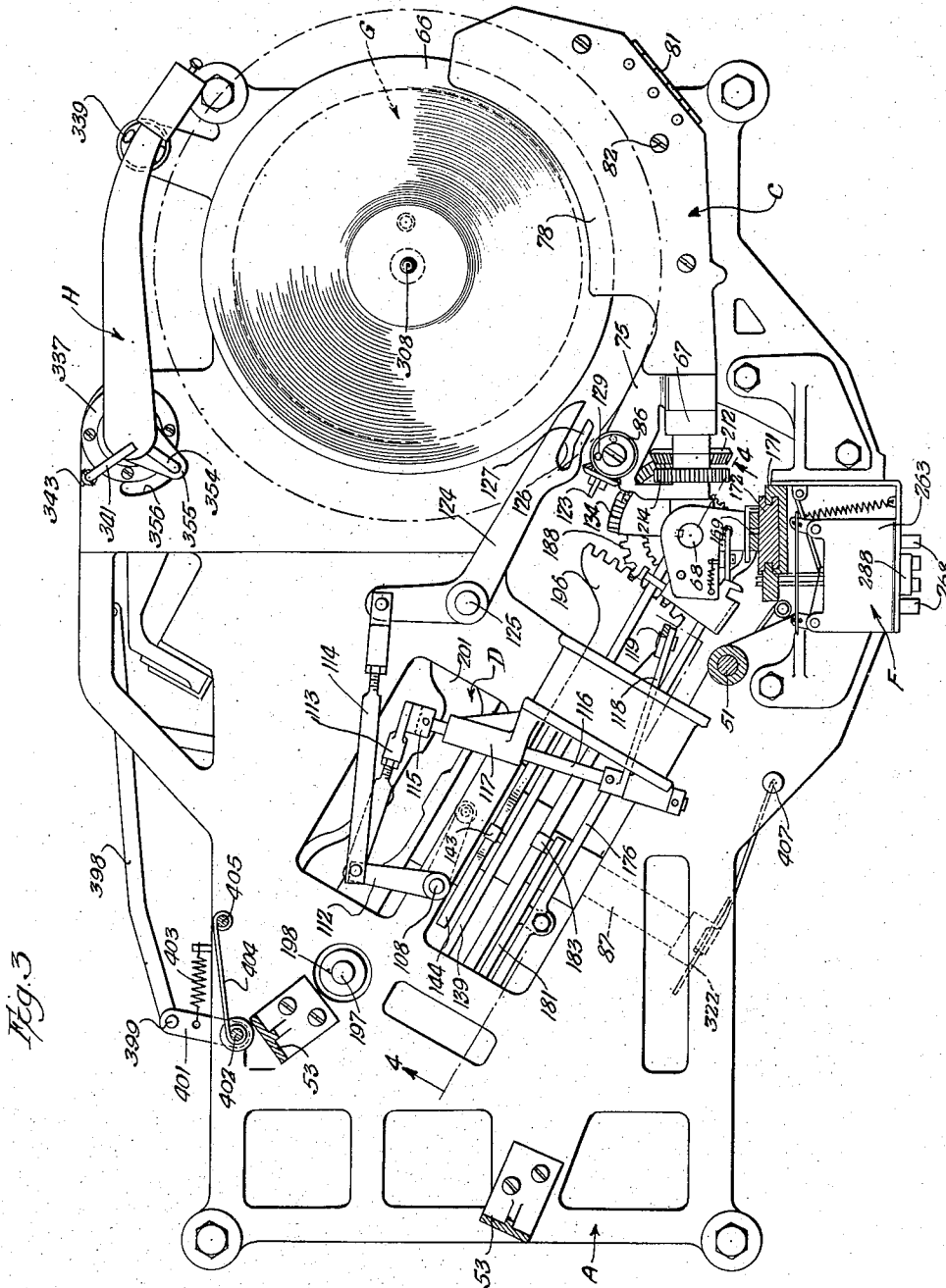


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24 Sheets-Sheet 4

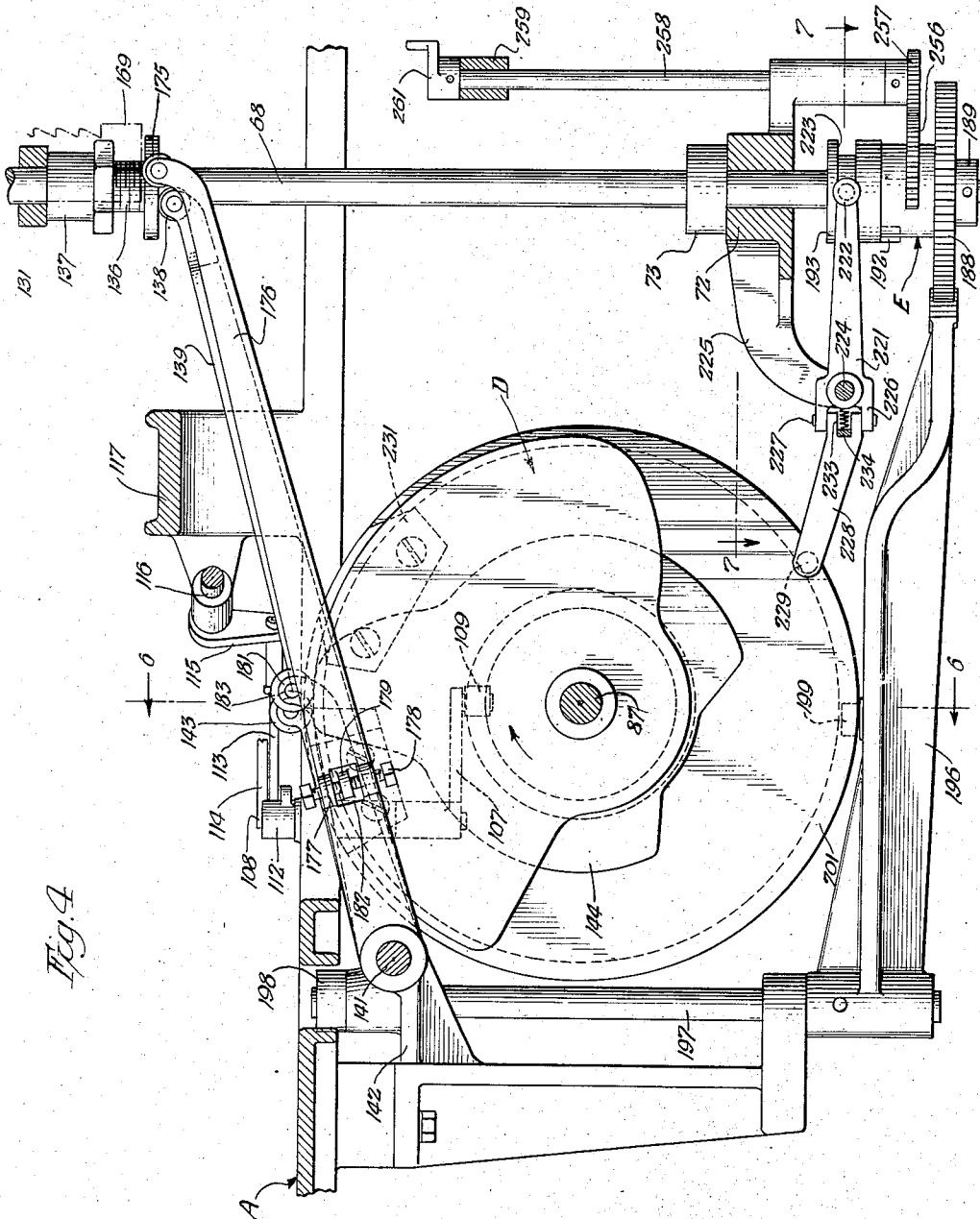


Fig. 4

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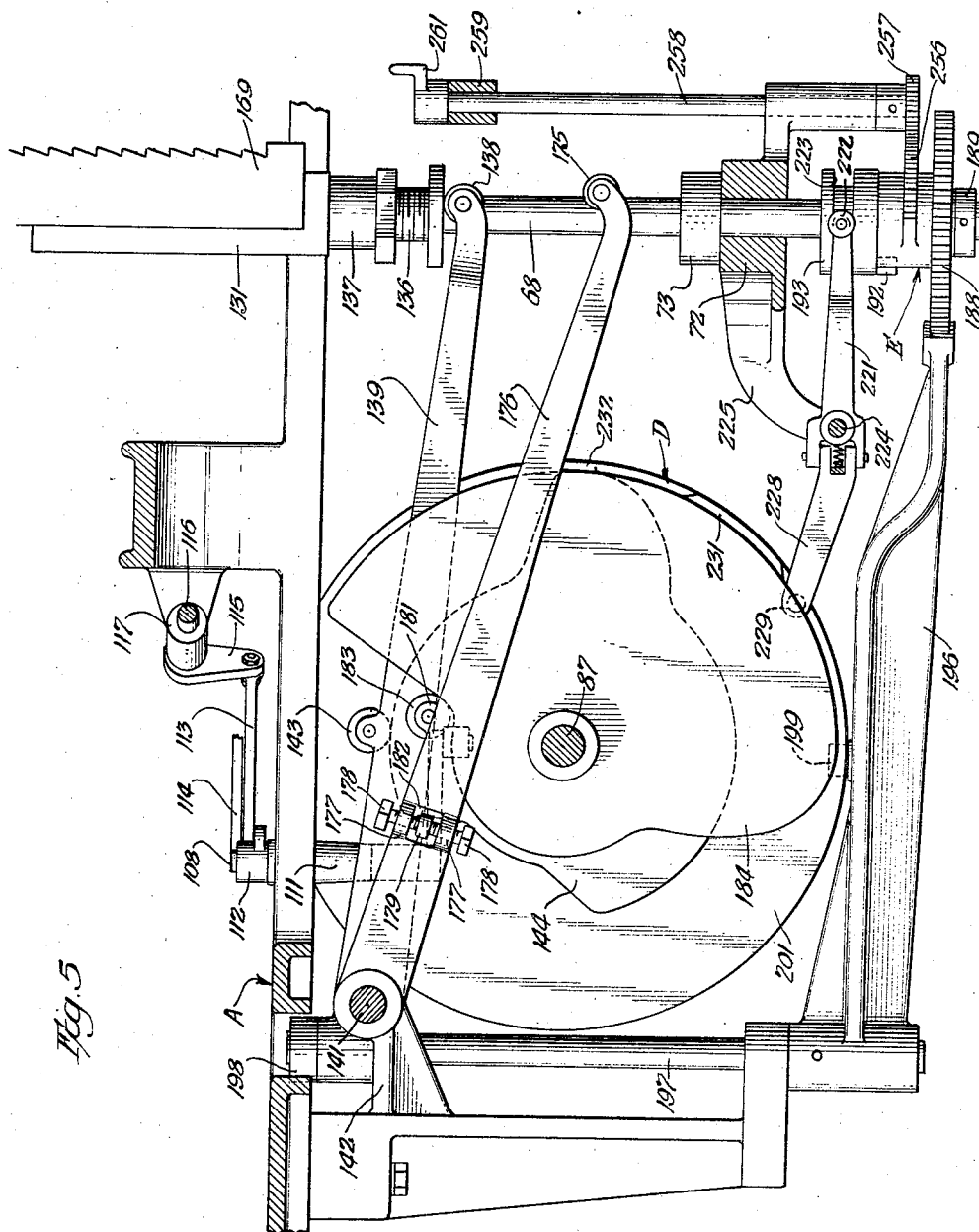


Fig. 5

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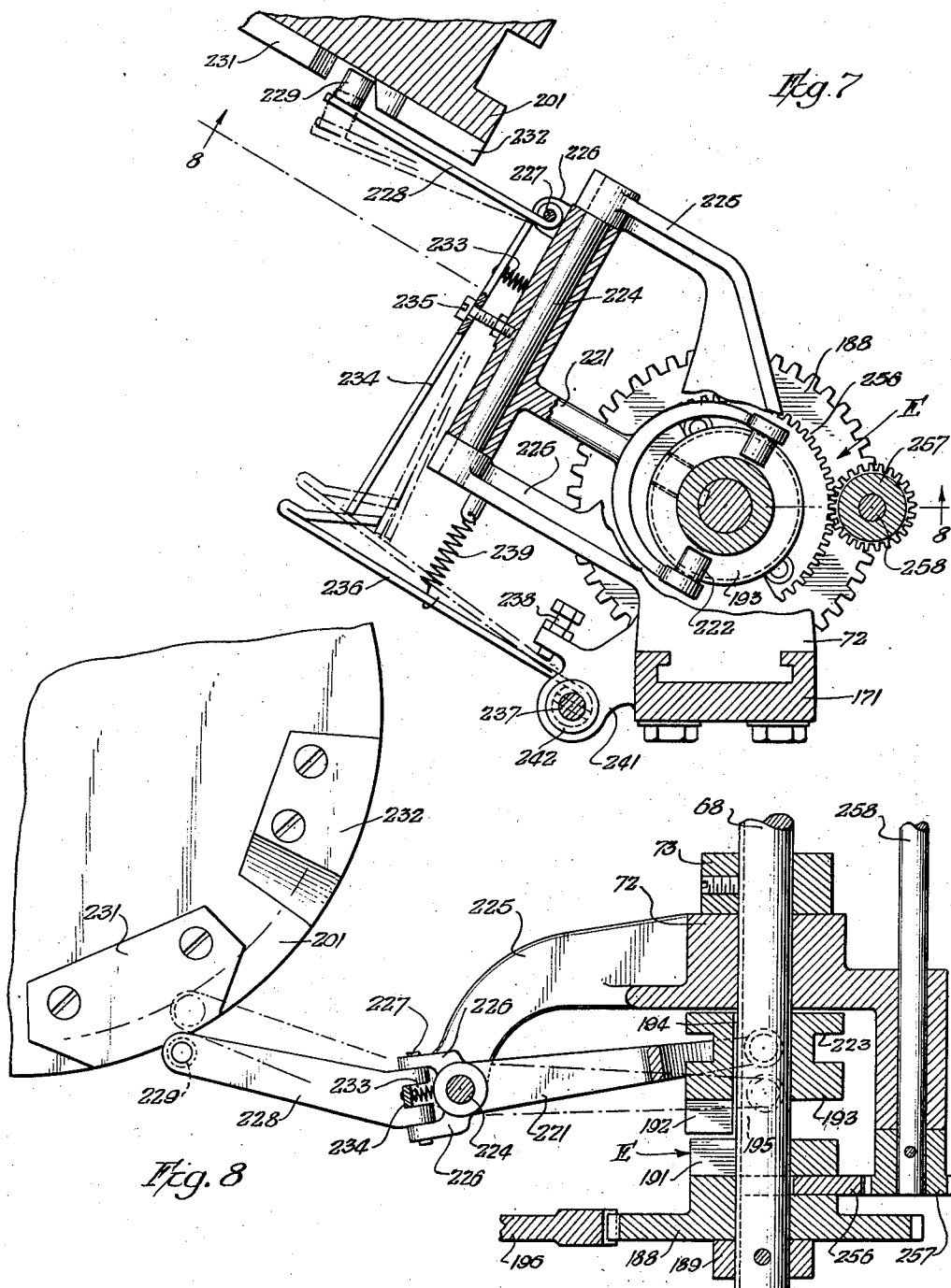
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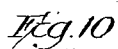


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AUTOMATIC PHONOGRAPH

24 Sheets-Sheet 8



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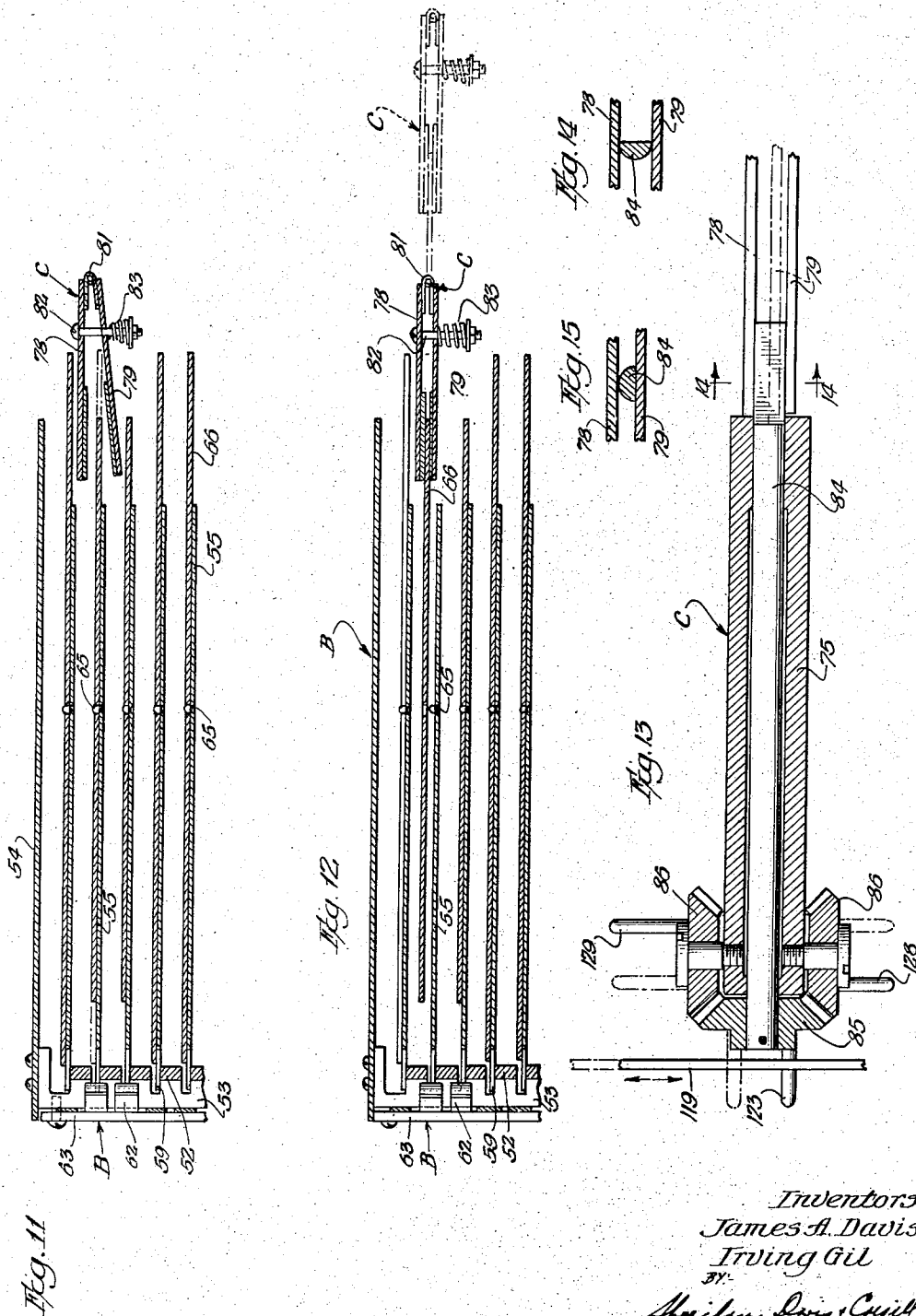
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AUTOMATIC PHONOGRAPH

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24 Sheets-Sheet 9



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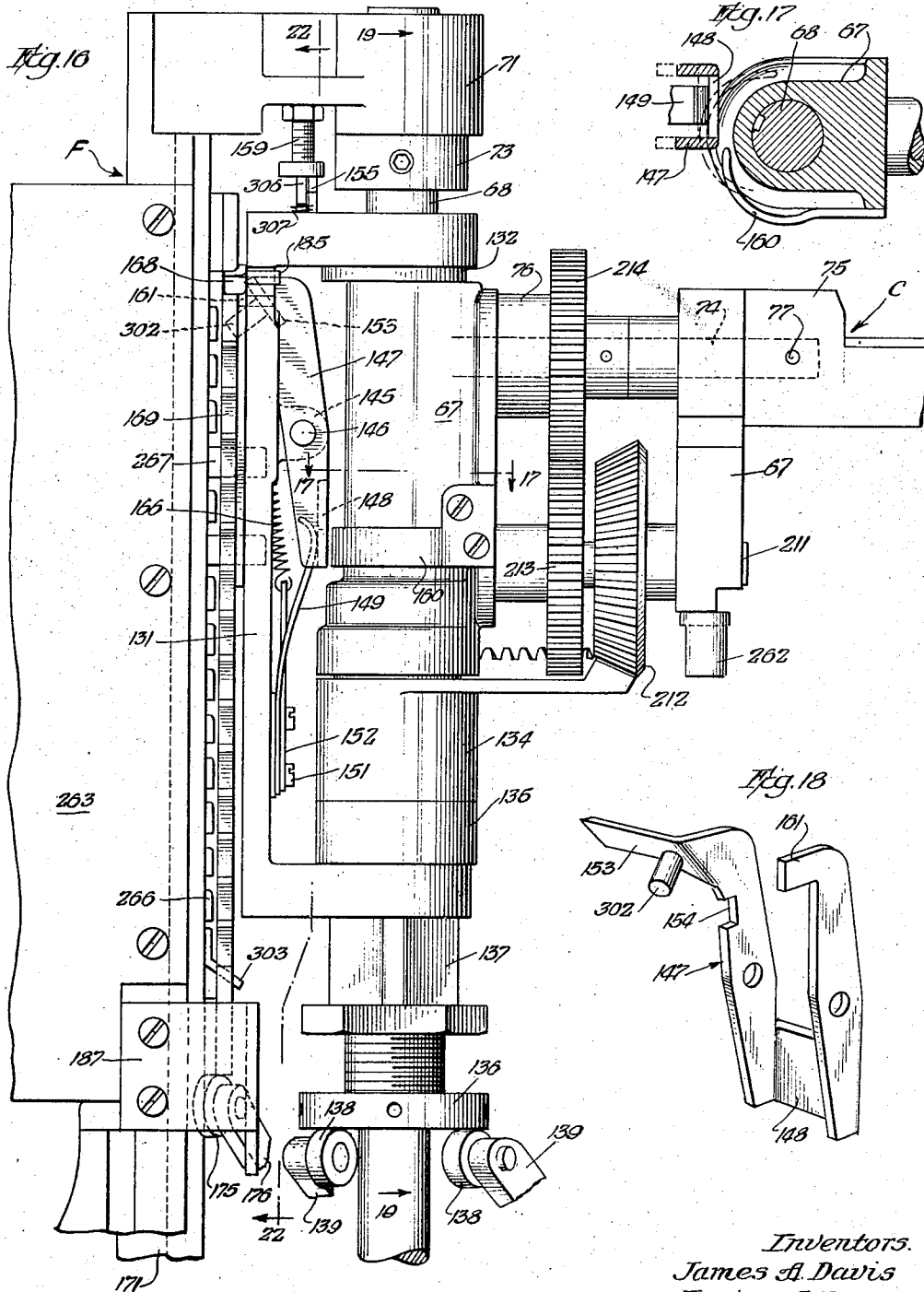
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J. A. DAVIS ET AL
AUTOMATIC PHONOGRAPH

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24 Sheets-Sheet 10



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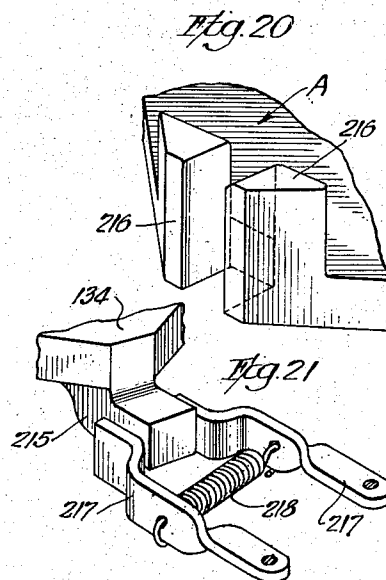
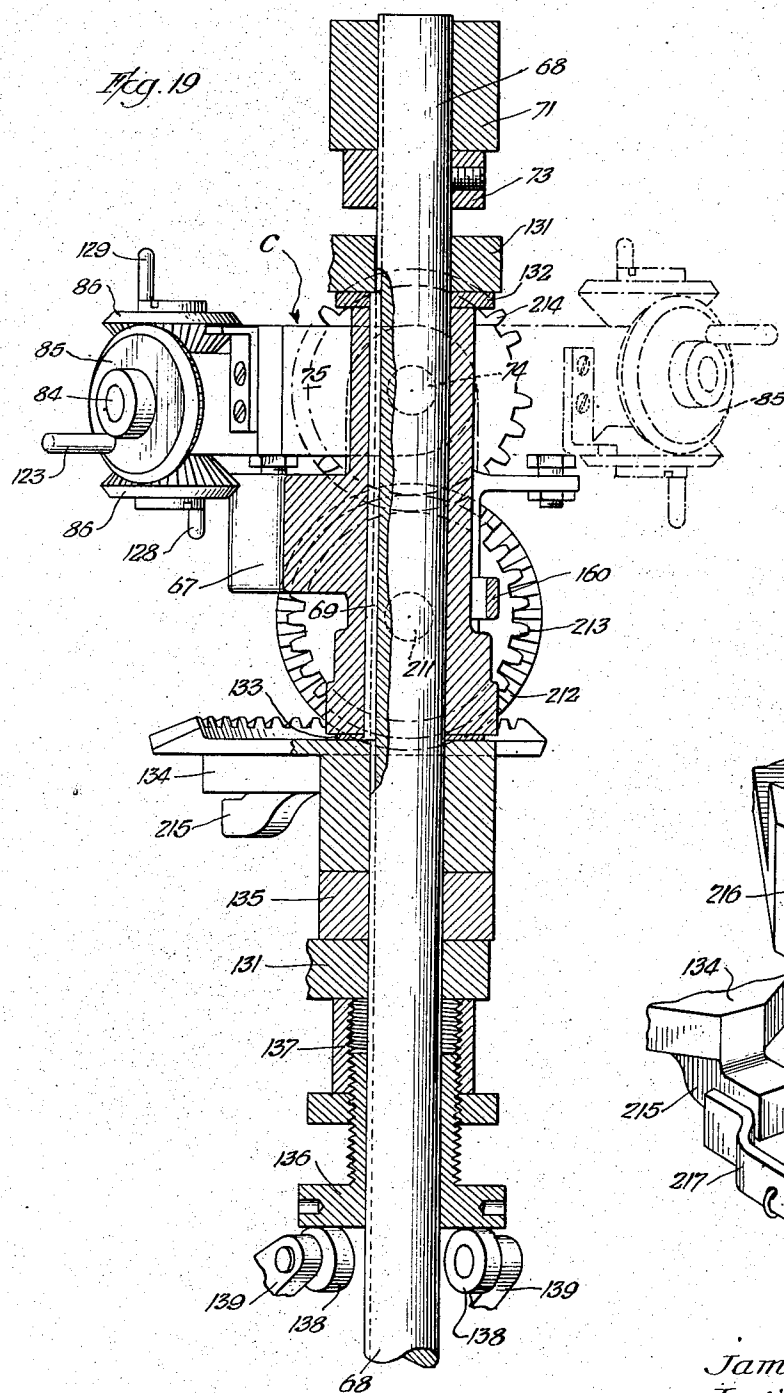
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24 Sheets-Sheet 11



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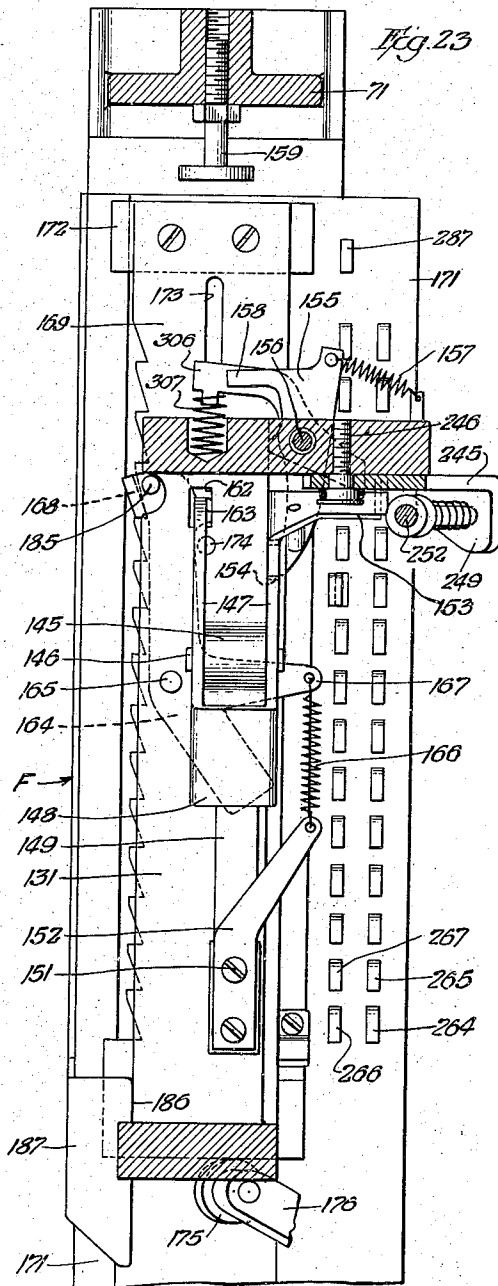
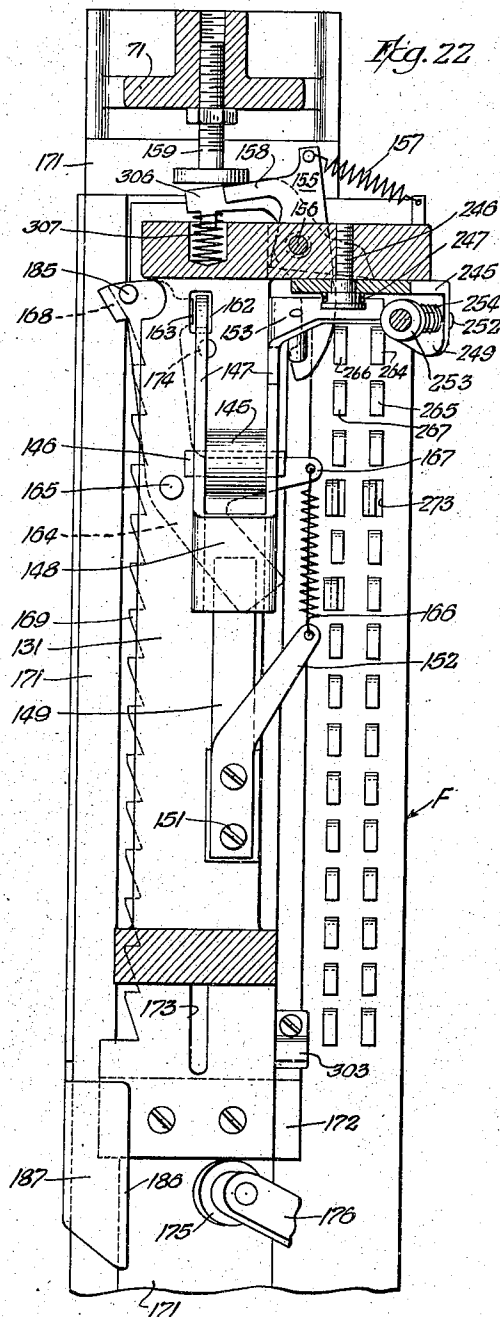
J. A. DAVIS ET AL

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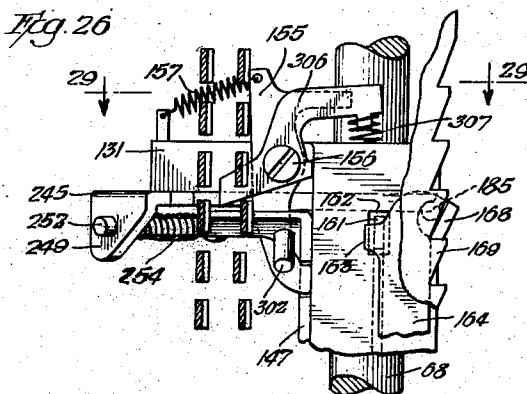
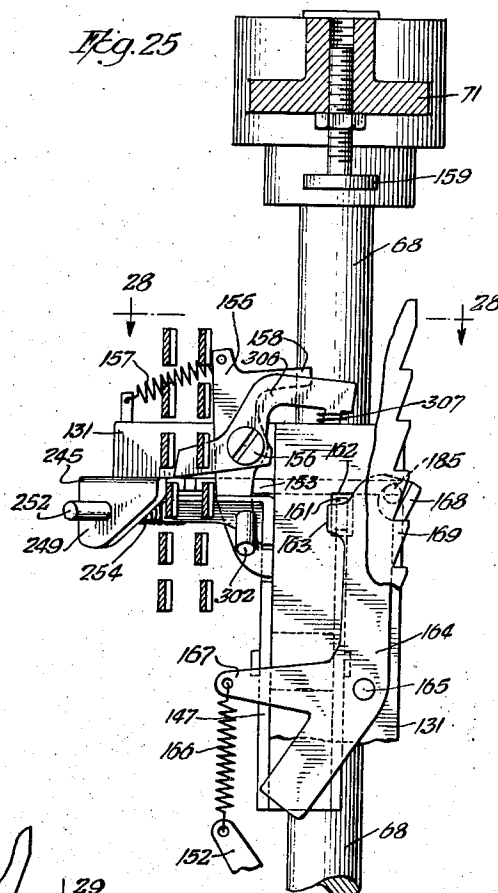
24 Sheets-Sheet 12



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AUTOMATIC PHONOGRAPH

24 Sheets-Sheet 13



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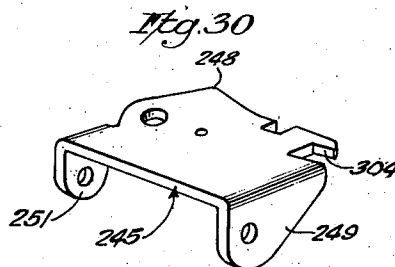
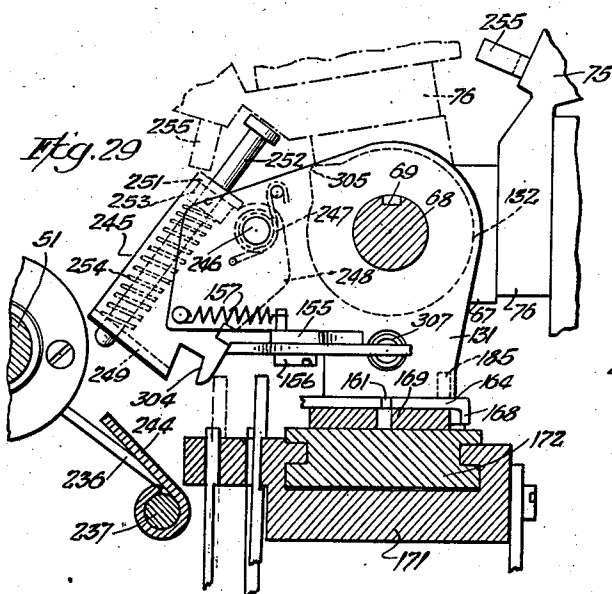
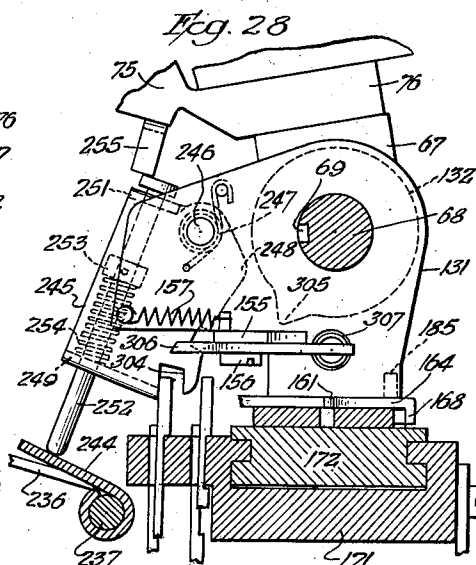
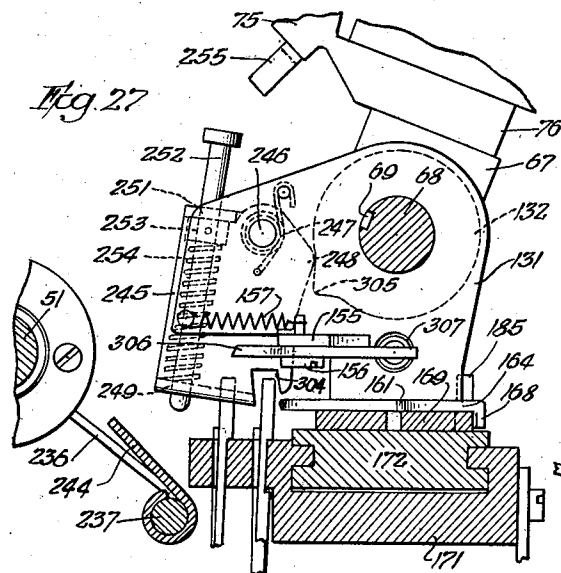
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24 Sheets-Sheet 14



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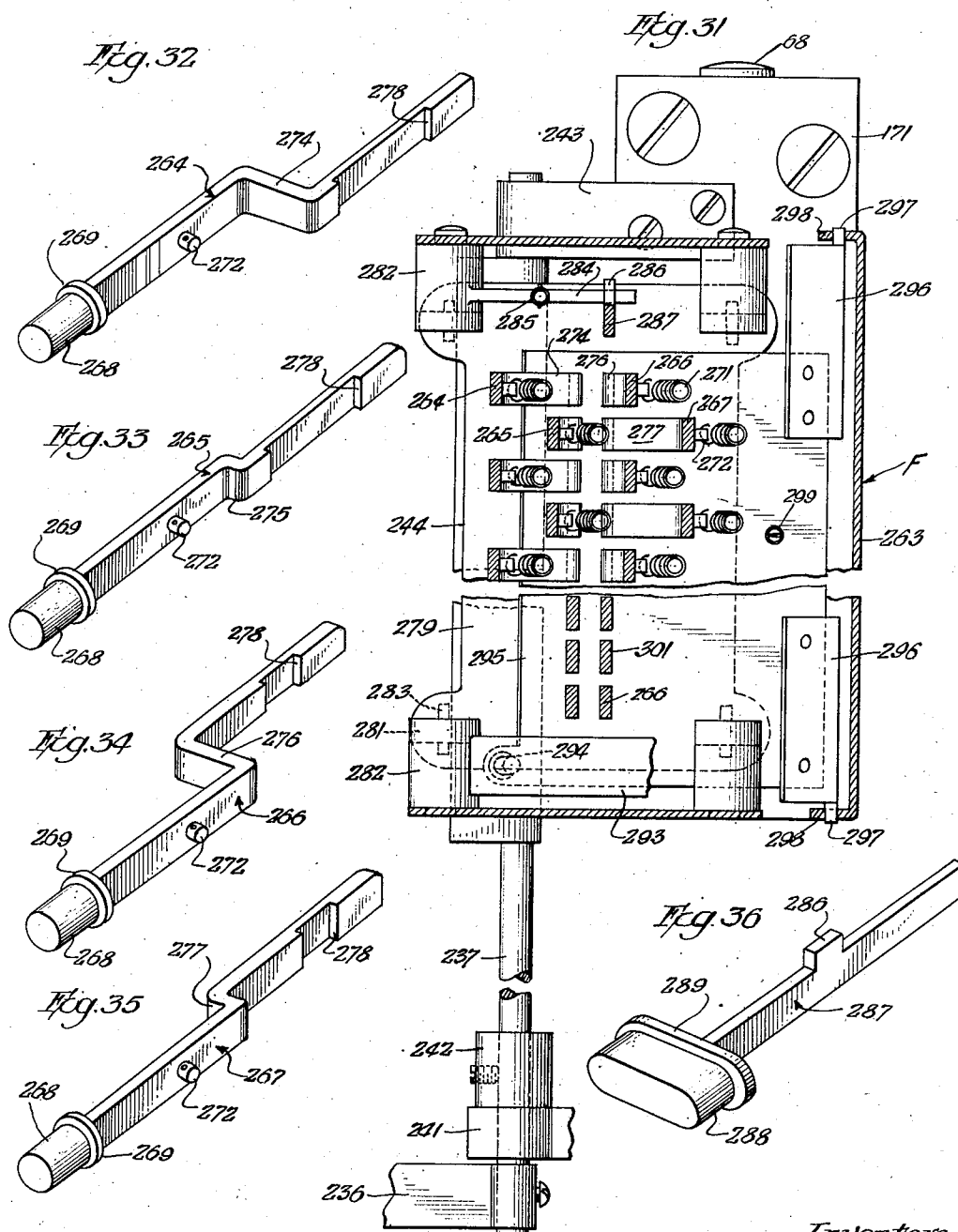
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24 Sheets-Sheet 15



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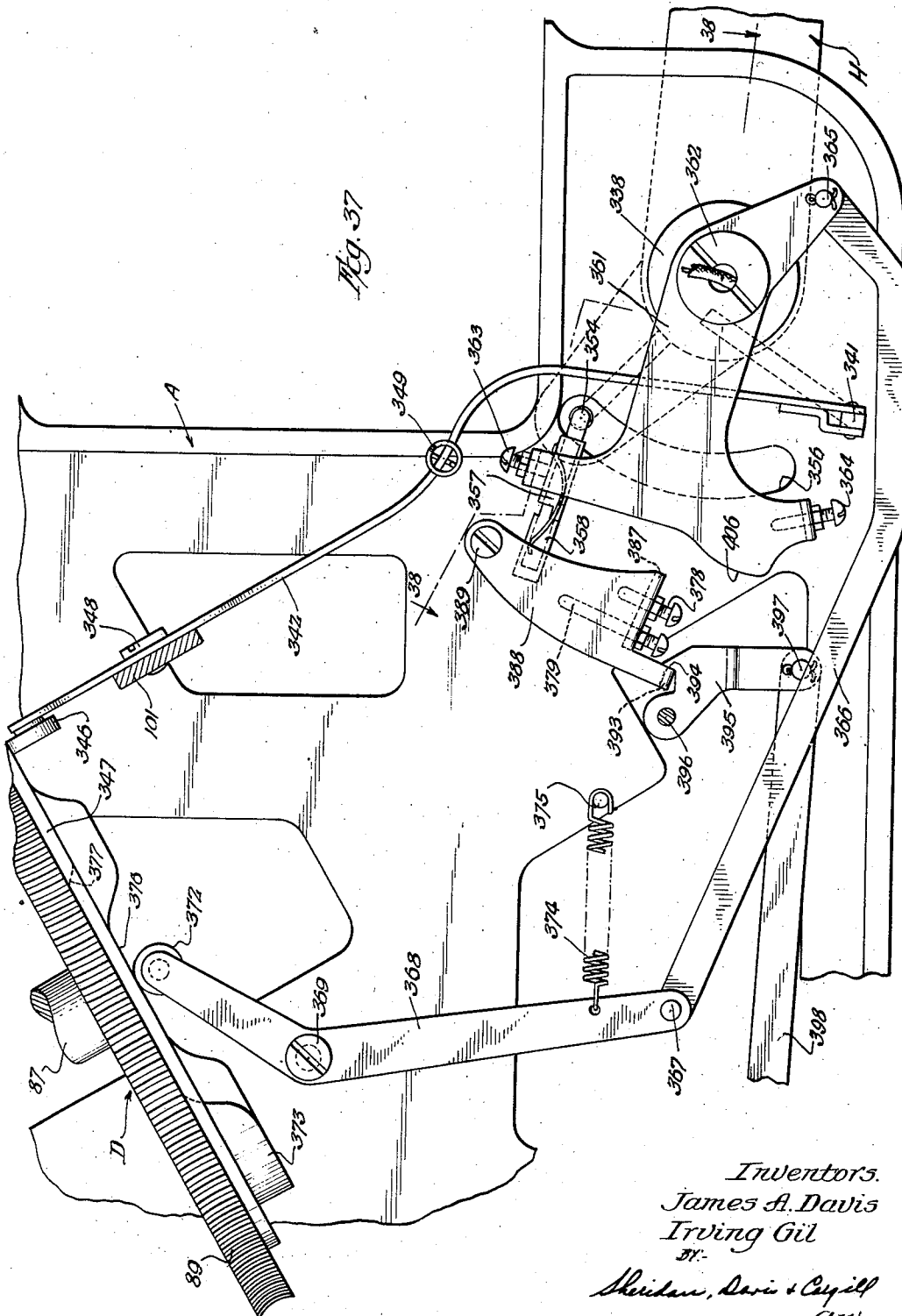
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24 Sheets-Sheet 16



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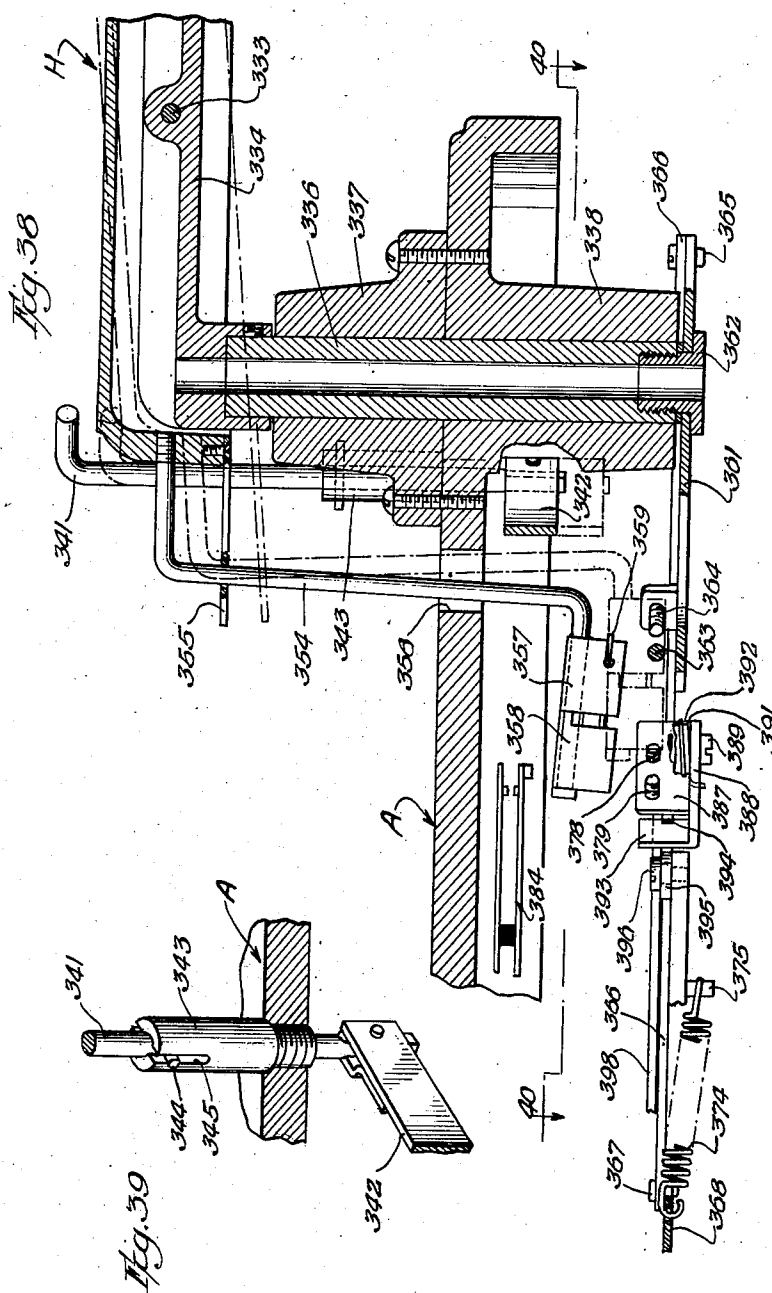
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24 Sheets-Sheet 17



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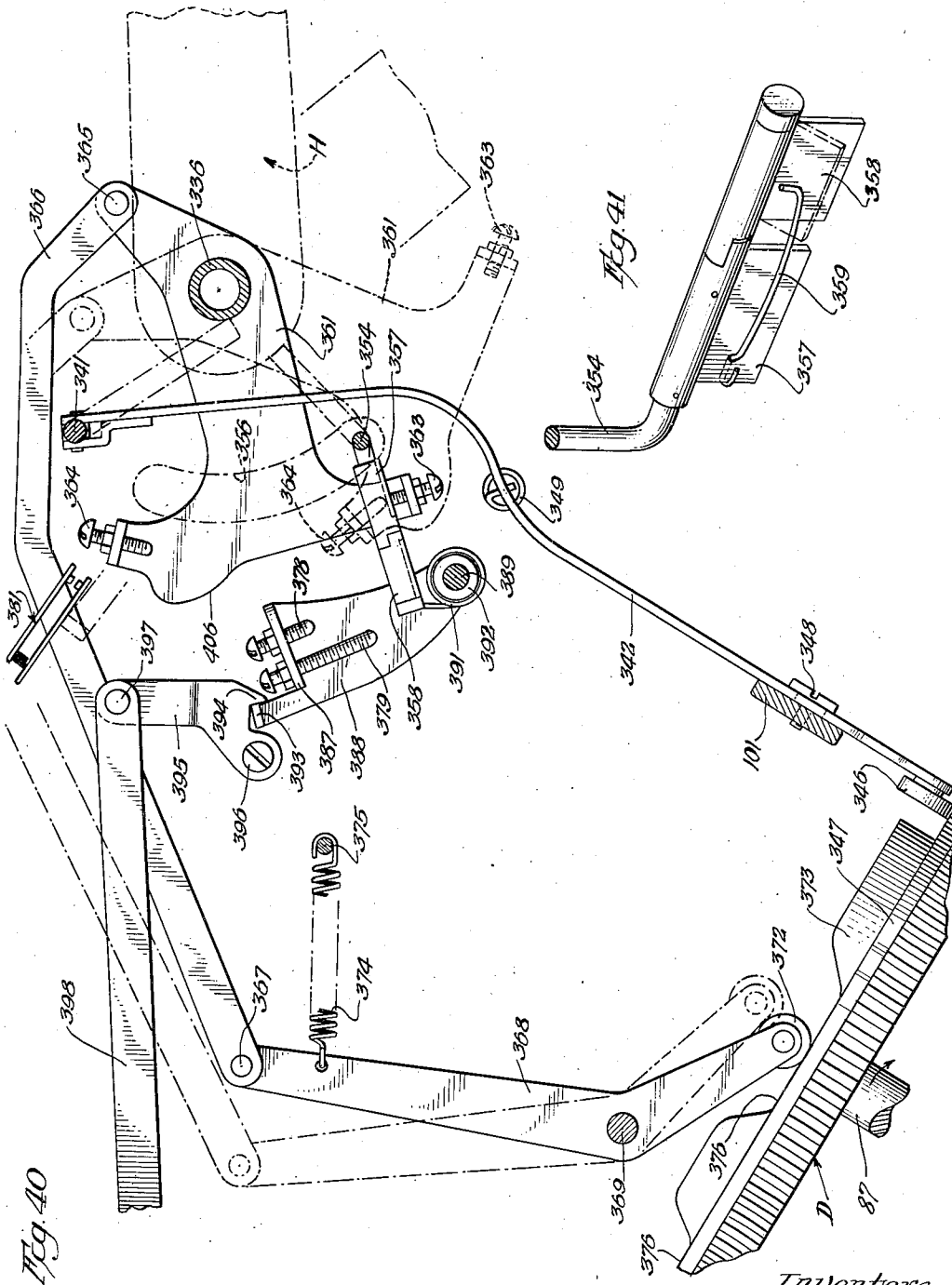
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Fig. 43

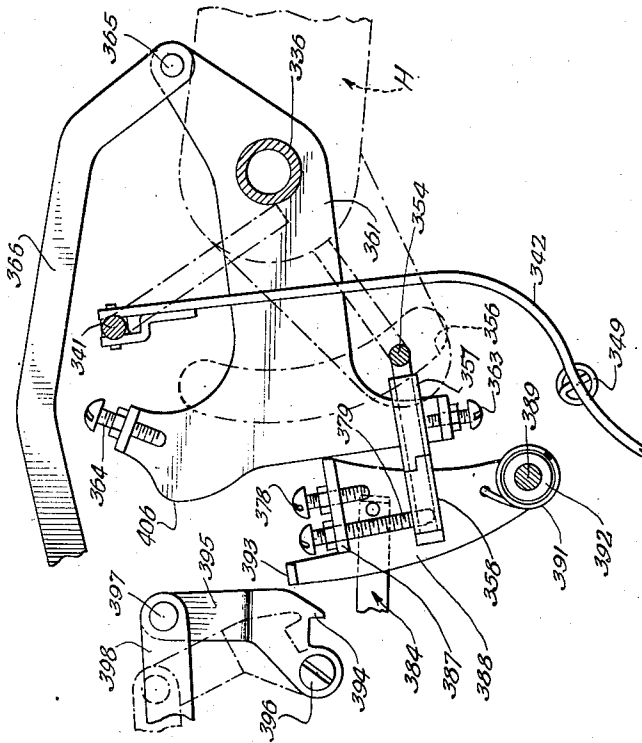
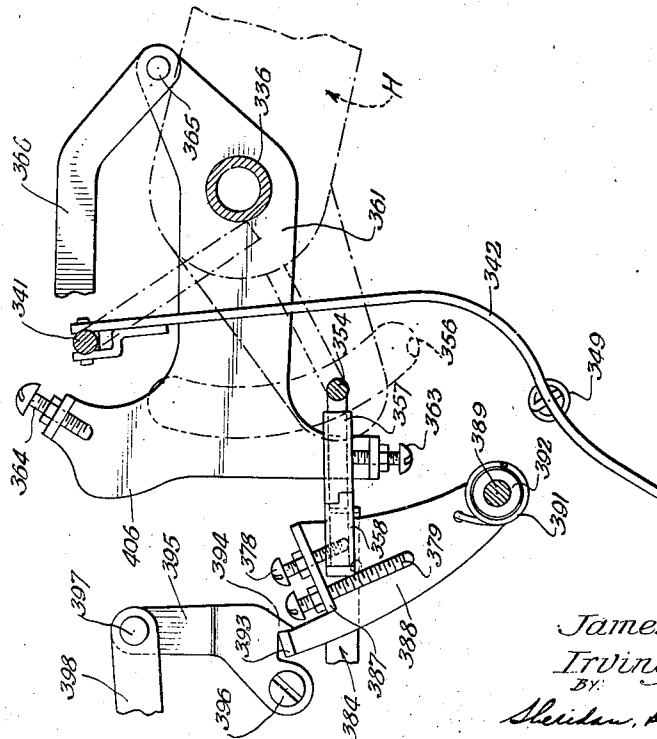


Fig. 42



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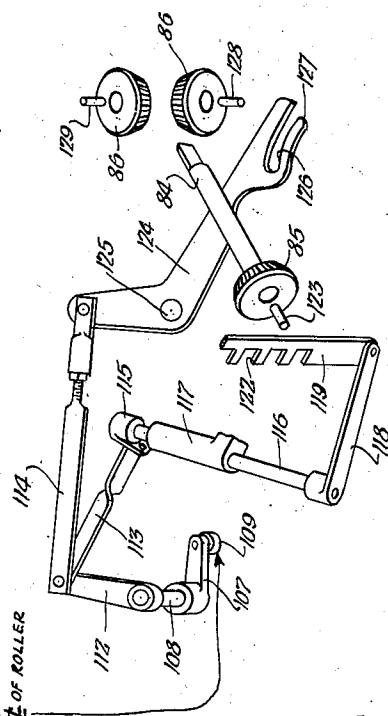
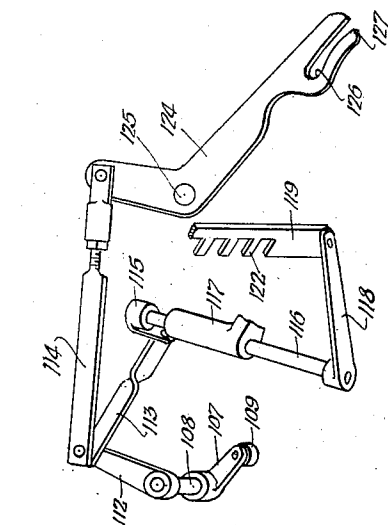
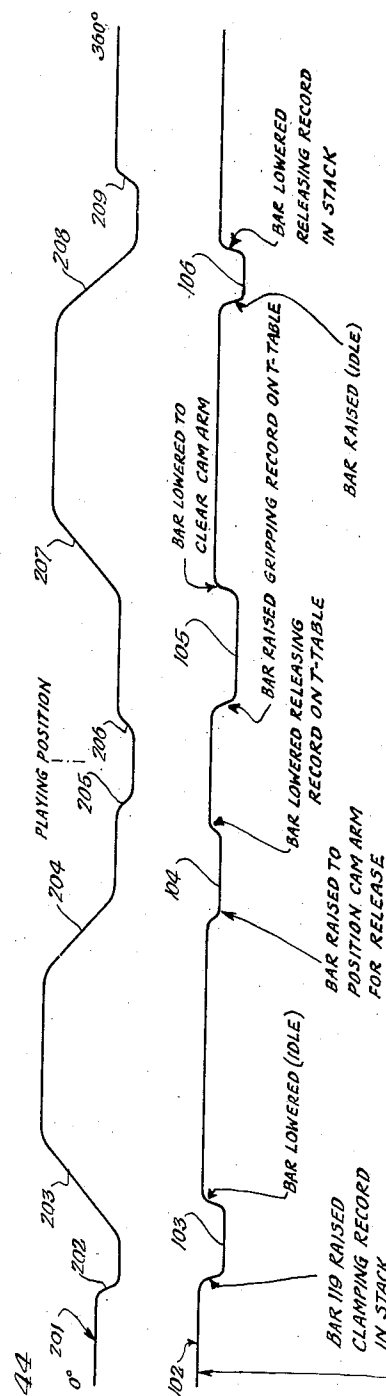
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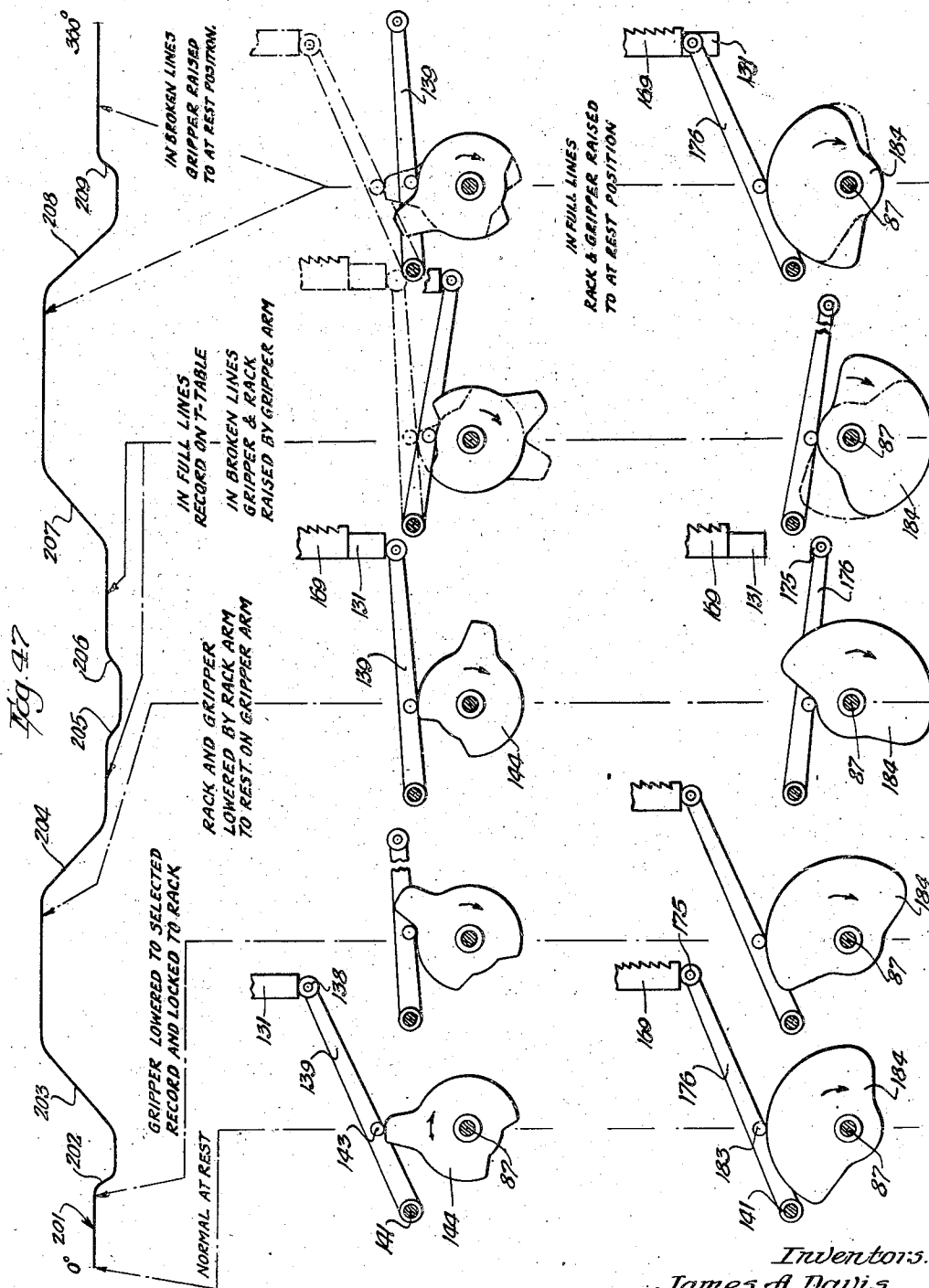
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24 Sheets-Sheet 21



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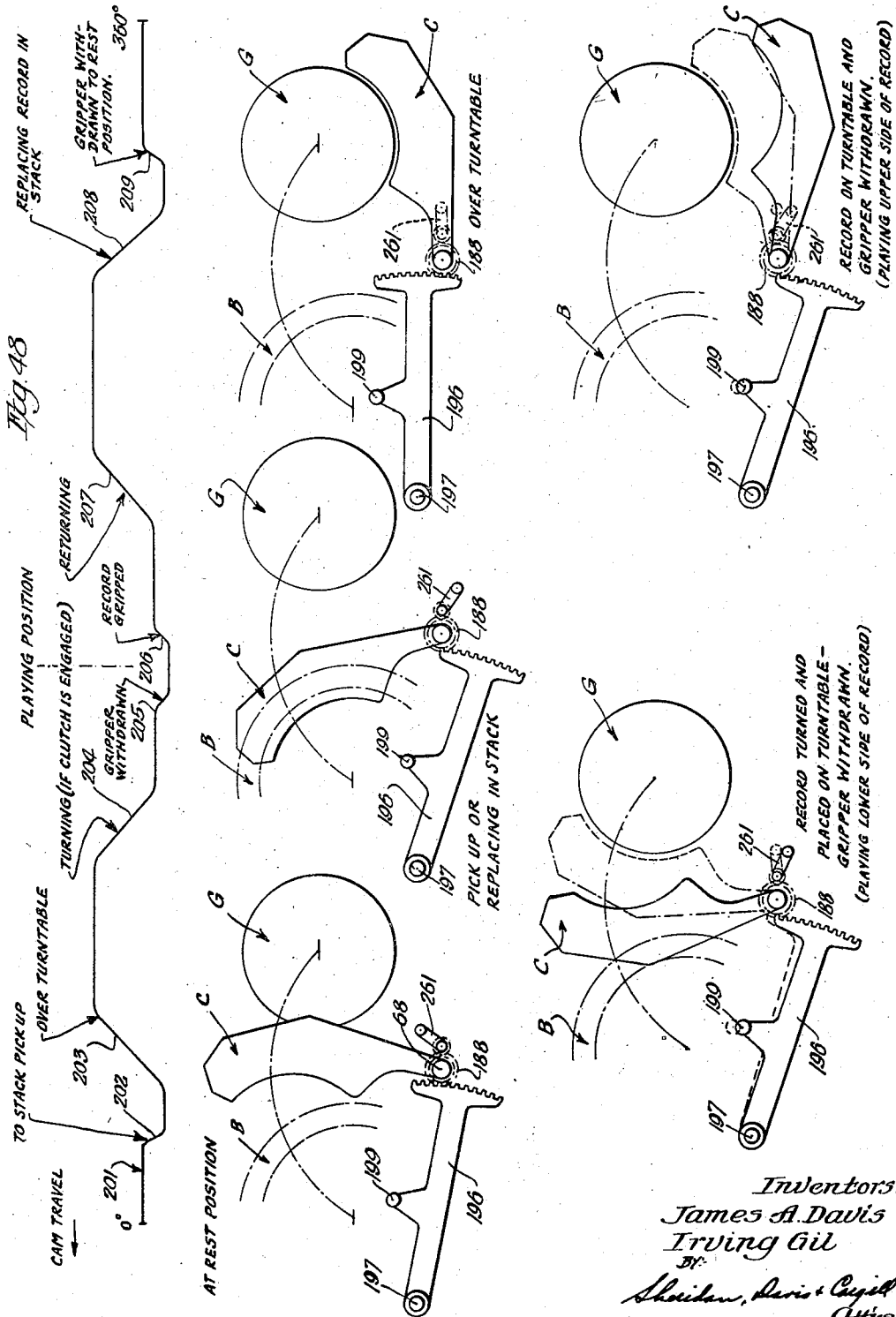
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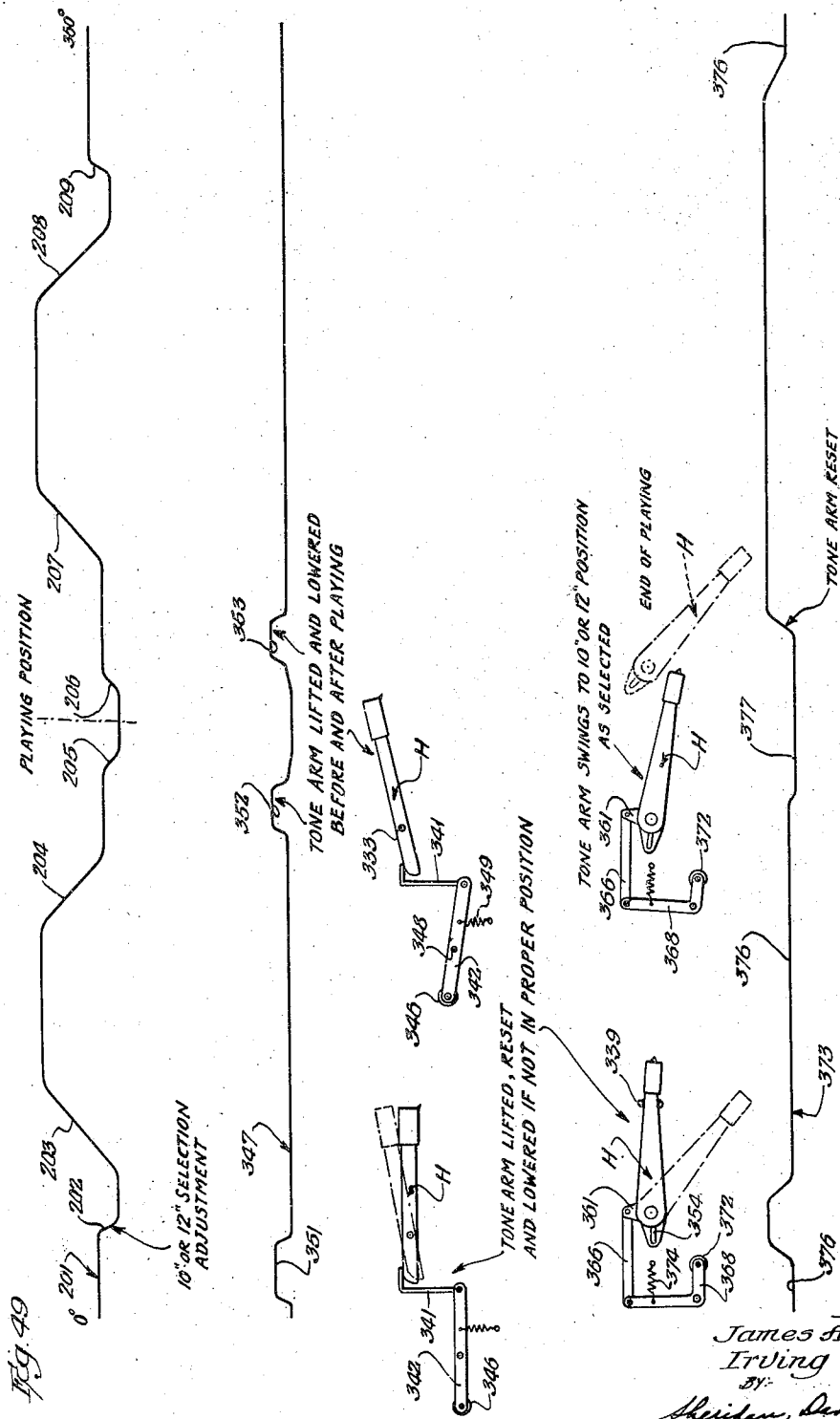
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24 Sheets-Sheet 23



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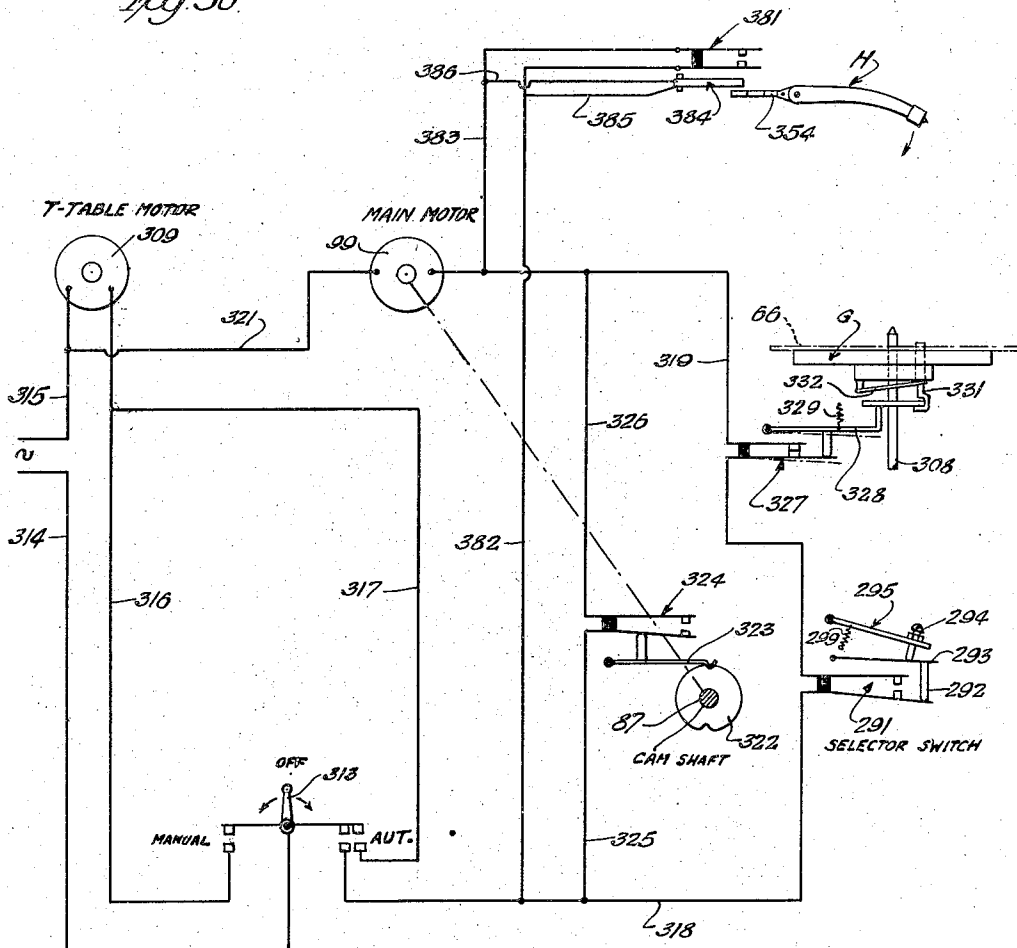
J. A. DAVIS ET AL
AUTOMATIC PHONOGRAPH

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24 Sheets-Sheet 24

Fig. 50.



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UNITED STATES PATENT OFFICE

2,482,659

AUTOMATIC PHONOGRAPH

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to said Davis, trustee

Application October 6, 1941, Serial No. 413,808

37 Claims. (Cl. 274—10)

1

This invention relates in general to phonographs, and more particularly to multi-record phonographs capable of automatically and selectively playing a plurality of records in desired sequence, and also optionally operable under manual control for playing any record.

The instant invention is in the nature of an improvement over that disclosed and claimed in our copending United States Letters Patent application Serial No. 364,136, filed November 4, 1940, for Phonograph, now United States Letters Patent No. 2,339,062, issued January 11, 1944. For so much of the subject matter disclosed but not claimed in that copending application which is also disclosed herein, we claim the priority of that earlier filed copending application.

A principal object of the invention is the provision of an automatically operable phonograph capable of selectively playing either or both sides of any one or ones of a plurality of records.

Another important object of the invention is the provision of a phonograph which is automatically operable to selectively play any one or ones of a plurality of records having different diameters.

A further important object of the invention is the provision of such a phonograph which is relatively simple in construction and inexpensive to manufacture, while being substantially foolproof in operation.

Another object of the invention is the provision in an automatic phonograph of novel and simplified record storage means for supporting a plurality of records individually to eliminate any possibility of warping thereof, while facilitating ready automatic selection and manual insertion and removal of the records.

A further object of the invention is the provision in such an automatic phonograph of means for permitting optional manual playing of any desired records, either contained in or other than those contained in the storage means.

Another object of the invention is the provision in such a machine of means for positively preventing subsequent misoperation of the automatic mechanism, if a record or the reproducer means are inadvertently left on the turntable following manual use thereof.

A further object of the invention is the provision in an automatic phonograph capable of selectively playing records of different diameter of means operable to move the reproducer means or tone arm to proper initial playing position relative to the record selected for playing in accordance with the diameter of the selected record.

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Another object of the invention is the provision in such a machine of means operable during the initial portion of each cycle of automatic operations for restoring to normal position the mechanism selectively operable in accordance with the diameter of the particular record to be played, so as to insure proper operation in each instance despite any possible inadvertent manual actuation thereof.

A further object of the invention is the provision in a selectively operable automatic phonograph of means for insuring a complete cycle of operations to return the mechanism to normal position, if the record associated with the actuated selective control means has been removed from, or has not been placed in, the record storage means, i. e., whenever a blank selection is made.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, when taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

In the drawings,

Figure 1 is a perspective view of a phonograph embodying the features of the invention, with the exterior casing thereof removed;

Fig. 2 is a top plan view of the machine of Fig. 1;

Fig. 3 is a view similar to Fig. 2 with the record stack or storage means removed;

Fig. 4 is an enlarged vertical sectional view taken substantially on the line 4—4 of Fig. 3, and showing the gripper and rack raising and lowering mechanism in upper or normal position;

Fig. 5 is a view similar to Fig. 4, showing the same mechanism in the intermediate or record reversal position;

Fig. 6 is a further enlarged vertical section taken substantially on the line 6—6 of Fig. 4 to illustrate the cam driving means;

Fig. 7 is a detail horizontal section taken substantially on the line 7—7 of Fig. 4 showing the clutch disengaging mechanism;

Fig. 8 is a detail vertical section taken substantially on the line 8—8 of Fig. 7;

Fig. 9 is a detail horizontal section taken through the selector mechanism, and showing a portion of the gripper in stack pick-up position;

Fig. 10 is a vertical section taken substantially on the line 10—10 of Fig. 9 to illustrate the mounting of the record supporting trays;

Fig. 11 is a vertical section through the record stack and gripper arm taken substantially on the

line 11—11 of Fig. 2, with the gripper plates open and in the record pick-up position;

Fig. 12 is a view similar to Fig. 11, showing a record engaged by the gripper plates and raised from its supporting tray;

Fig. 13 is a detail vertical section through a portion of the gripper arm and taken substantially on the line 13—13 of Fig. 9;

Fig. 14 is a detail vertical section taken substantially on the line 14—14 of Fig. 13;

Fig. 15 is similar to Fig. 14 with the gripper plates shown in the closed position of Fig. 12;

Fig. 16 is a detail side elevational view looking in the direction of the line 16—16 of Fig. 9;

Fig. 17 is a detail horizontal section taken substantially on the line 17—17 of Fig. 16;

Fig. 18 is a perspective view of the gripper latch pawl;

Fig. 19 is a vertical section taken substantially on the line 19—19 of Fig. 16;

Fig. 20 is a detail perspective view of the gripper bevel gear segment guide lugs;

Fig. 21 is a view similar to Fig. 20 of the gripper bevel gear segment centering means;

Fig. 22 is a vertical section taken substantially on the line 22—22 of Fig. 16, showing the gripper and rack locking mechanism in normal or inoperative position.

Fig. 23 is a view similar to Fig. 22 illustrating the same mechanism locked in a selected position.

Fig. 24 is a detail vertical section taken substantially on the line 24—24 of Fig. 9 and showing the rack lever and clutch conditioning and key release pawl in normal or inoperative position.

Fig. 25 is a view similar to Fig. 24 illustrating the same parts in operated position;

Fig. 26 is a view similar to Figs. 24 and 25 showing the clutch conditioning and key release pawl in cleared position;

Figs. 27, 28 and 29 are horizontal sections taken, respectively, on the lines 27—27, 28—28, and 29—29 of Figs. 24, 25 and 26;

Fig. 30 is a perspective view of the clutch conditioning and key release pawl;

Fig. 31 is a detail vertical section through the selector taken substantially on the line 31—31 of Fig. 9;

Figs. 32 to 36, inclusive, are perspective views of the four different types of selector keys and of the canceling key, respectively;

Fig. 37 is a bottom plan view of the mechanism for moving the tone arm;

Fig. 38 is a vertical section taken substantially on the line 38—38 of Fig. 37;

Fig. 39 is a detail perspective view showing the mounting of the tone arm raising rod;

Fig. 40 is a horizontal section taken substantially on the line 40—40 of Fig. 38;

Fig. 41 is a perspective view of the tail portion of the rod for swinging the tone arm;

Fig. 42 is a view similar to Fig. 39, with the parts moved to swing the tone arm into initial playing position for cooperation with a ten-inch record;

Fig. 43 is a view similar to Fig. 42 illustrating the position of the size selector mechanism when the tone arm has been swung into initial playing position for cooperation with a twelve-inch record;

Fig. 44 is a diagrammatic view illustrating the cyclic relationship between the gripper locking and releasing cam and the gripper swinging and reversing cam;

Figs. 45 and 46 are perspective views of the

gripper locking and releasing mechanism in different positions;

Fig. 47 is a diagrammatic view illustrating the different positions of the gripper and rack raising and lowering mechanism;

Fig. 48 is a diagrammatic view illustrating the different positions of the gripper swinging and reversing mechanism;

Fig. 49 is a diagrammatic view illustrating the different positions of the tone arm raising and swinging mechanism; and

Fig. 50 is a diagrammatic view of the wiring circuit of the machine, including illustrations of the several control switches employed.

Referring more particularly to the drawings, all of the operating mechanism of the present machine is preferably mounted upon, or depends from, a suitable skeleton supporting frame or motor board A which may be resiliently or otherwise secured in any desired manner within the usual outer cabinet or casing, not shown herein. The operating mechanism, in general, comprises a record stack or storage means B including means for individually supporting a plurality of records which may be of different diameters if desired; record gripper mechanism C selectively operable to withdraw any record from the stack and to return the same to proper position therein after playing; gripper operating mechanism including cam driving means D for locking and releasing and vertically moving the gripper, and means E operable to swing the record gripper to and from the stack B and to reverse the same when the under side of a selected record is to be played; selector mechanism F adapted to be selectively conditioned to determine which record or records and which side thereof are to be automatically played; turntable mechanism G to individually receive and rotate each record selected for playing; and reproducer means H adapted to be connected in the usual manner to any desired type of amplifier and speaker means, not illustrated, and to translate the irregularities of the sound track of the selected record into mechanical vibrations and to convert the latter into electrical impulses for amplification and conversion into sound. The instant operating mechanism also includes various special controls and interlocks for insuring proper automatic operation of the machine, for permitting optional playing of records other than those contained in the storage means or stack B, and for preventing any trouble in the subsequent operation of the automatic mechanism if such a record or the reproducer means is accidentally left on the turntable.

Record stack

Referring more particularly to Figs. 1, 2, 10, 11 and 12, the record stack B comprises a shaft 51 upstanding from, and supported in any suitable manner on, the skeleton frame A adjacent the forward central portion thereof, and a plurality of horizontally disposed and arcuately shaped guide bars or supporting rails 52 secured in vertically spaced relationship relative to each other to a pair of upstanding brackets 53 mounted on the frame A. A cover plate 54 is mounted on the upper ends of the brackets 53 and on the shaft 51. A plurality of vertically spaced record receiving discs or trays 55, which are shaped as illustrated in Fig. 2, have their inner or right hand ends individually and pivotally mounted on the shaft 51 in the following manner. Referring to Fig. 10, a plurality of flanged bearing rings 56 are press-fitted on, or otherwise rigidly se-

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cured to, the shaft 51 in vertically stacked relationship. Rotatably mounted upon each ring 56 is a bearing collar 57 to which one of the record trays 55 is secured by means of a screw 58. The several trays 55 are thus pivotally supported on the shaft 51 independently of each other to prevent the weight of the upper ones from resting upon the lower ones. At their opposite ends, each of the record supporting trays 55 terminates in a shouldered lug 59 (Fig. 2) slidably resting upon the upper surface of an associated supporting bar 52, the latter and the bearing rings and collars 56, 57 being so spaced as to insure each tray 55 being maintained in a horizontal position.

Pivotal movement of the trays 55 on the shaft 51 is limited in an inward or rearward direction by the rear bracket 53 contacting the lugs 59, and forward or outward movement of the trays is limited by the lugs 59 contacting a strip 61 secured to the forward ends of the supporting rails 52. Each of the trays 55 is normally latched in its rear-most or operating position by a spring pawl 62 secured to the rear bracket 53 by a vertical strip 63, and is provided on its forward edge with a tab 64. The tabs 64 on the several trays 55 are preferably staggered circumferentially relative to each other to facilitate manual engagement thereof for the purpose of moving any desired tray between its normal or full line position and its forward or broken line position of Fig. 2. Each tray 55 is also provided with an upstanding pin or protuberance 65 adapted to engage the usual central aperture in a record 66 to maintain the same in desired position thereon, and the upper record receiving surface of the trays are preferably covered with felt or some other such protective material to prevent damage to the records. With this arrangement, the several records 66 are independently supported in vertically spaced relationship in the stack in such a manner as to prevent warping thereof or other damage thereto. The centers of all of the records are normally maintained in vertical alignment, regardless of the diameters of the individual records, by means of the spring latches 62 engaging the forward edges of the tray lugs 59, and records of different diameters may be placed indiscriminately in any position in the stack. Whenever it is desired to change, replace or insert a record 66 in the stack, the tab 64 of the associated tray 55 may be grasped to pull or swing the tray to its forward position, such movement being yieldingly resisted by the spring latch 62, so that ready access to the stacked records and their supporting trays is provided at all times.

Record gripper

Referring to Figs. 1, 2, 9, 11 to 15 and 19, the gripper mechanism C is supported by a bracket 67 which is mounted on a vertical operating shaft 68 for sliding movement longitudinally thereof and is retained against rotation relative to the shaft by a suitable key 69. The shaft 68 extends both above and below the main frame A, and is journaled at its upper end in a bracket 71 connected to the upper end of the parallel shaft 51 of the record stack B. The shaft 68 is also journaled adjacent its lower end in a horizontal portion of a bracket 72 which is supported below the main frame A in a manner to be later described. Bearing collars 73 rigidly secured to the shaft 68 in contact with the bracket 71 (Fig. 19) and the bracket 72 (Figs. 1 and 4) prevent vertical or longitudinal movement of the shaft. Journaled in, and extending rearwardly from, the

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gripper supporting bracket 67 is a horizontally disposed stub shaft or main gripper shaft 74 (Figs. 9, 16 and 19). A casting 75 forming the body portion of the gripper is provided with a forward leg 76 which is journaled on the shaft 74 forwardly of the rear leg of the bracket 67, and is secured at the rear of the latter to the shaft 74 by a pin 77. The gripper mechanism is thus mounted for pivotal movement relative to the supporting bracket 67 on the horizontal axis of the shaft 74, and is adapted to be swung horizontally and moved vertically with the bracket 67 relative to the operating shaft 68, all for purposes to be more fully described hereinafter.

Rigidly secured to, or formed integrally with, the body portion 75 of the gripper is an upper and relatively stationary record engaging plate 78 which is normally disposed in its position of rest shown in Fig. 1 and in full lines in Fig. 2. The left-hand edge of the plate 78 is arcuate in shape, and its opposite side terminates in an angularly disposed edge to which a lower plate 79 is pivotally connected by means of a hinge 81. The plate 79 is similar in outline to the plate 78, and the two are adapted to engage or clamp the peripheral edge of a record 66 therebetween, as shown in broken lines in Fig. 2 and in Fig. 12, regardless of the diameter of the record to be gripped. In order to accomplish this clamping function, a plurality of bolts 82 are provided which extend through suitable apertures in the two plates and have springs 83 mounted thereon and disposed between washers on their lower ends and the bottom surface of the lower plate 79. The springs 83 urge the arcuate edge portions of the plates 78, 79 together, and the inner surface of the latter may be covered with suitable protective material to prevent damage to the records.

Journaled adjacent its ends and extending horizontally through the body portion 75 of the gripper is a cam shaft 84 (Fig. 13), the rear end of which terminates in a half round or flattened portion extending between the gripper plates 78 and 79. In its normal position, which is when the various parts of the machine are in their positions of rest as shown in Figs. 1 and 2, the full diameter of the rear end of the shaft 84 engages the inner surfaces of the plates 78 and 79 to maintain them in their separated or inoperative position of Figs. 11 and 14. Rotation of the shaft 84 through an angle of 90° from such position will permit the springs 83 to swing the lower plate 79 upwardly into the clamping position shown in Figs. 12 and 15. Rotation of the cam shaft 84 for the purpose of picking up or releasing a record by thus causing actuation of the gripper plates 78, 79 is accomplished, in a manner to be later more fully described, through the agency of a bevel gear 85 (Fig. 13) secured to the front end of the shaft, and/or similar upper and lower bevel gears 86 meshing therewith and mounted on suitable stud shafts extending outwardly from the body portion 75.

During operation of the machine, the record gripper C is first moved downward on the shaft 68 from its normal position of Fig. 1 until it reaches the horizontal level of the particular record 66 in the stack B which has been selected for playing. The gripper is then swung to the left from its full line to its broken line position of Fig. 2, where it pauses long enough for the cam shaft 84 to be rotated to allow the lower plate 79 to be moved by the springs 83 from its position

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of Fig. 11 to the full line position of Fig. 12 to grip the selected record 66 and raise the same out of engagement with its supporting tray 55 and centering pin 65. The gripper C and the record held thereby are then moved horizontally or swung to the right to the position of Fig. 3 to bring the record over and in vertical alignment with the turntable G. The gripper C then continues its downward movement on the shaft 83 until it reaches a position slightly above the turntable G, where it pauses to permit reversal or turning over of the record if the under side thereof is the side which has been selected for playing. After such reversal, which is accomplished by rotating the gripper C through 180° about the axis of the shaft 74, or after the same time interval required for such reversal if the record is not actually reversed, the gripper continues its downward movement on the shaft 83 to deposit the record on the turntable G. The cam shaft 84 is then again partially rotated to spread the plates 78, 79 of the gripper apart to release the record, and the gripper is then given a further outward swinging movement in a horizontal plane relative to the turntable and into a position of rest clear of the outer periphery of the record. After playing of the record so disposed on the turntable, the gripper C is again swung horizontally back to its position of Fig. 3 and the cam shaft 84 rotated to permit reengagement of the record by the plates 78, 79 through the agency of the springs 83. The gripper and played record are then raised slightly above the turntable to the aforesaid reversing position, wherein the gripper either pauses if the original top side of the record was played, or is again reversed if the original underside of the record was that side played. Subsequently, the gripper C and the played record held thereby are raised to a position opposite and slightly above the supporting tray 55 of the stack from which it was removed. The gripper is then swung horizontally to return the record to the stack, the shaft 84 rotated to release the record from the plates 78, 79 and the gripper swung back to its full line position of Fig. 2. It is then returned upwardly to the normal or inoperative position of Fig. 1, and this is done in each cycle of operations of the machine regardless of the particular vertical position in the stack of the record which has been selected for playing. These different steps in the complete cycle of operation of the gripper C are illustrated diagrammatically in Figs. 44 to 48, and the several means for so operating this mechanism will now be described.

Gripper operating mechanism

The motivating force for the operation of all of the various parts of the machine, except the manually settable selector mechanism and the turntable G, comes from the main cam driving means D. As best seen in Fig. 6, this means comprises a plurality of cams rigidly secured to a horizontal shaft 87 which is rotatably supported in a pair of brackets or hangers 88 depending from the skeleton frame A. At the rear end of the main cam shaft 87, to the right in Fig. 6, is secured a worm-wheel 89 which is in mesh with and adapted to be driven by a worm 91 keyed to a shaft 92. A pulley wheel 93 (Figs. 1 and 6) also secured to the shaft 92 is driven by a belt 94, a double pulley wheel 95 and a second belt 96 from a pulley wheel 97 which is secured to the shaft 98 of a main driving or changer motor 99. The motor 99 is hung in any desired manner from

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the skeleton frame A by suitable brackets 101, and is energized to drive the cam means D through the above-described connections under the control of selectively and automatically operable switch means to be later described. The main cam shaft 87 is thus rotated 180° to perform all of the above mentioned functions necessary to remove a selected record 66 from the stack B and deposit the same on the turntable G for playing, when the motor 99 is deenergized and the main cam shaft stopped, until the playing of the record has been completed. Thereafter, the motor 99 is started to rotate the shaft 87 through another 180° to complete the automatic cycle of operations of the machine and return the played record to its proper position in the stack, when the motor and cam driving means D are again stopped to leave the machine parts in their original or normal positions, unless more than one record has been selected for playing. In the latter case, the machine will automatically continue through similar successive cycles of operation until all selected records have been played.

Gripper plate locking and release

As has been previously described, during each cycle of operations the gripper cam shaft 84 is rotated 90° to permit the springs 83 to swing the lower gripper plate 79 relative to the upper plate 78 to grip or engage the selected record in the stack after the gripper has been moved into proper relationship therewith. The cam shaft 87 is again operated when the selected record has been lowered onto the turntable to release the record, so that the gripper C may be withdrawn to permit playing of the record, and it is operated for the third time after playing to remove the record from the turntable. The fourth time that the cam shaft 84 is rotated 90° in each cycle of operations of the machine is after the gripper has returned the played record to the stack over its supporting tray 55. These two operations of the cam shaft 84 at the stack, and the two adjacent the turntable, are performed respectively by two different mechanisms under the control of a single cam lever in the following manner.

Referring to Figs. 1, 3, 6, 9, 13, 44, 45 and 46, one of the cam driving means D comprises a gripper locking cam 102 (Fig. 6) which is rigidly secured to the main cam shaft 87 to be rotated thereby. The cam 102 is of the drum or cylinder type, and includes four different dwells or laterally offset portions 103, 104, 105 and 106, as illustrated diagrammatically in Fig. 44. A cam lever 107, which includes a vertical shaft portion 108, is provided at its free end with a follower or roller 109 disposed in the groove of the cam 102. The shaft portion 108 is journaled in and extends upwardly through a stud 111 depending from the frame A, and is secured at its upper end above the latter to one end of a lever 112. The other end of the lever 112 is pivotally connected to the ends of two adjustable links 113 and 114 (Figs. 3, 4, and 45). The link 113 is pivoted at its other end to the lower end of a crank arm 115 secured to a horizontal shaft 116, which is journaled in a bracket 117 mounted upon or formed integrally with the skeleton frame A. Also secured to the shaft 116 is a crank arm 118 which is pivoted to the lower end of a bar 119, the upper end of which is pivotally connected to the shaft retaining bracket 71 by a link 121 (Fig. 2) to insure vertical movement of the bar. The bar 119 is provided along its

left edge with a plurality of spaced apertures 122 (Fig. 45) adapted to engage or cooperate with a pin 123 extending horizontally from the bevel gear 85 on the gripper cam shaft 84 whenever the gripper is swung into operative relationship with any one of the records in the stack, in the manner shown in Fig. 9. The link 114 is also pivotally connected to one arm of a bell-crank or cam arm 124, which is pivoted at 125 for horizontal movement on the skeleton frame A. The free arm of the crank 124 is provided with a cam slot 126 (Figs. 1, 3 and 45), for cooperation with a pin 128 on the lower gripper cam shaft bevel gear 86 or a pin 129 on the upper bevel gear 85, when the gripper is in its lowermost position in cooperative relationship with the turntable. The forward leg 127 of the cam arm 124 defining the slot 126 terminates short of the end of the arm to readily admit either of the pins 128 or 129 to the slot 126, as will be more fully described hereafter.

Whenever the roller 109 of the cam lever 107 is disposed in a normal portion of the cam groove 102, the several parts operated thereby will be in their normal position of Fig. 45, wherein the toothed bar 119 is at its lowermost point of travel and the free end of the cam arm 124 is in its rearmost or inoperative position, as shown in Fig. 3. At the beginning of any cycle of operations the cam lever 107 remains stationary for a sufficient length of time during the initial rotation of the cam driving means D to permit the gripper C to be positioned horizontally and swung into operative relationship with that record in the stack which has been selected for playing. As the gripper C reaches such operative stack position, the roller 109 enters the first dwell 103 of the cam groove 102 (Fig. 44) to swing the lever 107 and raise the toothed bar 119, thus moving the several parts from their normal position of Fig. 45 to their operated position of Fig. 46. As the gripper C was swung into cooperative relationship with the stack, the pin 123 on the gear 85 was moved into engagement with one of the apertures 122 of the bar 119, as shown in Fig. 9. Which one of the apertures 122 that the pin 123 cooperates with in any cycle of operations depends upon the vertical position in the stack of the particular record which has been selected for playing. The subsequent raising of the bar 119 after the gripper C has been swung into its stack position of Fig. 9 will rotate the gear 85 through an angle of 90° from its normal full line position to its broken line position of Fig. 13 to accomplish the desired clamping together of the plates 78, 79 by the springs 83. This will result in lifting the selected record 66 from its normal position of Fig. 11 to its elevated position of Fig. 12, so that the same may be withdrawn from the stack and swung over the turntable by the gripper C to the horizontal position shown in Fig. 3.

It will be noted from Fig. 13 that the clamping action imparted to the gripper by the raising of the bar 119 has also resulted in the pins 128 and 129 on the gears 83 being rotated from their full line positions to their broken line positions of this figure. The gripper is then lowered in its position of Fig. 3 to a point slightly above the turntable G, regardless of which record has been removed from the stack. As has been previously explained, in this latter position of the gripper, reversal thereof is accomplished if the under side of the record has been selected for playing. During the travel of the gripper to this intermediate

position directly above the turntable prior to reversal of the record, the follower 109 has been moved out of the first dwell 103 of the cam 102 to lower the bar 119 and swing the cam lever 124 back to their normal positions of Fig. 45 and Fig. 3, in which position the record locking mechanism remains in an idle phase until after the record has been reversed, if such reversal is required, and just prior to the subsequent further downward movement of the gripper to position the record on the turntable. The return of the cam lever 124 to normal position for such an idle phase is done only to provide clearance for the operation of the record reversing mechanism, to be later described. At this time, i. e., just prior to the final positioning of the record on the turntable, the follower 109 enters the second dwell 104 of the cam 102 to again move the gripper locking mechanism from its position of Fig. 45 to its position of Fig. 46, wherein the cam slot 126 of the arm 124 will be swung forwardly to be disposed directly below one or the other of the pins 128 or 129. The final lowering of the gripper arm to place the record on the turntable will then result in either the pin 128 or the pin 129 being positioned in the cam slot 126. During such movement of the gripper arm, the cam follower 109 has remained idle in the base portion of the dwell 104. As soon as the record has been deposited on the turntable, the far end of the dwell 104 again moves the follower 109 and the gripper locking mechanism to return the latter to the normal position of Fig. 45. Such return movement of this mechanism includes the rearward swinging of the free end of the cam arm 124, which causes the cam slot 126 to move whichever one of the pins 128 or 129 is disposed therein to rotate its associated gear 86 through an angle of 90°. The gripper cam shaft 84 is, thus, actuated to spread the plates 78, 79 apart to release the record and free the same from the gripper arm. The latter is then swung horizontally, in a manner to be later more fully described, away from the turntable to provide the proper clearance for the reproducer means H, in which withdrawn position it remains until completion of the playing of the record. If the pin 128 has been the one operated upon by the cam arm 124 to release the record on the turntable, it will be disposed adjacent the open end of the slot 126 after accomplishing this function and prior to the horizontal withdrawal of the gripper. The forward leg 127 of the arm 124 is made shorter than the rear leg thereof to provide clearance for the pin 128 during such horizontal withdrawal of the gripper. If the record was previously reversed and the pin 129 was the one actuated by the cam arm 124 to release the record on the turntable, the same freedom of movement to prevent further actuation of the pin 129 during horizontal withdrawal of the gripper arm from the turntable will be permitted by the particular shape of the cam slot 126.

As soon as the playing of the record has been completed and the reproducer means has been returned to inoperative position, in a manner to be later described, the gripper arm C will again be moved horizontally from its withdrawn position into cooperative relationship with the record on the turntable, such movement placing either the pin 128 or the pin 129 in active relationship with the cam slot 126. The follower 109 of the cam lever 107 then enters the third dwell 105 of the cam 102 to again move the gripper locking mechanism from its position of Fig. 45 to its position of Fig. 46. The free end of the cam arm

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124 is thus swung forwardly to actuate either the pin 128 or the pin 129 to rotate the associated gear 86 and the shaft 84 to permit the springs 83 to cause the plates 78, 79 to grip the record which is on the turntable. The gripper arm C and the played record held thereby are then moved upwardly to bring the latter into its proper horizontal position relative to the stack B. During such operation, the exit portion of the dwell 105 of the cam 102 causes return of the gripper locking mechanism from its position of Fig. 46 to its normal position of Fig. 45 in a second idle phase which, like the first, is solely to provide clearance between the record reversing mechanism and the cam lever 124. The gripper arm is then swung horizontally to return the played record to the stack in the position shown in Fig. 12. During the initial portion of such horizontal movement of the gripper arm C, the follower 109 enters the fourth dwell 106 of the cam 102 to again raise the bar 119 to its position of Fig. 46. As soon as the record has been swung into proper position in the stack so that its central aperture is disposed above the pin 65 of the associated tray 55, during which movement the pin 123 of the gear 85 has entered one of the apertures 122 of the bar 119, the cam follower 109 is moved out of the dwell 106 into the normal portion of the cam 102 to lower the bar 119 to its position of Fig. 45. The gripper cam shaft 84 is thus rotated back to its normal position of Fig. 13 to spread the plates 78, 79 and permit the played record to drop onto its supporting tray 55, as shown in Fig. 11. This constitutes a complete cycle of operations of the gripper plate locking and releasing mechanism.

Gripper lowering and raising mechanism

The gripper mechanism supporting bracket 67, which has already been described as being slidably keyed to the vertical shaft 68, is interposed between the upper and lower horizontal arms of a slide bracket 131 (Figs. 1, 16 and 19) through which the shaft rotatably extends. Mounted directly above and below the bracket 67 on the shaft 68 and keyed to the latter therewith are a key release cam disc 132 and a bearing or thrust disc 133, respectively, and interposed between the latter and the lower arm of the slide bracket 131 are the hub portion of a bevel gear segment 134, freely rotatable on the shaft 68, and a spacer or bearing ring 135. An outwardly threaded sleeve or hollow bolt 136 terminating in a circumferential flange or head portion at its lower end is slidably mounted on the shaft 68 below the slide bracket 131, and a nut 137 is screwed on the outer threaded portion of the bolt, with its upper end contacting the under surface of the lower arm of the bracket to normally support the latter and the gripper mechanism C. The nut 137 thus functions to facilitate vertical adjustment of the slide bracket 131 and the gripper mechanism C relative to the bolt 136 to accurately position the gripper in the desired normal horizontal plane. The head portion of the bolt 136 rests upon a pair of rollers 138 rotatably secured to the forked or yoke end portions of a cam lever or gripper arm 139. The other end of the gripper arm or lever 139 is pivotally mounted on a horizontal shaft 141 (Figs. 4, 5 and 6) supported by suitable brackets 142, which are secured in any desired manner to the skeleton frame A. Intermediate its ends, the lever 139 is provided with a roller or cam follower 143 which rests upon the peripheral surface of a gripper raising and lowering cam

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144 forming one of the cam driving means D and secured to the main cam shaft 87.

The rear surface of the vertical portion of the gripper slide bracket 131 is provided with a boss or bearing lug 145 (Figs. 16, 22 and 23) through which a pin 146 extends for pivotally supporting a double-armed latch pawl lever 147 intermediate the ends thereof, the pawl 147 being shown in perspective in Fig. 18. The two arms of the latch pawl 147 are joined at their lower ends by a web portion 148 against which the upper free end of a leaf spring 149 impinges to urge the lower end of the pawl rearwardly, or to the right in Fig. 16. The lower end of the spring 149 is secured by screws 151, together with a bracket 152, to the rear surface of the slide bracket 131. The left arm of the latch pawl 147 (shown at the right side in Figs. 22 and 23) is provided at its upper end with an outwardly extending cam portion 153 adapted to be contacted and swung rearwardly to an intermediate release position (not shown) by any of the keys of the selector F which have been actuated, in a manner to be later described, for the purpose of determining the horizontal position at which the gripper mechanism C will be stopped, in the initial downward movement thereof, to align the same with the desired record in the stack B. The same arm of the latch pawl 147 is also provided with a recess 154 adapted to be engaged by the lower end of a latch lever 155 to hold the pawl 147 in its fully released position of Fig. 23. The latch lever 155 is pivotally mounted at 156 on the upper horizontal arm of the gripper slide bracket 131, and is urged into active position to engage the recess 154 by a spring 157 interconnected between the upper end thereof and a stud on the bracket 131. When the machine is in its normal or at rest position, the slide bracket 131 is at its highest point of travel, as shown in Fig. 22, wherein an arm 158 of the latch lever 155 is contacted by an adjustable stud 159, screwed into and depending from the upper operating shaft bracket 71, to hold the latch lever 155 out of engagement with the latch pawl 147. As soon as the slide bracket 131 is started to be lowered by the gripper arm 139, the lower end of the latch lever 155 is swung by its spring 157 into contact with the outer surface of the arm of the latch pawl 147 carrying the cam portion 153. Rearward movement of the latter to swing the latch pawl 147 to its intermediate release position by the uppermost actuated key of the selector is not sufficient to clear the cam portion 153 from the stems of any other lower keys of the selector which may also have been actuated. Consequently, means are provided to swing the latch pawl 147 further to its fully released position of Fig. 23, wherein it will be held for the duration of the cycle of operations by the latch lever 155. This means comprises a curved pawl actuating arm 160 (Figs. 1, 16, 17 and 19) secured at its rear end to the right side of the gripper supporting bracket 67. The forward end of the arm 160 is normally disposed to one side of the lower web portion 148 of the latch pawl 147, as shown in full lines in Fig. 17. As soon as the pawl 147 has been swung to its intermediate release position, the downward movement of the gripper slide bracket 131 is temporarily stopped, and the gripper arm C is swung first from its full line to its broken line position of Fig. 2 to pick up the selected record, and then to its position of Fig. 3, as will be later described. During this latter swinging of the gripper arm, the arm 160 is moved with the bracket 67 to its broken line position of Fig. 17 to contact

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the lower web portion 148 of the latch pawl 147 and move it forwardly against the action of the spring 149 to swing the latch pawl into its fully released position of Fig. 23, wherein it is held by the lower end of the latch lever 155 being swung into the recess 154 by the spring 157.

The other arm of the latch pawl 147 terminates at its upper end in a forwardly extending nose portion 161, which normally extends through an aperture 162 in the vertical part of the gripper slide bracket 131 to contact a lug 163 on a rack lever 164, as shown in Figs. 22 and 24. The rack lever 164 is pivotally mounted at 165 on the forward side of the slide bracket 131, and is urged in a clockwise direction viewing Fig. 22, or a counter-clockwise direction viewing Fig. 24, by a spring 166 interconnected between an arm 167 thereon and the bracket 152. Consequently, when the latch pawl 147 is moved by its cam arm 153, as previously described, from its operative position of Figs. 16, 22 and 24 to its intermediate release position, the spring 166 swings the upper end of the rack lever 164 inwardly (to the right in Figs. 22 and 23 and to the left in Figs. 24 and 25). This upper end of the lever 164 terminates in a forwardly extending flange or tooth 168 which co-operates with the right-hand toothed edge (at the left side in Figs. 22 and 23) of a rack bar or slide 169.

The rack bar 169 is slidably mounted for vertical movement in suitable ways provided in a guide bracket 171 by means of slide pieces 172 (Figs. 3, 9 and 27), which are secured to the upper and lower ends of the rack in any desired manner. The guide bracket 171 is mounted intermediate its ends on the skeleton frame A, and the upper operating shaft bracket 71 and the lower shaft bracket 72 are secured to the upper and lower ends thereof, respectively (Fig. 1). A vertical slot 173 (Figs. 22 and 23) in the rack bar 169 is engaged by a pin 174 extending forwardly from the slide bracket 131 to permit relative vertical movement between the rack and the slide bracket, while preventing rotation of the latter on the shaft 68. The rack bar 169 is normally supported at its lower end by a roller 175 rotatably secured to the free end of a cam lever or rack arm 176. The other end of the arm or lever 176 is pivotally mounted on the shaft 141 (Figs. 4, 5 and 6). Intermediate its ends, the lever 176 is provided with a pair of spaced lugs 177 through which adjusting screws 178 extend for engaging the opposite sides of an arm 179 of a lever 181 which passes through an aperture 182 in the lever 176 between the lugs 177. The lever 181 is also pivotally mounted on shaft 141, and is provided with a roller or cam follower 183 which rests upon the peripheral surface of a rack bar raising and lowering cam 184, forming one of the cam driving means D and secured to the main cam shaft 87 adjacent the gripper raising and lowering cam 144. The levers 176 and 181 together function as a single arm, with the relative adjustability therebetween facilitating accurate initial relative positioning of the rack 169 and the gripper slide bracket 131.

In their normal position at the beginning of any cycle of operations, the several above described parts are arranged as shown in Figs. 4, 16, 22 and 24, and at the left-hand portion of Fig. 47. In such normal position, the rack lever 164 is maintained inactive by the latch pawl 147. Immediately upon causing the initiation of a cycle of operations, in a manner to be later more

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fully described, the main cam shaft 87 is started to rotate in a clockwise direction, viewing Figs. 4 and 47. The initial rotation of the main cam shaft 87 causes the high portion of the gripper cam 144 to be removed from under the follower 143 of the gripper arm 139 to lower the latter and the slide bracket 131, together with the gripper mechanism C. Such lowering of the gripper mechanism continues until the latter arrives at a horizontal position opposite that record in the stack B which has been selected for playing. The upper end of the latch pawl 147 is then swung rearwardly, as previously described, to release the rack lever 164, which is immediately moved by its spring 166 to engage the tooth 168 thereof with the particular tooth of the rack bar 169 which it happens to be opposite. Up to this point, the gripper slide bracket 131 has been in its uppermost or normal position by its cam arm 176, as shown in the two left-hand portions of Fig. 47. As soon as the gripper slide bracket 131 is thus latched or locked to the rack bar 169, further downward movement of the gripper mechanism is temporarily halted, the rack arm 176 then functioning to maintain the vertically moving parts at rest, while the gripper arm 139 is free to continue its downward movement to the lower position shown in Fig. 5. Continued rotation of the main cam shaft 87 will then result in the follower 183 of the rack arm 176 being lowered by its cam 184, as illustrated in the central portion of Fig. 47, to bring the rack and gripper mechanism to rest on the gripper arm 139. This represents the intermediate position of the gripper mechanism, at which point reversal of the selected record takes place if the under side of the record is that which has been selected for playing, and the gripper cam 144 retains the parts in such intermediate position until reversal of the record has been accomplished by virtue of the follower 143 being in contact with the intermediate portion of the cam 144. After reversal of the record, or after the gripper mechanism has remained at rest for a similar period if the record is not to be reversed, the low portion of the cam 144 is brought into contact with the follower 143 to permit further lowering of the gripper arm 139, the rack 169 and the gripper mechanism to their lowermost position to deposit the record upon the turntable. These operations constitute the first half of the complete cycle, and the parts remain at rest in such lowermost position until the playing of the record has been completed.

After playing of the record, rotation of the main cam shaft 87 is again started, with the initial result of the gripper cam 144 raising the arm 139, together with the rack bar 169 and the gripper mechanism, to the intermediate or record reversing position. During such movement of these parts and during the succeeding portion of the cycle wherein the played record is again reversed if the underside thereof was that side selected for playing, the rack arm 176 remains in its lowermost position, and the rack and gripper mechanism are supported by the gripper arm 139. After completion of this reversal portion of the cycle, the gripper arm 139 remains in such intermediate position, while the rack arm 176 is raised by its cam 184 to return the rack and gripper mechanism to the normal position of the rack 169, as illustrated in full lines in the right-hand portion of Fig. 47. While the parts are retained in this horizontal position by the rack

cam 184, the gripper mechanism is swung toward the stack to return the played record thereto, in a manner to be later described. As soon as the played record has been replaced in the stack and the gripper arm swung back to the normal full line position of Fig. 2, the high portion of the gripper cam 144 comes into action to raise the follower 143 and the gripper arm 139 back to normal or at rest position. Such movement of the gripper arm results in the raising of the gripper slide bracket 131 relative to the rack bar 169 to return the parts to the position shown in Figs. 16, 22 and 24. In the latter portion of this vertical movement of the parts, the latch lever 155 is moved to inoperative position to release the latch pawl 147, as previously described, and the upper end of the rack lever 164 is swung outwardly by contact with the smooth upper portion of the rack to permit the nose 161 of the latch pawl 147 to be returned to operative position by the spring 149 to retain the rack lever in such inactive position.

It will thus be seen that a complete cycle of operations, so far as vertical movement of the gripper mechanism is concerned, constitutes a variable initial downward movement of the gripper mechanism relative to the rack bar 169, a further downward movement to record reversal position together with the rack bar, and a final downward movement with the rack bar to the lowermost position to deposit the record on the turntable. This comprises the first half of a complete cycle. The second half of the cycle includes raising of the gripper mechanism with the rack bar to the intermediate or record reversal position, further raising of the gripper and rack bar to return both to the normal rack position, and subsequent raising of the gripper mechanism relative to the rack bar 169 to return the former to its uppermost position.

From the time the gripper slide bracket 131 is latched to the rack bar 169 at the horizontal position in which the gripper arm is disposed opposite the selected record in the stack, and until the gripper slide bracket and the rack bar are lowered to the intermediate or record reversal position, the weight of the gripper mechanism will effectively retain the tooth 168 of the rack lever 164 in engagement with the associated tooth of the rack bar 169, since the vertically moving mechanism is then being supported by the rack arm 176. At such point, however, the gripper slide bracket 131 is brought to rest upon the roller 133 of the gripper arm 139, and the rack arm 176 continues its downward movement during the record reversal portion of the cycle. Consequently, means must be provided to prevent further downward movement of the rack bar 169 relative to the gripper slide bracket 131 during such record reversal portion of the cycle, since the weight of the gripper mechanism can no longer perform the function of retaining the tooth 168 of the rack lever 164 in engagement with the rack 169. This function is accomplished by a rearwardly extending pin 185 on the upper end of the rack lever 164 being engaged during such portion of the cycle by the vertical end surface 186 of a stationary lug 187 (Figs. 1, 16, 22 and 23) secured to the guide bracket 171. This is the only portion of the cycle of operations, together with the return movement of the parts from their lowermost position to the intermediate or record reversal position, in which the weight of the gripper mechanism does not function to

insure retention of the rack lever 164 in proper locking position.

Gripper swinging mechanism

As has previously been noted, the gripper mechanism C is normally in the position shown in Fig. 1 and in full lines in Fig. 2, and during each automatic cycle of operations of the machine and after the gripper has been lowered into horizontal alignment with the stack position of the record selected for playing, it is first swung toward the stack B to its broken line position of Fig. 2, which is the same as that illustrated in Fig. 9, to pick up the selected record, and is then swung in the opposite direction to bring the record into vertical alignment with the turntable G, as shown in Fig. 3. Since the gripper supporting bracket 67 is keyed to the shaft 68, such swinging movement of the gripper is accomplished by partial rotations of the shaft 68. Referring to Figs. 4, 5 and 8, it will be seen that a gear 188, which is part of the gripper swinging and reversing means E, is rotatably mounted on the shaft 68 adjacent its lower end and rests upon a bearing collar 189 pinned to the end of the shaft. The upper surface of the hub portion of the gear 188 is provided with a radial slot 191 (Fig. 8) within which a downwardly extending tooth 192 of a clutch member 193 is normally disposed (as shown in Fig. 4) to cause the latter to be rotated with the gear 188. The clutch member 193 is mounted for vertical sliding movement on the shaft 68 into and out of engagement with the gear 188, and is prevented from rotating on the shaft by means of a groove or keyway 194 therein engaging a key 195 embedded in the shaft. A horizontally disposed lever 196, which is provided at one end with a gear segment meshing with the gear 188 (Figs. 1 and 3), is secured at its other end to a shaft 197 (Figs. 4, 5 and 6), which is journaled in one of the brackets 142 and is restrained against downward movement by a bearing collar 198 secured to its upper end. Intermediate its ends, the segment lever 196 is provided with a roller or cam follower 199 disposed in the groove of a drum or cylinder type cam 201, which comprises one of the cam driving means D and is mounted upon and rigidly secured to the main cam shaft 87 to be rotated thereby. The cam 201 comprises the gripper swinging and reversing cam, and is provided with a plurality of laterally sloping portions 202 to 209, inclusive, as shown in Figs. 6 and 48, for the purpose of swinging the segment arm 196 to move the gripper C horizontally and to reverse the same, if required, at the proper times during each cycle of operations.

In the initial rotation of the main cam shaft 187, the gripper C remains in its normal position between the stack B and the turntable G by virtue of the follower 199 being engaged by a straight portion of the cam 201, as illustrated in the upper left-hand portion of Fig. 48, until the sliding bracket 131 has been locked to the rack bar 169, such idle phase of the cam 201 being sufficiently long to permit lowering of the gripper into alignment with the bottom record in the stack if such record has been selected for playing. The follower 199 is then engaged by the first laterally sloping portion 202 of the cam 201, which swings the segment lever 196 to rotate the gear 188 and the shaft 68, through the clutch member 193, to swing the gripper C to its stack or record pick-up position shown in the center of Fig. 48. The timing of the movements imparted to the gripper

by the cam 201 and the relationship therewith of the operations caused by the other cams 102, 144 and 184 are illustrated in Figs. 44 and 47, which include the same diagrammatic showing of cam 201 as is in Fig. 48. Another short idle phase of cam 201 then allows the shaft 84 to be actuated by the bar 119 to permit the plates 78, 79 to grip the selected record. The follower 199 is thereafter contacted by the second laterally sloping portion 203 of the cam 201, which pivots the segment lever 196 to swing the gripper C to carry the record over the turntable, as shown at the upper right-hand side of Fig. 48. A third and longer straight or idle portion of the cam 201 then permits lowering of the gripper, as previously described, to its intermediate or record reversing position over the turntable. The cam follower 199 is then engaged by the next laterally sloping portion 204 of the cam to swing the segment lever 196 back to its broken line position shown in the lower left-hand corner of Fig. 48 to reverse the gripper C and the record carried thereby in the following manner.

Gripper reversing mechanism

Referring to Figs. 1, 9, 16 and 19, a horizontal shaft 211 is journaled in, and extends between, the front and rear legs of the gripper supporting bracket 67 below, and in parallel spaced relationship to, the main gripper shaft 74. Rigidly secured to the shaft 211 in any suitable manner are a bevel gear 212, meshing with the bevel gear segment 134, and a gear 213. The gear 213 is in mesh with a similar gear 214 mounted on, and rigidly secured to, the main gripper shaft 74. Depending and extending outwardly from the bevel gear segment 134 is a dog 215 (Fig. 19) which is preferably formed integrally therewith. Normally the segment 134 swings about the shaft 68 with the gripper supporting bracket 67, since it is in mesh with the bevel gear 212, but during a portion of each cycle of operations it is held against any horizontal movement. A pair of spaced lugs 216 (Fig. 20) are formed integrally with or secured rigidly to the skeleton frame A to receive the dog 215 of the bevel gear segment 134 therebetween just prior to, during and after the gripper mechanism is moved into its intermediate or record reversal position adjacent the turntable, as shown in Fig. 3. When the gripper mechanism is in such position with the dog 215 disposed between the lugs 216, the cam follower 199 enters the third laterally sloping portion 204 of the cam 201 to swing the segment lever 196 to the broken line position shown in the lower left-hand portion of Fig. 48. This swinging of the segment lever 196 rotates the gear 188, the clutch member 193 and the shaft 68 to move the gripper supporting bracket 67 in a counter-clockwise direction relative to the bevel gear segment 134, when looking down on the mechanism as in Fig. 3. Since the bevel gear segment 134 is being held stationary, the obvious result of such movement of the bracket 67 is to rotate the bevel gear 212 and the gear 213 in counter-clockwise direction, as seen in Fig. 19. This will cause the gear 214 and main gripper shaft 74 to be rotated in the opposite direction, with a resultant movement of the gripper body 75, the plates 78, 79 and the record carried thereby about the axis of the shaft 74. The several gears are so proportioned that the gripper plates and record will be turned through 180° to the broken line position shown in the lower left-hand corner of Fig. 48.

The cam follower 199 then enters the fourth

straight or idle portion of the cam 201 to permit further downward movement of the gripper to deposit the record on the turntable and rotation of the gripper cam shaft 84 to release the record to be played, as previously described. The cam follower 199 is then contacted by the next laterally sloping portion 205 of the cam 201 to further swing the segment lever 196 from its broken line position to its full line position, as shown in the lower left-hand corner of Fig. 48, to withdraw the gripper C into cleared position away from the turntable. During the subsequent playing of the record, as has been noted heretofore, the main cam shaft 87 remains stationary. After the playing of the record has been completed and the reproducer means H has been returned to inoperative position, in a manner to be later described, the cam follower 199 is moved by the laterally sloping portion 206 of the cam 201 to return the gripper C to its pick-up position adjacent the turntable. The next straight or idle portion of the cam 201 permits operation of the gripper locking mechanism to cause engagement of the record on the turntable by the plates 78, 79 and to allow the gripper to again be raised to its intermediate level or record reversal position.

In the operation of the instant mechanism it sometimes happens that the gripper C is moved one way or the other slightly out of the desired position adjacent the turntable to accurately align the central aperture of the record with the center pin of the turntable. For this reason, spring centering means, shown in Fig. 21, are provided for insuring the proper positioning of the gripper mechanism relative to the turntable. These means comprise a pair of spaced levers 217 pivotally mounted at their rear ends to the under side of the skeleton frame A, and having their forward ends in substantial vertical alignment with the respective lugs 216. Intermediate their ends, the levers 217 are connected by means of a coil spring 218. With this arrangement, even though the gripper mechanism may have been moved slightly out of proper alignment, it will be automatically returned thereto.

Subsequent to the reengagement of the played record by the gripper C, the cam follower 199 is engaged by the laterally sloping portion 207 of the cam 201 which functions to swing the segment lever 196 back to the position shown in the upper right-hand portion of Fig. 48. Since the dog 215 is disposed between the lugs 216 at this time to retain the bevel gear segment 134 stationary, such swinging of the segment lever 196 will cause reversal of the gripper and the record held thereby to turn the same back to normal position. The next idle portion of the cam 201 following the sloping portion 207 permits upward return of the gripper and rack 169 to the normal rack position, wherein the played record will again be in substantial horizontal alignment with its particular stack supporting tray. The cam follower 199 is then moved by the laterally sloping portion 208 to replace the record in the stack. The short idle portion of the cam 201 following this sloping portion 208 permits operation of the gripper locking mechanism to release the played record from the plates 78, 79. The final laterally sloping portion 209 of the cam 201 then functions to swing the gripper horizontally away from the stack and back to normal position, and the following idle portion of the cam maintains the gripper in this position while it is being returned upwardly to its final position of rest.

The above described swinging and reversing movements are imparted to the gripper mechanism C in each automatic cycle of operations, if the bottom or under side of the record is that which has been selected for playing. However, whenever it is desired to play the top or upper side of the selected record, it is necessary to disengage or raise the clutch member 193 as soon as the gripper has been lowered to carry the record to the intermediate or reversal position shown in the upper right-hand portion of Fig. 48, in order to prevent the subsequent swinging of the segment lever 196 to its broken line position at the lower left-hand corner of Fig. 48 from reversing the gripper mechanism. This disengagement of the clutch is automatically accomplished, whenever the top side of the selected record is to be played, in the following manner.

Clutch disengaging mechanism

Referring to Figs. 4 to 9 and 22 to 30, a forked crank 221, which is provided with a pair of rollers 222 engaging diametrically opposed portions of a circumferential groove 223 in the clutch member 193, is pivotally mounted on a horizontal shaft 224 (Figs. 7 and 8) supported by laterally extending arms 225 formed integrally with the lower operating shaft bracket 72. The hub of the crank 221 opposite the forked end thereof is provided with a pair of outwardly extending, vertically spaced lugs 226 through which a vertical pin 227 extends. A bell-crank lever 228, disposed at its central portion between the lugs 226, is pivotally mounted on the pin 227, and is provided at the end of its outwardly extending arm with a roller or cam follower 229. The weight of the parts is such that the lever 228 and the forked crank 221 are normally retained by gravity in their position of Fig. 4, as shown in broken lines in Fig. 8, wherein the clutch member 193 is engaged with the gripper swinging and reversing gear 188.

As shown in full lines in Fig. 7, the roller 229 is urged into the path of movement of a segmental clutch disengaging cam 231 and a resetting cam 232, which are secured in spaced relationship to each other on the forward side surface of the gripper swinging and reversing cam 201, by a spring 233 interposed between the arm 234 of the lever 228 and the hub portion of the forked crank 221. A screw 235 screwed into the hub portion of the forked crank 221 extends through a suitable aperture in the arm 234 to guide and limit such pivotal movement of the lever 228 on the pin 227. The bell-crank lever 228 is normally held in its inoperative position with the roller 229 out of the path of movement of the cams 231 and 232, as shown in broken lines in Figs. 7 and 9, by the rearwardly bent nose of a latch arm 236 engaging the outer surface of the arm 234 adjacent its free end. The latch arm 236 is rigidly secured to a vertical rod 237 at its other end, and is urged into active position in contact with an adjustable stop screw 238 by a spring 239 interconnected between it and the forward bracket arm 225. The rod 237 is rotatably journaled adjacent its lower end in a bracket 241 secured to or formed integrally with the main guide bracket 171 (Figs. 1, 7 and 31), and is maintained in proper vertical position by a thrust bearing collar 242 secured thereto and resting upon the bracket 241. The adjustable stop screw 238 is mounted in an arm of this lower bracket 241. The upper end of the rod 237 is journaled in a bracket 243 secured to the main guide bracket 171 (Figs. 1, 2, 9 and 31), and a vertically dis-

posed latch arm actuating plate 244 is secured to the rod 237 along the upper portion thereof.

Means are provided for automatically moving the latch arm 236 against its spring 239 to release the bell-crank lever 228 to be conditioned or moved to the operative full line position of Fig. 7 by spring 233, as the gripper C is swung toward the stack B to pick up the selected record, but only if the top side of the record is that side which has been selected for playing. This means comprises a selectively operable clutch conditioning and key release pawl 245 (Figs. 9 and 22 to 29, and shown in perspective in Fig. 30) which is pivotally secured to the underside of the top horizontal arm of the gripper slide bracket 131 by means of a shoulder screw 246. A coil spring 247 is loosely wound on the screw 246 and is connected at its ends, respectively, to the bracket 131 and the pawl 245 to urge the latter in a counter-clockwise direction, as seen from the top in Fig. 27, into normal or inactive position, wherein a protuberance 248 on the inner edge of the pawl contacts the circular peripheral portion of the key release cam 132 to limit movement of the pawl in such direction. The forward end of the pawl 245 is provided with a downwardly extending flange 249 having an upwardly and inwardly sloping lower cam surface adapted to be contacted by any actuated or depressed key stem in the left-hand column, viewing Figs. 24 to 29, in a manner to be later described, to swing the forward end of the pawl outwardly or to the left from its normal position of Fig. 27 to its conditioned or active position of Fig. 28. As will be seen from Fig. 25, the pawl 245 has been swung to this active position at the same time that the gripper slide bracket 131 is locked to the rack bar 169 by the rack pawl 164. The rear end of the pawl 245 is provided with a depending flange 251, and a horizontal rod or plunger 252 is slidably disposed in suitable apertures in the flanges 249 and 251. A collar 253 is secured to the plunger 252, intermediate the flanges 249, 251, to limit rearward movement thereof, and a coil spring 254 is mounted on the plunger between the collar 253 and the forward flange 249 to resiliently maintain the plunger on its normal or rearward position of Fig. 27. Immediately following the swinging of the pawl 245 to its active position of Fig. 28 by downward movement of the gripper slide bracket 131 to bring the gripper arm into horizontal alignment with the record in the stack selected for playing, the gripper arm, including the supporting bracket 67 and body portion 75, is swung from the position of Fig. 27 to the position of Fig. 28 to pick up the selected record. A pin 255 is provided on the forward end of the gripper body portion 75 which will thus move the plunger 252 rearwardly, if the pawl 245 has been swung to active position, to swing the plate 244 from its position of Fig. 27 to that of Fig. 28. This will move the latch arm 236, against the action of the spring 239, from its active or broken line position of Fig. 7 past the full line position shown therein, to release the bell-crank lever 228 for movement to its active full line position of Fig. 7.

The bell-crank 228 will remain in this active position, in which the forked crank 221 is in the lowered position of Fig. 4 with the clutch member 193 engaging the gear 188, until the gripper arm C has been swung over the turntable G and lowered to the intermediate or record reversal position shown in the upper right-hand portion of Fig. 48. At this time, the gripper swinging and reversing cam 201 has reached its position of Fig.

5, wherein the segmental clutch disengaging cam 231 thereon has been advanced adjacent the roller 229 on the bell-crank lever 228. Since the latter has been moved to active position, due to the selection of the top side of a record for playing, the cam 231 will now come into action to lower the roller 229 and raise the forked end of the crank 221, as shown in full lines in Fig. 8, to disengage the clutch member 193 from the gear 188 by raising the tooth 192 out of the slot 191. The active portion of the cam 231 is just sufficiently long to permit the continued rotation of the gear 188 by the segment lever 196 to take the slot 191 out of vertical alignment with the tooth 192. Thereafter, the cam 231 passes the roller 229, and the tooth 192 rests upon the upper surface of the gear 188 until after playing of the selected record and return of the gear 188 and segment lever 196 to the position shown in the upper right-hand portion of Fig. 48 by the laterally sloping part 207 of the cam 201. This will bring the slot 191 back into register with the tooth 192, and the clutch member 193 will fall back into engagement with the gear 188.

In the meantime, the bell-crank lever 228 is returned to normal position and reengaged by the latch arm 236 by the cam 232. This is accomplished by the forward sloping surface of the cam 232 engaging the roller 229 to swing the lever 228 counter-clockwise on the pivot pin 227, and against the action of spring 233, to carry the arm 234 past the nose of the latch arm 236 to the innermost broken line position of Fig. 7. The spring 239 will then return the latch arm 236 to its active or broken line position of Fig. 7 to retain the bell-crank lever 228 in its normal or inactive position.

During the idle swinging of the segment lever 196 from and back to the position shown in the upper right-hand portion of Fig. 48, which would otherwise accomplish reversal of the record and withdrawal of the gripper arm if the under side of the record had been selected for playing, it is necessary to employ such movement of the segment lever to cause withdrawal of the gripper mechanism C to the full line position shown in the lower right-hand corner of Fig. 48, and return thereof to the broken line position subsequent to the playing of the record. This is accomplished by the following normally idle mechanism, as illustrated in Figs. 1, 2, 4, 5, 7 and 8. A gear segment 256 is secured to the gripper swinging and reversing gear 188 in any suitable manner and meshes with a gear 257 fixed to the lower end of a vertical shaft 258. The shaft 258 is journaled above the gear 257 in an extension of the lower operating shaft bracket 72, and adjacent its upper end in a bearing bracket 259 (Fig. 1) secured to the main guide bracket 171. At the upper end of the shaft 258 is secured a crank arm 261 having an upwardly extending pin adapted to be engaged by a hollow socket 262 depending from the rear leg of the gripper supporting bracket 67 (Figs. 1 and 16). The arrangement of these parts is such that after the gripper mechanism C has been moved over the turntable G and lowered to its intermediate or record reversal position shown in the upper right-hand portion of Fig. 48 and the segment lever 196 has been swung in an idle stroke to the broken line position illustrated in the lower left-hand corner of Fig. 48, the crank and pin 261 will have been moved into vertical alignment with the socket 262. The gripper is then lowered, as previously explained, to deposit the record on the turntable, which will lower the

socket 262 onto and into engagement with the pin of the crank 261, as shown in broken lines in the lower right-hand corner of Fig. 48. Swinging of the segment lever 196 to the full line position of the lower parts of Fig. 48 by the laterally sloping portion 205 of the cam 201 will then rotate the gear 257, shaft 258 and crank 261 to swing the gripper C to the full line withdrawn position shown in the lower right-hand corner of Fig. 48. After playing of the record has been completed, the portion 206 of the cam 201 will actuate the segment lever 196 and crank 261 to return the gripper C to pick-up or engaging position with the record on the turntable. Subsequent raising of the gripper to the intermediate or record reversal position will disengage the socket 262 from the pin on the crank 261, and further movements of the crank will have no effect until the gripper is again lowered to deposit a record on the turntable with the normal top side thereof up.

Selector mechanism

Selectively operable means are provided for initiating the previously described automatic operations of the machine and for controlling the same to determine which record in the stack B and which side thereof will be played. This means comprises the selector mechanism F, illustrated in Figs. 1, 9, 16, 22 to 29 and 31 to 36, and includes an open-backed casing 263 secured along its rear edge on the right-hand side to the edge of the main guide bracket 171. A plurality of each of four differently shaped selector keys 264, 265, 266 and 267 are included as a part of the selector mechanism, each of which has a head or button portion 268 loosely fitting and extending forwardly through a suitable aperture in the front plate of the casing 263 and terminating in a flange 269 normally held in engagement with the rear surface of the front plate of the casing by a coil spring 271 (Fig. 9) interconnected between a suitable lug on the casing and a protuberance 272 on the key stem. The rear end of each key stem extends through, and is disposed in, a suitable aperture 273 (Fig. 22) in a laterally extending portion of the main guide bracket 171 (Fig. 9). As seen in Figs. 1, 9 and 31, the heads 268 of the several keys are arranged in four vertical rows or columns, all of the forward portions of the keys 264 being in the left-hand row, and those of the keys 265, 266, and 267, respectively, making up the other three rows, to provide ready accessibility thereto. The top keys 264 and 266, and each succeeding pair, are disposed in the same horizontal plane, as are the top keys 265 and 267 and each succeeding pair thereof. Each of these pairs of keys is positioned to select a particular record 66 in the stack B, the keys 264 and 265 being adapted to select the top side of their associated records for playing, and the keys 266 and 267 selecting the reverse or bottom sides of the records. Thus the top key 264 will select the upper side of the top or number one record in the stack and the top key 266 will select its under side, and the top key 265 will select the upper side of the second or number two record and the top key 267 its reverse side. In other words, the different keys 264 in the first row select the top sides of the odd numbered records in the stack, the keys 265 the top sides of the even numbered records, the keys 266 the bottom sides of the odd numbered ones, and the keys 267 the bottom sides of the even numbered records in the stack. Each of the keys 264 (Fig. 32) has its rear end offset to the right by means of a laterally extending intermediate por-

tion 274. Each key 265 is provided with a similar but shorter laterally disposed intermediate portion 275 to offset its rear end to the right just enough to place it in vertical alignment with the rear ends of the keys 264. The rear ends of the keys 266 and 267 are similarly offset to the left different distances by lateral intermediate portions 276 and 277, respectively, to place all of them in vertical alignment. As best seen in Figs. 22 and 24, this arrangement results in the rear ends of all of the keys being in two vertical rows, with those in the outer row (keys 264 and 265) selecting the top sides of the various records in the stack, and those in the inner row (keys 266 and 267) selecting the bottom sides of their associated records for playing. At the same time, the rear ends of each pair of keys 264, 266 and 265, 267 are in horizontal alignment, and these different pairs are vertically spaced from each other to select the different records in the stack.

The right side of the rear offset portion of each key stem is cut away or reduced to provide a shoulder 278 adjacent the end thereof (Figs. 32 to 35) for latching the key in rearwardly depressed or active position. Whenever a key is actuated or moved rearwardly against its spring 271 to active position, the spring will cause the rear end of the key stem to be moved to the right to engage the shoulder 278 with the rear surface of the guide bracket 171, as shown in Fig. 9, where the key will normally remain latched until automatically released in a manner to be later described. Means are also provided for optionally releasing all previously set or actuated keys to cancel the selections made. This means comprises a vertical plate 279 (Figs. 9 and 31) having two vertical slots through which the two rows of the rear portions of the several key stems extend. Each of the four corners of the plate 279 is flared and provided with a suitable aperture through which a rearwardly extending flange 281 of a collar 282 extends to support the plate. Each collar 282 is rotatably mounted on either the top or bottom of the casing 263, and the flanges 281 are provided with pins 283 for retaining the plate 279 thereon. The upper left-hand collar 282 has an inwardly extending arm 284 formed integrally therewith, to which the rear end of a coil spring 285 is attached to normally hold the parts in their position of Fig. 9, the forward end of the spring 285 being anchored to the casing 263. A shoulder 286 on the upper surface of a canceling key 287 (Figs. 9, 31 and 36) contacts the arm 284, the key 287 being provided with a head or button 288 extending through a suitable aperture in the front wall of the casing 263 and a flange 289 for limiting forward movement thereof, while the rear end of the key stem slidably engages a suitable aperture in the guide bracket 171. With this arrangement, rearward movement of the key 287 will move the plate 279 to the left, against the action of the spring 285, to swing the rear ends of any actuated ones of the keys 264 to 267 to the left. The shoulders 278 of such keys will thus be disengaged from the rear surface of the guide bracket 171 to permit their springs 271 to return the same forwardly to normal or inoperative position.

Whenever any one of the keys 264, 265, 266 or 267 is depressed or moved rearwardly, it immediately causes a normally open selector switch 291 (Figs. 9 and 50) to be closed. As will be explained later, the closing of the selector switch 291 will ordinarily initiate an automatic cycle

of operations by causing energization of the motor 99 to rotate the main cam shaft 87. The selector switch 291 is of the type commonly referred to as a "micro-switch" having a plunger 292 for moving the contacts thereof apart, and a pivoted lever 293 is normally urged against the plunger 292 by an adjustable screw 294 mounted in a plate 295. The plate 295 (Figs. 9 and 31) is rigidly secured to a pair of hinge members 296, each of which is provided with a pin 297 pivotally engaged by a horizontally disposed lug or tab 298 formed integrally with the side wall of the casing 263. The free side of the plate 295 and the screw 294 are urged forwardly by a spring 299 interconnected between the plate and the casing 263, and the rear offset portions of all of the keys 264 to 267 extend through suitable apertures 301 in the plate. Consequently, depression or inward movement of any one of these keys to active or latched position will cause the intermediate portion 274, 275, 276 or 277 thereof to contact and swing the plate 295 rearwardly against the action of spring 299 to allow the contacts of the selector switch 291 to close.

From the above description of the selector key mechanism and referring to Figs. 5 and 24 to 26, it will be seen that depression or rearward movement of any one of the keys 264 to 267 will cause the rear end thereof to be disposed in the path of movement of the cam portion 153 of the latch pawl 147. Consequently, the several keys 264 to 267 not only initiate an automatic cycle of operations of the machine by closing the selector switch 291, but also function to trip the latch pawl 147 to cause locking of the gripper slide bracket 131 to the rack bar 169 to determine the horizontal position relative to the stack B to which the gripper mechanism C will be lowered in its initial movement.

Means are provided for insuring the completion of a cycle of operations if a selector key is depressed to close the switch 291 and then released by operation of the canceling key 287 before the latch pawl 147 is tripped, or if the main motor 99 is energized in some other manner. This means comprises a pin 302 extending downwardly and forwardly from the cam portion 153 of the latch pawl 147 and disposed to the right and out of the path of the rear ends of the keys 264 to 267. A cam plate 303 (Figs. 16 and 22) is secured to the rear face of the main guide bracket 171 below the lowest pair of keys 264 and 266. The arrangement of this cam plate 303 and the length of the pin 302 are such that the latch pawl 147 will be tripped to release the rack lever 164 to lock the gripper slide bracket 131 to the rack bar 169 by contact of the pin 302 with the cam plate 303 in the same position of the parts as would happen if either of the lowermost keys 264 or 266 had been moved rearwardly to active position. In other words, the pin 302 and cam plate 303 function to automatically cause the selection of the reverse or bottom side of the lowermost record 86 in the stack B for playing, if a cycle of operations has been started by energization of the main motor 99 and no one of the several keys 264 to 267 are in their rearward or active position. If these members 302 and 303 were not provided, a complete cycle of automatic operations would not take place under such conditions, since the second half of the cycle would not be initiated by the reproducer means H, in a manner to be later described.

As best seen in Figs. 9 and 24 to 30, the clutch

conditioning and key release pawl 245 is provided in its forward edge with a slot 304. When the pawl 245 is in its normal or inactive position of Figs. 9, 24 and 27, the slot 304 is in vertical alignment with the rear ends of the keys 266 and 267 which select the bottom or reverse sides of the several records in the stack B. Consequently, when any of these keys 266 or 267 have been depressed, and none of the keys 264 or 265 which select the top sides of the various records for playing have been depressed, the clutch conditioning pawl 245 will remain in its normal or inactive position throughout the automatic cycle of operations. Under such circumstances, swinging movement of the gripper mechanism C to the stack pick-up position of Fig. 9, which results in the pin 255 moving the plunger 252 forwardly, comprises only an idle movement of this plunger, as shown in Fig. 9, since the forward end thereof will not contact the latch arm actuating plate 244. However, if any one of the several keys 264 or 265 have been depressed, or moved rearwardly to their active position, downward movement of the gripper slide bracket 131 will result in the sloping cam edge of the forward depending flange 249 of the pawl 245 coming in contact therewith to swing the pawl 245 from its normal position of Figs. 24 and 27 to its active position of Figs. 25 and 28. Subsequent swinging of the gripper mechanism to the stack position will then result in the pin 255 and plunger 252 moving the latch arm actuating plate 244 to release the bell-crank lever 228, as previously described.

The gripper mechanism C will then function to pick up the selected record from the stack B and will be swung over the turntable to its full line position of Fig. 29. Such swinging of the gripper mechanism causes a nose 305 on the cam disc 132 to contact the protuberance 248 on the pawl 245 to swing the latter from its active position of Figs. 25 and 28 to its cleared position of Figs. 26 and 29. A latch lever 306, which is pivoted at 156 with the lever 155, is normally held with its lower end in engagement with the upper surface of the pawl 245 by virtue of a spring 307 disposed in a suitable recess in the upper portion of the gripper slide bracket 131 and engaging the under surface of the upper arm of the latch lever. When the pawl 245 is moved to its cleared position of Fig. 29 in the manner described, the spring 307 functions to swing the lower end of the latch lever 306 downwardly into engagement with the right-hand side surface of the pawl 245 to retain the latter in such cleared position. In this manner, the pawl 245 is moved out of the path of any of the selector key stems, so as not to contact any ones thereof which may have been depressed and are disposed below the particular key having already caused selection and pick-up of a record. The pawl 245 remains in this cleared position throughout the remainder of the cycle of operations and until the gripper slide bracket 231 is returned to its uppermost or normal position of Figs. 22 and 24. In this position, the upper arm of the latch lever 306 is depressed by contacting the stud 159 to release the pawl 245 and permit its return to normal position by the spring 247.

Besides causing engagement of the clutch member 193 whenever the top side of any of the records has been selected for playing, as already described, the pawl 245 causes the release of whichever one of the several keys 264 to 267 has caused the locking of the gripper slide bracket 131 to the rack bar 169. Regardless of whether

or not the pawl 245 has been moved to its active position of Fig. 28 by virtue of the selection of the top side of a record for playing, it is subsequently moved to its cleared position of Fig. 29 by the nose 305 of the cam 132. In such movement of the pawl 245, the right-hand side surface of the slot 304 therein will contact the end of the particular selector key which has caused the gripper mechanism to be stopped in that position to swing the same to the left and permit its spring 271 to return it to normal position. If one of the keys 264 or 265 has caused the operation to take place, the pawl 245 will have been moved to its active position of Figs. 25 and 28 prior to the swinging thereof to the cleared position of Fig. 29, so that the rear end of that particular key will be disposed in the slot 304. Similarly, if one of the keys 266 or 267 has caused the operation of the machine, the rear end of its key stem will be disposed in the slot 304 at the time the pawl 245 is swung from its position of Fig. 27 to its cleared position of Fig. 29. Thus, whenever any one of the selector keys has been depressed and has caused the picking up of its associated record 66 from the stack B by the gripper mechanism C, the subsequent swinging of the latter to carry the record over the turntable G will swing the pawl 245 to its position of Figs. 26 and 29 to release that particular selector key, and to move the pawl 245 clear of the rear ends of any other keys, which may also have been depressed, for the remainder of that series of operations of the machine. Such release of the selector key responsible for locking of the gripper slide bracket 131 to the rack bar 169 will, of course, cause the selector switch 291 to be opened by the spring 299, if no other selector key has been depressed. However, the main motor 99 will continue to operate to complete the cycle of operations for a reason to be later explained, the selector switch 291 being employed only to cause initial energization of the motor 99 at the beginning of an automatic cycle of operations.

Whenever more than one of the selector keys have been depressed, the selector switch 291 will remain closed until all have been released, and the cycle of operations will be automatically repeated as long as one of the selector keys remains depressed. In view of the previous description, it will be appreciated that the sequence of selection for playing of the records depends upon their stack position, or the relative position of their associated selector keys. If more than one key has been actuated, the first record to be played will be that represented by the uppermost key depressed. If two keys of any horizontally aligned pair 264, 266 or 265, 267, which in each instance represent the two sides of a particular record, are both depressed, the fact that the outermost one 264 or 265 will swing the pawl 245 to active position, as indicated in Figs. 24, 25, 27 and 28, will result in the top side of that particular record being played before the bottom side. In the next cycle of operations, if no other key of higher stack position has been depressed in the meantime, the other key 266 or 267 will function to stop the gripper mechanism in the same horizontal stack pick-up position, but the pawl 245 will not be actuated thereby, so that the clutch 193 will remain engaged and the bottom or reverse side of the record will be played.

Turntable mechanism

Referring to Figs. 1 to 3 and 50, it will be seen that the turntable G comprises the usual felt

covered metal disc secured to a vertical shaft having an upwardly extending record receiving and centering pin 308, which is driven by a suitable electric motor 309 supported by brackets 311 depending from the skeleton frame A. A speed adjusting device 312 (Fig. 1) is provided for varying the speed of rotation of the turntable, the details of which form no part of the present invention. A main switch 313, which is normally open and is adapted to be selectively closed for either manual or automatic operation of the machine, as shown in Fig. 50, is mounted on a suitable panel at the front of the machine below the selector F (Fig. 1). The wiring diagram of Fig. 50 shows that the center pole of the switch 313 is connected directly to one side 314 of the main line or source of electrical energy, while the other side 315 of the main line is connected directly to one side of the turntable motor 309. A suitable lead 316 is connected from the manual side of the switch 313 to the other side of the turntable motor 309, and to another lead 317 connected to the automatic side of switch 313. Consequently, whenever the main switch 313 is closed, either for manual or automatic operation of the machine, the turntable motor 309 will be energized to rotate the turntable G.

The main motor 99 will not be energized to rotate the cam driving means D, however, even upon closing of the main switch 313 for automatic operation, since one side of the selector switch 291 is connected by a lead 318 to the automatic side of the switch 313, the other side by a lead 319 to the motor 99, which is connected at its other side by a conductor 321 to the main line 315, and the selector switch 291 is normally open. Under ordinary circumstances, and after closing of the automatic side of the main switch 313, closing of the selector switch 291 by depression of any one of the selector keys will normally energize the motor 99 to rotate the main cam shaft 87. The latter carries a notched disc 322 (Figs. 1, 6 and 50) which is peripherally engaged by the free end of a spring lever 323. The lever 323 is pivotally mounted in any suitable manner at its other end, and engages the plunger of a normally open micro-switch 324, which is shunted across the selector switch 291 by conductors 325 and 326 connected respectively to the leads 318 and 319. In the normal or at rest position of the machine, the free end of the lever 323 engages in one of the two diametrically opposed recesses or notches in the disc 322 and switch 324 is open. As soon as the cam shaft 87 starts to rotate during an automatic cycle of operations, as instituted by closing of the selector switch 291, the lever 323 is raised by the disc 322 to hold the switch 324 closed. The main motor 99 thus continues to operate to rotate the cam shaft 87 through 180°, even though the selector switch is opened by return of the depressed selector key as previously explained, when the switch 324 will again be opened by the free end of the lever 323 engaging in the other notch in the disc 322.

Means are provided for insuring that main motor 99 will be stopped or deenergized, after the first half of the automatic cycle of operations controlled by the cam driving means D has been completed, even though the selector switch 291 remains closed because of the depression of more than one of the selector keys. This means comprises a normally closed turntable micro-switch 327 (Fig. 50) interposed or electrically connected in series in the line or lead 319 between the selector switch 291 and the main motor 99. A lever

328, pivotally mounted at one end in any suitable manner and urged upwardly by a spring 329, is formed at its other end with a disc portion which is marginally engaged by the lower hooked end of a vertical pin 331. The pin 331 extends upwardly through a suitable aperture in the turntable G, and is connected intermediate its ends by a lever 332 to the underside of the turntable. The spring 329 normally maintains the parts in their full line position of Fig. 50, with the upper end of the pin 331 disposed above the record receiving surface of the turntable G. When a record 66 is deposited on the turntable by the gripper C, which is done just prior to the completion of the first half of an automatic cycle of operations, it will depress the pin 331 against the action of spring 329 to the broken line position of Fig. 50 to open the switch 327. The main motor 99 will thus subsequently be deenergized by opening of the switch 324 by the disc 322, even though the selector switch 291 is closed, by virtue of the record 66 resting or being disposed on the turntable.

The turntable switch 327 also functions to prevent automatic operation of the machine, if the turntable has been used for manual playing of a record and the operator has neglected to remove the record therefrom. In other words, whenever a record is on the turntable, the switch 327 will be open, so that closing of the selector switch 291 cannot cause energization of the motor 99.

Since the main motor 99 will be stopped by the breaking of its circuit through the switch 324 being opened at the end of the first half of each automatic cycle of operations, means must be provided for automatically reenergizing the motor 99 independently of the switch 324, or of the switches 291 and 327 since the latter will also be open, as soon as playing of the record has been completed. Such means are necessary to automatically institute the second half of the cycle for returning the played record and operating mechanism to normal position, and are under the control of the reproducer means H.

Reproducer mechanism

Referring to Figs. 1 to 3 and 38, the usual tone arm forming part of the reproducer means, which may be of the type disclosed in United States Letters Patent No. 2,154,093, issued April 11, 1939, to William H. Hutter, is pivoted at 333 intermediate its ends on a horizontal bracket 334 for vertical movement relative thereto, and includes a needle 335 adapted to engage and traverse the grooves or sound tracks of a record disposed on the turntable G. Conventional means are mounted in the outer end of the tone arm H for converting the vibrations imparted by a record to the needle 335 into electrical impulses, which are transmitted to the amplifier to be reproduced as sound by a suitable speaker in well-known manner. Since these means may be of any desired construction and form no part of the instant invention, they have not been illustrated herein. In order to permit the needle or stylus 335 to follow the sound tracks of the record being played, the bracket 334 upon which the tone arm H is mounted is rigidly secured at its inner end to a hollow vertical shaft 336, which is journaled in a bearing bracket 337 secured to the main frame A and a depending boss 338 formed integrally with the frame. The bracket 334 and tone arm H are thus free to swing horizontally over the turntable G from a supporting cradle

339 (Fig. 1) upon which the outer portion of the tone arm normally rests.

In order to remove the tone arm H from the supporting cradle 339, and to return the same thereto after a record has been played, means are provided for first moving the tone arm about its pivot 333 to raise the outer or needle-carrying end thereof by depressing or lowering the inner end adjacent the shaft 336 to its broken line position of Fig. 38. This means comprises a vertical rod 341 bent horizontally at its upper end to extend over the inner end of the tone arm, and rigidly secured at its lower end to one end of a cam lever 342. Intermediate its ends, the rod 341 extends through, and is journaled for vertical sliding movement in, a guide bushing 343 (Fig. 39), which is screwed into a suitable tapped aperture provided in the main frame A. A horizontal pin 344 extending through the rod 341 and a slot 345 in the bushing 343 prevent rotation of the rod to maintain the upper bent end thereof in proper position relative to the inner end of the tone arm H. The other or free end of the cam lever 342 is provided with a roller or follower 346 (Figs. 6, 37 and 40) cooperating with a cam 347, which is formed on or secured to the outer side surface of the worm wheel 89 and comprises one of the cam driving means D. The cam lever 342 is pivotally mounted at 348 intermediate its ends on one of the motor brackets 101, and a spring 349 interconnected between the latter and the lever 342 functions to maintain the follower 346 in engagement with the cam 347. The cam 347 is provided with three laterally inset portions or dwells 351, 352 and 353 (Figs. 6 and 49) into which the follower 346 is moved by the spring 349 to lower the rod 341 and raise the outer or needle carrying end of the tone arm H to the broken line position of Fig. 38 for purposes to be later more fully described.

Means are also provided for moving the tone arm H horizontally from its normal or rest position on the cradle 339 into initial playing position over the outer edge of a record on the turntable G, and for returning the same horizontally from its innermost or end of playing position to its rest position on the cradle 339. This means includes a rod 354 (Fig. 38) screwed into or otherwise secured at its upper end to the inner end of the tone arm H and extending horizontally for a short distance to the left thereof, then bent downwardly to provide a substantially vertical intermediate portion, and terminating at its lower end in a right-angled tail portion extending in substantially the same direction as the upper end thereof. The intermediate portion of the rod 354 extends through a reinforcing plate 355, which is substantially horizontally disposed and is rigidly secured at its right-hand end to the tone arm H, and through an arcuate slot 356 provided in the main frame A. An actuating plate 357 having a hub portion formed integrally therewith and rigidly secured to the lower tail part of the rod 354 depends vertically therefrom. A stop flap 358 shaped similarly to the plate 357 is rotatably mounted on the tail part of the rod 354, the hub portions of the plate and flap being cut away at their adjacent ends (Fig. 41) to permit rearward swinging of the flap 358 relative to the plate 357, while preventing forward swinging of the flap from its normal vertical position. A spring 359 is secured at one end to the plate 357, and extends along the rear surfaces of the plate and the flap 358 to resiliently maintain

the latter in its normal full line position of Fig. 41. A horizontally disposed tone arm actuating screw 362 (Figs. 37 and 38), is screwed into a suitable tapped portion of the bore of the vertical shaft 336. The left end of the lever 361 is provided with forwardly and rearwardly extending arm portions terminating in upwardly extending flanges in which are respectively mounted horizontally disposed, adjustable screws 363 and 364 (Fig. 40). The right end of the actuating lever 361 is pivotally connected at 365 to one end of a bent link 366, the other end of which is pivoted at 367 to one end of a cam lever 368 (Figs. 37, 38 and 40). The cam lever 368 is pivotally supported at 369 intermediate its ends from a depending bracket 371 (Fig. 6) formed integrally with or secured to the main frame A. The other or free end of the cam lever 368 is provided with a roller or follower 372 cooperating with a cam 373, which is formed integrally with the cam 347 or secured therewith to the worm-wheel 89 and comprises one of the cam driving means D. A spring 374, secured by a stud 375 to a part of the frame A, is connected to the cam lever 368 to resiliently urge the follower 372 into engagement with the cam 373 to swing the tone arm actuating lever 361 in a clockwise direction, if looking down thereon as in Fig. 40, when either one of two laterally inset portions or dwells 376 of the same depth (Fig. 40) or a third and deeper dwell 377 (Fig. 37) formed on the cam 373 are presented to the follower, the relative positions of these dwells 376, 377 circumferentially of the cam 373 being illustrated in Fig. 49.

The above described reproducer mechanism operates as follows. As will be noted from Figs. 6, 40 and 49, the follower 346 engages the straight portion of the cam 347, and the follower 372 is normally disposed in the first laterally inset portion or dwell 376 of the cam 373 when the machine is in its rest position. At the beginning of any automatic cycle of operations, the spring 349 will cause the follower 346 to enter the first dwell 351 of the cam 347 to raise the outer or needle-carrying end of the tone arm H from the cradle 339. The follower 372 will then be carried outwardly by the curved wall portion leading from the first dwell 376 of the cam 373 to swing the cam lever 368 from its full line to its broken line position of Fig. 40. The raising of the outer end of the tone arm H has previously resulted in downward movement of the actuating plate 357 on the tail portion of the rod 354 from its full line position to its broken line position of Fig. 38. In this latter position, the plate 357 is disposed in the path of movement of the screws 363, 364 on the actuating lever 361, so that movement of the latter by such initial movement of the cam lever 368 will swing the tone arm H horizontally from any position in which it may have been left into its normal position over the cradle 339. In other words, the first function of these parts at the beginning of an automatic cycle of operations of the machine is to place the tone arm H on the cradle 339, so as to eliminate the possibility of any damage to the machine or records if an operator has inadvertently left the tone arm on the turntable. This is very liable to have happened if the machine has been employed for manual playing of records. After the tone arm H has thus been swung outwardly over the cradle 339, the dwell 351 of the cam 347 passes the follower 346, so that the latter is engaged by the straight portion of the cam, to swing the

cam lever 342 and raise the rod 341 to its full line position of Fig. 38, thus lowering the outer end of the tone arm H onto the cradle 339. The straight portion of the cam 347 will then maintain the rod 341 in such raised or inactive position. As soon as these operations have been completed, which is during that initial portion of the cycle in which the gripper C is being lowered to the selected stack position and before the gripper is swung horizontally into the stack to pick up the selected record, the follower 372 enters the second dwell 376 of the cam 373 under the influence of the spring 374 to swing the tone arm actuating lever 361 in an idle stroke back to its full line position of Fig. 40, for a purpose to be later described.

The previously described operations of the machine then continue to pick up the record selected for playing and move the same into cooperative relationship with the turntable G. As soon as the record is lowered onto the turntable, the cam follower 372 enters the third dwell 377 of the cam 373 to permit the spring 374 to swing the actuating lever 361 from its full line position of Fig. 40 to its position of Fig. 42. Just prior to this action of the lever 361, the follower 346 has entered the second dwell 352 of the cam 347, under the action of the spring 349, to raise the outer end of the tone arm H and lower the plate 357 to its active or broken line position of Fig. 38. Consequently, the swinging of the actuating lever 361 will cause the screw 363 to engage the plate 357 and move the latter, together with the tone arm H, from its full line position of Fig. 39 to its position of Fig. 42. Such horizontal swinging of the tone arm will dispose the needle 335 over the outer groove of the record on the turntable. As the record is released by the gripper mechanism C in the manner previously described, the cam 347 carries the follower 346 out of the second dwell 352 to raise the rod 341 and lower the needle-carrying end of the tone arm H onto the record. At approximately the same time, the gripper arm C is being withdrawn horizontally from the turntable. During the subsequent playing of the record, the rod 354 and its associated parts are in their full line position of Fig. 38, since this is the position assumed by the tone arm when the needle 335 is in engagement with a record on the turntable. At the same time, the tone arm actuating lever 361 remains in its position of Fig. 42 by virtue of the spring 374 maintaining the follower 372 in the third dwell 377 of the cam 373. As soon as the gripper arm has been withdrawn horizontally from the record engaging position adjacent the turntable, the main cam shaft 87 has completed 180° of movement from its initial position, and the free end of the spring lever 323 has entered the second notch in the disc 322. As previously described, this will result in de-energization of the main motor 99 to stop the cam driving means D, the depositing of the record on the turntable having opened the switch 327 to prevent energization of the motor through the leads 318, 319 in case the selector switch 291 has remained closed.

The playing of the record functions as an active part of the automatic cycle of operations by virtue of the fact that the tail part of the rod 354 is swung in a clockwise direction, as viewed from the top of the machine, because of the needle 335 following the usual sound track of the record. Such movement of the rod 354 from its position of Fig. 42 will not be interfered with by the stop screw 378, since the flap 358 is in its

raised or full line position of Fig. 38. As soon as the playing of the record has been completed, the needle 335 is carried or swung inwardly toward the center pin 303 of the turntable by the usual finish or terminating groove provided in the record. The tail part of the rod 354 is thus moved to its broken line position of Fig. 40, wherein it engages one of a pair of spring contact members 381 to close the same. As shown in Fig. 50, the contact members 381 comprise a switch which is connected in parallel with, or shunted across, the switch 324 by leads 332 and 333 connected respectively, to the leads 318 and 319. The closing of the switch 381 by the rod 354 after completion of the playing of the record will thus reenergize the main motor 99 to again start rotation of the cam shaft 87. As soon as this takes place, the spring lever 323 is moved by the disc 322 to close the switch 324 to insure continued operation of the motor 99 until the cycle of operations has been completed and the cam driving means D returned to initial position. As the second half of the cycle of operations begins and the gripper arm C is being swung into record engaging position adjacent the turntable, the follower 342 is moved by the spring 349 into the third dwell 353 of the cam 347 to lower the rod 341 to its broken line position of Fig. 38 to raise the outer end of the tone arm H out of engagement with the record. As soon as the tone arm has thus been raised, the third dwell 377 of the cam 373 passes the follower 372 to swing the actuating lever 361 from its position of Fig. 42 to its broken line position of Fig. 40. The raising of the outer end of the tone arm was accompanied by downward movement of the actuating plate 357 on the rod 354 into the path of movement of the screw 364, so that the latter engages the plate 357 to swing the tone arm H in a counter-clockwise direction, as viewed from the top of the machine, back to inactive position over the cradle 339. The dwell 353 of the cam 347 then passes the follower 346 to raise the rod 341 against the action of the spring 349 to permit the tone arm H to be lowered onto the cradle 339. During such horizontal swinging of the tone arm back to inactive position, the stop flap 358 on the tail portion of the rod 354 will be moved from its broken line to its full line position of Fig. 40 as it passes the stop screw 378, which will be permitted by virtue of the arrangement illustrated in Fig. 41 enabling rearward swinging of the flap against the action of the spring 359. The several parts will be maintained in such positions until just prior to the completion of the automatic cycle of operations, when the spring 374 will cause the follower 372 to reenter the first dwell 376 in the cam 373 to return the actuating lever 361 to its full line position of Fig. 40.

At the completion of the cycle of operations, the spring lever 323 will again enter the first notch in the disc 322 to open the switch 324. The switch 381 has been opened by the return of the tone arm H to inactive position on the cradle 339, the turntable switch 327 has been closed by the spring 329 raising the lever 328 when the gripper mechanism removed the record from the turntable, and if only one selector key was depressed the switch 291 was opened upon its release, so that the main motor 99 will then be deenergized to stop the cam driving means D in normal position at the completion of the automatic cycle of operations. However, if more than one selector key has been depressed, the switch 291 has remained closed, so that the main motor

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99 will continue to operate to immediately institute another automatic cycle of operations. This repetition of successive automatic cycles of operations will continue so long as any one of the selector keys remains depressed, and until the last one which has been depressed is released to open the selector switch 291.

It may happen during any automatic cycle of operations that no record is in the particular stack position selected for playing. Under such circumstances, the automatic cycle of operations would terminate after the completion of 180° of rotation of the main cam shaft 87, since the movement of the tone arm H by the record on the turntable normally functions to reinstitute operation of the main motor 99 to complete the second half of the cycle of operations. Although the turntable switch 327 will be closed under these unusual circumstances because the gripper mechanism will have been unable to deposit a record on the turntable, if only one selection has been made, the selector switch 291 will have previously been opened by the release of the selector key which was depressed. Means are provided for reenergizing the main motor 99 under these circumstances to complete the second half of the cycle of operations and return the several parts to their normal positions. Referring to Figs. 38, 42 and 50, a pair of spring contacts 384 are mounted in any desired manner on the main frame A directly above the end of the lower tail portion of the rod 354 when the tone arm H has been swung to the normal initial playing position of Fig. 42. After the tone arm has been swung to this position, the rod 341 is raised to its full line position of Fig. 38 to allow the needle-carrying end of the tone arm to be lowered onto the record, in the manner hereinbefore described. If the gripper mechanism has been unable to deposit a record on the turntable under the circumstances noted, the needle-carrying end of the tone arm H will fall below the normal record level (shown in full lines in Fig. 38) to raise the bottom end of the rod 354 to close the contacts 384. Such additional lowering of the needle-carrying end of the tone arm will result because the upper end of the rod 341 will be in its full line position of Fig. 38, and the turntable G, as seen in Figs. 2 and 3, is of smaller diameter than the records. Referring to Fig. 50, the contacts 384 are electrically connected in parallel with the contacts 381 by suitable leads 385 and 386 connected, respectively, to the leads 382 and 383. Consequently, when the rod 354 is so raised to close the switch comprising the contacts 384, the main motor 99 is reenergized to start the second half of the cycle of operations, so that the several parts may be returned to their normal positions.

As has previously been stated, the instant mechanism is adapted to accommodate records of different diameters. In the embodiment disclosed herein, records of either ten or twelve inch diameter may be placed in any desired position in the stack B. If a ten-inch record has been selected for playing, the mechanism operates in the manner described. However, if the record selected for playing is twelve inches in diameter, it is necessary that the tone arm H, when being swung into initial record playing position, not be moved as far as is necessary if a ten-inch record is to be played. This, of course, is due to the fact that the starting groove on a twelve-inch record will be disposed one inch further from the centering pin 308 than will the starting groove of a ten-inch record, when the record is

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deposited on the turntable G. Consequently, means must be provided for automatically selectively conditioning or positioning the adjustable stop screws 378, 379 to determine the proper position to which the tone arm will be moved to start the playing of a record, in accordance with the size of the particular record selected for playing.

Record size selection

Referring to Figs. 2, 3, 37, 38, 40, 42 and 43, the adjustable stop screws 378 and 379 are threaded through suitable tapped apertures in a vertical flange 387 at the rear end of a horizontally disposed tone arm stop lever 388. The lever 388 is pivotally supported or journaled at its forward end on a shaft or rod 389 depending from the main frame A, and is resiliently urged in a clockwise direction (looking down) by a coil spring 391. The spring 391 is wound around a sleeve 392 secured to the shaft 389, with its ends engaging the latter, and the lever 388, respectively. The inner side of the rear end of the stop lever 388 extends beyond the flange 387 and terminates in an upwardly extending finger 393 adapted to be engaged by a nose 394 of a latch pawl 395. The pawl 395 is pivotally mounted at 396 at its forward end on a portion of the main frame A, and is pivotally connected at its rear end at 397 to the right-hand end of a link 398. The left end of the link 398 is pivotally connected at 399 (Fig. 2) to the rear end of an arm 401, which is rigidly secured at its forward end to a vertical shaft 402 journaled in and extending upwardly through the main frame A adjacent the rear bracket 53 of the record stack B. A coil spring 403 is interconnected between the arm 401 and a suitable stud on the frame A to resiliently maintain the arm and the link 398 in the normal position shown in full lines in Figs. 2, 40, 42 and 43. Above the frame A and adjacent its upper and lower ends, the shaft 402 has rigidly secured thereto the left ends of a pair of arms 404, which support a vertical rod 405 at their right-hand ends. The rod 405 extends for the full height of the stack B, and is normally disposed in adjacent relationship to the peripheral edges of the twelve-inch records 66 in the stack, as shown in full lines in Fig. 2, to be swung thereby against the action of spring 403 to the broken line position of Fig. 2, whenever a twelve-inch record is removed from the stack by the gripper C. It will be understood, of course, that the normal position of the rod 405 will not enable it to be contacted by any of the ten-inch records 66 in the stack as the same are selectively swung out of the stack by the gripper C.

Thus, whenever any one of the twelve-inch records 66 has been selected for playing, it will contact the rod 405 to swing the arm 401, link 398 and latch pawl 395 from their normal or full line positions to their broken line positions of Figs. 2 and 43, as the record is swung horizontally by the gripper C from the stack B toward its position of Fig. 3 over the turntable by the laterally sloping portion 203 of the gripper cam 201. Such movement of the latch pawl 395 will release the stop lever 388 to permit it to be swung from its position of Fig. 42 to its position of Fig. 43 by the spring 391. The stop lever 388 will be held in the latter position by engagement of the right-hand edge of the flange 387 thereon with the left end of the tone arm actuating lever 361, so that subsequent movement of the lever 361 to swing the tone arm H to initial playing posi-

tion, in the manner previously described, will cause the stop flap 353 to be engaged by the screw 379 instead of the screw 378. The needle 335 will then be positioned above the starting groove in the twelve-inch record which is to be played, instead of being in its normal further inward initial playing position above the starting groove of a ten-inch record as shown in Fig. 42.

Means are provided for automatically returning the stop lever 333 to the normal position of Figs. 40 and 42, wherein it will be latched by engagement of the nose 394 of lever 395 with the finger 393, after playing of the record has been completed, and also at the beginning of each cycle of operations to prevent misoperation of the tone arm if the lever 333 has been released by inadvertent manual actuation of the rod 405. This means comprises a cam surface 406 (Figs. 40, 42 and 43) formed integrally with, and as an extension of, the left end or edge of the tone arm actuating lever 361 adjacent the rearwardly extending arm thereof which supports the screw 364. As previously described, the initial operation of the parts at the beginning of any automatic cycle of operations results in movements of the rod 341 and tone arm actuating lever 361 to place the tone arm in inactive position on the cradle 339, in the event that it has been left inadvertently on the turntable. These operations are completed during that portion of the cycle in which the gripper mechanism C is being lowered into horizontal alignment with the position of the record in the stack that has been selected for playing. Prior to the horizontal swinging of the gripper into the stack to pick up the selected record, the cam follower 372 has entered the second dwell 375 of the cam 373 under the influence of the spring 374 to return the tone arm actuating lever 361 from its broken line to its full line position of Fig. 40. The primary purpose of this idle movement of the tone arm actuating lever 361 is to prevent subsequent misoperation of the stop lever 333 by the cam surface 406, and to position the left end of the lever 361 forwardly of the cam surface 406 to function as a positioning stop for the stop lever 333. Consequently, whenever the rod 405 is moved from its full line to its broken line position of Fig. 2 by the outward swinging of a twelve-inch record from the stack D by the gripper mechanism C, which is accomplished by the laterally sloping portion 203 of the cam 201, the latch pawl 395 will be swung from its full line to its broken line position of Fig. 43. The spring 391 will then function to move the stop lever 333 into the position of Fig. 43, wherein the screw 379, rather than the screw 378, will function to determine the initial playing position to which the tone arm H will be moved. During playing of the record, the levers 361 and 333 will remain in their positions of Fig. 43. Subsequent movement of the actuating lever 361 to its broken line position of Fig. 40 to return the tone arm H to normal or inactive position will cause the cam surface 406 to contact the right hand edge of the flange 397 to swing the stop lever 333 in a counter-clockwise direction back to its normal position of Fig. 40. Since no mechanism is provided for retaining the members 395, 393, 401, 404, and 405 in their released position against the action of the spring 403, such return of the stop lever 333 by the cam surface 406 will result in the former being reengaged by the latch pawl 395. This particular relatching of the stop lever 333, however, is merely ancillary to the return of the tone arm to inactive position

after playing of the record and constitutes an idle operation, since the subsequent returning of the played record to its stack position, as represented in broken lines in Fig. 2, will again actuate the rod 405 to cause release of the latch pawl 395. As soon as the played record has been completely returned to the stack, the spring 403 will, of course, return the latch pawl 395 to its active position of Fig. 40. During the remainder of the automatic cycle of operations and just prior to the end thereof, the spring 374 will again swing the cam lever 333 to carry the follower 372 into the first dwell 376 of the cam 373. This will result in the actuating lever 361 being returned from its broken line to its full line position of Fig. 40, during which movement the protuberance formed by the cam surface 406 on the end of the lever 361 will again swing the stop lever 333 back to normal position and into latched engagement with the pawl 395. In the event that the rod 405 has been inadvertently moved at any time prior to the initiation of an automatic cycle of operations, thus accidentally releasing the stop lever 333 to be swung to its twelve-inch position of Fig. 43 by the spring 391, the first movement of the cam lever 333 by the follower 372 being carried out of the first dwell 376 of the cam 373 to move the actuating lever 361 from its full to its broken line position of Fig. 40 to position the tone arm H on the cradle 339 will also function to return the stop lever 333 to its latched position of Fig. 40. Consequently, subsequent movement of the tone arm to proper record playing position will be assured, regardless of whether a ten-inch or a twelve-inch record is next selected for playing.

Operation in general

As will be appreciated from the foregoing description, the present machine is adapted for optional automatic or manual operation. In other words, any desired records may be played by using the turntable G and manually moving the tone arm H to initial playing position. When the machine is so employed, the main switch 313 is moved to the manual position shown in Fig. 50 to close the circuit comprising the lead 316 and the main line 314, 315 to energize the turntable motor 309. The automatic tone arm operating mechanism is so designed that manual movement of the tone arm will not be interfered with, and will not cause subsequent misoperation of the automatic mechanism. When the machine is subsequently used to automatically play any selected record or records in the stack B, the tone arm H will be replaced in inactive position upon the cradle 339 at the beginning of the cycle of operations to prevent damage to the machine or the record selected for playing if the tone arm has been inadvertently left on the turntable. Also, if a record has been left on the turntable after manual use of the machine, the switch 327 will prevent automatic operation until such record has been removed. Whenever it is desired to employ the automatic features of the machine, the main switch 313 is first moved to the right, as viewed in Figs. 1 and 50. Any desired record or records, and either side thereof, may then be selected for playing merely by depression of the corresponding keys 284 to 287 of the selector F. It will be readily understood that any well known type of coin-controlled mechanism may be applied to the instant machine to control the operation of the main switch 313. Since the addition of such coin-controlled mechanism is well within the ability of anyone skilled in the art and does

not constitute a part of the instant invention, it has not been illustrated in the accompanying drawings. The automatic mechanism herein disclosed is such as to enable the use of records of different diameters, as well as permitting the selective playing of either or both sides of any or all of the records. The advantages of such an arrangement are clearly apparent, and it is also thought that the advantages of the several interlocking and safety features provided will be readily understood. The simplicity of the stack mechanism B greatly facilitates changing thereof and replacement of desired records.

As a final safety feature, in the event that some unforeseen circumstances may cause the automatic mechanism to be stopped in the middle of a cycle of operations, and to enable initiation of an automatic cycle of operations without necessitating actuation of the selector mechanism for any desired reason, means are provided for manually closing the micro-switch 324 at any time. This means is best illustrated in Figs. 1, 3 and 6, and comprises a lever 407 pivotally mounted at 408 intermediate its ends and extending upwardly through a suitable aperture in the main frame A. A coil spring 409 is interposed between the frame A and an enlarged head portion or finger button in the upper end of the lever 407 to normally maintain the latter in a vertical position. The lower end of the lever 407 is bent outwardly to underlie the free end of the spring lever 323. Consequently, movement of the lever 407 against the action of the spring 409 will raise the free end of the lever 323 to close the switch 324, thus starting the main motor 99.

During each automatic cycle of operations of the machine, the gripper mechanism C will first be lowered into horizontal alignment with the uppermost record 66 in the stack B selected for playing. During this operation of the gripper mechanism, the tone arm actuating mechanism will be operated to place the tone arm in inactive position on the cradle 339, if the same has been inadvertently left out of such inactive position. The gripper mechanism is then swung toward the stack and the gripper release mechanism operated to cause picking up or gripping of the selected record. The selected record is then swung out of the stack and over the turntable, and is lowered to the intermediate or record reversal position directly above the centering pin 308 of the turntable. If the under side of the record has been selected for playing, the gripper mechanism is then reversed to present the same uppermost for subsequent engagement by the needle 335. If the top side of the record has been selected for playing, this portion of the cycle is rendered idle by disengagement of the clutch member 193 from the gear 188. The record is then lowered onto the turntable, and the gripper locking mechanism is actuated to release the same thereon. While this releasing operation is taking place, the tone arm H is being raised from the cradle 339 and swung inwardly toward the turntable. It is then lowered to engage the needle 335 with the starting groove of the record, regardless of the diameter of the particular record selected for playing, and at approximately the same time the gripper mechanism is withdrawn horizontally from the turntable. This completes the first half of the automatic cycle of operations and the main motor 99 is then deenergized to stop the cam shaft 87 after the latter has been rotated through 180 degrees. After completion of the playing of the record, the ter-

minating groove therein will further actuate the needle-carrying end of the tone arm H to cause the tail portion of the rod 354 to close the switch 381 and reenergize the main motor 99 to begin the second half of the automatic cycle of operations. During the latter, the tone arm is raised out of engagement with the record and returned to inactive position on the cradle 339, the gripper mechanism is moved horizontally toward the turntable and reengages the record, and the latter is raised to the intermediate or reversal position. The gripper mechanism is then reversed, if the under side of the record was played, and is raised and swung back toward the stack to replace the played record on its associated supporting tray 55, after which the gripper mechanism is returned to its normal or at rest position. This cycle of operations will be repeated until all selected records have been played, when the main motor 99 will be deenergized. Manual opening of the switch 313 will then cause deenergization of the turntable motor 309.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

We claim:

1 An automatic phonograph, comprising means for storing a plurality of records one above the other in horizontal positions a rotatable turntable at one side of the storage means, vertically reciprocable and horizontally swingable transferring means for removing records one at a time from said storage means, thereafter reversing the record relative to said turntable, depositing the same on said turntable for playing, and returning the played record to its original position in said storage means, selectively operable means for predetermining a plurality of records to be played; and means controlled by said predetermining means and controlling the operation of said transferring means for preventing reversal of one or more of the records selected by said selectively operable means to result in playing of the obverse sides thereof.

2. In an automatic phonograph having a turntable, record supporting means for supporting a plurality of records one above the other at one side of said turntable, a vertically reciprocable, horizontally swingable member operable to remove a record from said supporting means, reverse the same through an angle of 180°, deposit the record on said turntable for playing the reverse side thereof, and return the played record to its original position in said supporting means, means for controlling the operation of said member, and optionally operable means for controlling the operation of said member and preventing reversal of the record thereby to cause the record to be deposited on said turntable to result in playing of the obverse side thereof.

3. A phonograph, comprising a rotatable turntable, a normally inactive tone arm manually movable into initial playing position in cooperation with any desired record placed manually on said turntable, means for storing a plurality of disc records of different diameters, means for transferring records one at a time from said storage means to said turntable for playing either side thereof and for returning the played record

to its initial position in said storage means, means for automatically moving said tone arm into variable initial playing position relative to a record on said turntable, means automatically operable by the record during the transfer thereof to said turntable for determining the proper initial playing position to which said tone arm will be moved in accordance with the diameter of the particular record so transferred, selectively operable means for predetermining either or both sides of one or a plurality of records in said storage means to be played, means controlled by said predetermining means for controlling the operation of said transferring means, and means selectively operable to cause rotation of said turntable for manual operation of the phonograph or to cause rotation of said turntable and condition the phonograph for automatic operation under control of said predetermining means.

4. In a multi-record phonograph having record storage means, a rotatable turntable, cyclically operable mechanism including a motor for transferring selected records for playing one at a time from said storage means to said turntable in the first half of each cycle and for returning the played record to said storage means in the second half of the cycle, means for selecting the records to be played, means for initiating each cycle of operations by energizing said motor, a normally inactive tone arm, means operable after a record has been transferred to said turntable to move said tone arm into initial playing position and permit engagement thereof with said record, means immediately operable to deenergize said motor during playing of a record, and means operable by said tone arm after completion of the playing of a record to reenergize said motor to initiate the second half of the cycle of operations; normally inactive means for energizing said motor, and means operable by said tone arm for operating said normally inactive means to reenergize said motor to initiate the second half of the cycle of operations when a blank selection has been made and no record has been transferred from said storage means to said turntable.

5. An automatic phonograph, comprising a record magazine including means for individually and horizontally supporting a plurality of disc records in vertically spaced relationship, a vertically stationary turntable rotatably mounted in horizontally and vertically spaced relationship relative to said magazine, a gripper arm including means for engaging a single record, mechanism for locking and releasing said record engaging means, mechanism for moving said gripper arm horizontally between said magazine and said turntable, mechanism for moving said gripper arm vertically between an initial position spaced vertically from said magazine and a record playing position adjacent said turntable, mechanism for reversing said record engaging means by rotating the same on a horizontal pivot through an angle of 180°, driving means for actuating said several mechanisms in properly timed relationship to cause said gripper arm to transfer records one at a time from said magazine to said turntable for playing and to return the played record to its supporting means in said magazine, selectively operable means for predetermining the top sides of one or a plurality of records to be played, selectively operable means for predetermining the bottom sides of one or a plurality of records to be played, means controlled by said predetermining means for controlling the

record selective operations of said gripper arm, and means controlled by said first recited predetermining means for rendering ineffective said mechanism for reversing said record engaging means.

6. In an automatic phonograph, stationary means for individually supporting horizontally one above the other a plurality of record discs of different diameters bearing phonographic recordings on their opposite faces, playing means horizontally spaced from the stationary supporting means and including a vertically stationary disc support member and a reproducer for reproducing phonographic recordings, means for predetermining any plurality of said recordings for reproduction by said playing means, and means governed in part by the predetermining means for moving each record disc bearing one or more predetermined recordings once for each such predetermined recording from said stationary supporting means and placing said record disc on said vertically stationary disc support member with a different predetermined recording in reproducible position each time every said record disc bearing more than one predetermined recording is so moved and for returning said record discs to their respective original positions in said stationary supporting means with their recordings in the same positions relative to one another.

7. In an automatic phonograph, stationary means for individually supporting horizontally one above the other a plurality of record discs of different diameters bearing phonographic recordings on their opposite faces, playing means horizontally spaced from the stationary supporting means and including a vertically stationary disc support member and a reproducer for reproducing phonographic recordings, means for predetermining any plurality of said recordings for reproduction by said playing means, transfer means for selectively engaging and moving each record disc bearing one or more predetermined recordings once for each such predetermined recording from said stationary supporting means and placing said record disc on said vertically stationary disc support member with a different predetermined recording in reproducible position each time every said record disc bearing more than one predetermined recording is so moved and for returning said record discs to their respective original positions in said stationary supporting means with their recordings in the same positions relative to one another, and means controlled by said predetermining means for controlling the record disc selection operations of said transfer means.

8. In an automatic phonograph, a record reproducer, a playing record support, a record magazine laterally spaced from said playing record support, record transferring means capable of reciprocable movements in a plurality of directions for transferring records between said magazine and said playing record support, means for laterally reciprocating said record transferring means to remove a record from said magazine into axial alignment with said playing record support, means for moving said record transferring means toward said playing record support to deposit the record thereon, means for laterally moving said record transferring means to receive the record from said playing record support after the playing of the record, means for moving said record transferring means away from said playing record support to remove the

played record to a position laterally spaced from its original position in said magazine, and means for moving said record transferring means laterally to return the record to said magazine.

9. In an automatic phonograph, a record reproducer, a playing record support, a record magazine laterally spaced from said playing record support, record transferring means capable of reciprocal movements in a plurality of directions for transferring records between said magazine and said playing record support, means for laterally reciprocating said record transferring means to receive a record and remove it from said magazine into vertical alignment with said playing record support, means for moving said record transferring means toward said playing record support to deposit the record thereon, means for imparting planetary rotation to said transferring means to reverse said record prior to the depositing thereof on said playing record support, means for laterally moving said record transferring means to receive the record from said playing record support after the playing of the record, means for moving said record transferring means away from said playing record support to remove the played record to a position laterally spaced from its original position in said magazine, and means for moving said record transferring means laterally to return the record to said magazine.

10. In an automatic phonograph, a record reproducer, a playing record support, record storage means laterally spaced from said playing record support, record transferring means capable of movement in a plurality of directions for transferring records between said storage means and said playing record support, means for laterally moving said record transferring means to receive a record and remove it from said storage means into axial alignment with said playing record support, means for moving said record transferring means toward said playing record support to deposit the record thereon, means for imparting planetary rotation to said transferring means to reverse said record prior to the depositing thereof on said playing record support, means for laterally moving said record transferring means to receive the record from said playing record support after the playing thereof, means for moving said record transferring means away from said playing record support to move the played record to a position laterally spaced from its original position in said storage means, means for imparting planetary rotation to said transferring means to again reverse said record after playing thereof, and means for moving said record transferring means laterally to return the played record to its original position in said storage means.

11. In an automatic phonograph, a record reproducer, a playing record support, record storage means laterally spaced from said playing record support, record transferring means capable of movement in a plurality of directions for transferring records between said storage means and said playing record support, means for laterally moving said record transferring means to receive and remove a record from said storage means, means for moving said record transferring means toward said playing record support to deposit the record thereon, means for imparting planetary rotation to said transferring means to reverse said record prior to the depositing thereof on said playing record support, means for laterally moving said record transferring means to receive the record from said play-

ing record support after the playing thereof, means for moving said record transferring means away from said playing record support to move the played record to a position laterally spaced from its original position in said storage means, means for imparting planetary rotation to said transferring means to again reverse said record after playing thereof, means for moving said record transferring means laterally to return the played record to its original position in said storage means, means for predetermining a plurality of records for playing, and means controlled by certain of said predetermining means for preventing operation of said means for imparting planetary rotation to said transferring means.

12. An automatic phonograph, comprising stationary record storage means including means for individually supporting one above the other a plurality of record discs of different diameters bearing phonographic recordings on their opposite faces, playing means including a disc support member and a normally inoperative reproducer movable to playing position for reproducing phonographic recordings, means for predetermining any plurality of said recordings for reproduction by said playing means, means governed in part by said predetermining means for moving each record disc bearing one or more predetermined recordings once for each such predetermined recording from said storage means to said disc support member with a different predetermined recording in reproducible position each time every said record disc bearing more than one predetermined recording is so moved, means operable to move said reproducer to playing position relative to the record disc on said disc support member in accordance with the diameter of such record disc, and means for returning said record discs to their respective original supporting means with their recordings in the same original positions relative to one another.

13. An automatic phonograph, comprising means for storing a plurality of records, a playing record support, means for transferring records one at a time from said storage means to said playing record support, means for predetermining one or more records to be played, means for supporting said transferring means and for controlling movement thereof to selective position relative to any one of said records in said storage means as determined by said predetermining means, a normally inactive support member, means controlled by said predetermining means for locking said transferring means to said support member in such selective position, means for moving said transferring means in such selective position to receive and remove the associated record from said storage means, and means operable to then control movement of said support member to cause movement of said transferring means to deposit the record removed from said storage means on said playing record support.

14. A multi-record phonograph comprising a stationary record magazine adapted to receive and support a plurality of records, a vertically stationary rotatable turntable at one side of said magazine and accessible for the manual deposit thereon of a record to be played, means for rotating said turntable, reproducer means manually and automatically movable to initial playing position relative to a record on said turntable, automatic means for delivering records one at a time from said stationary magazine to said turntable for playing thereon, record selector means for predetermining one or more records in said mag-

azine for delivery to said turntable by said automatic means, means controlled in part by said selector means for moving said reproducer means and for driving said automatic means, and selectively operable control means having a position controlling the moving and driving means for automatic operation of the phonograph and having another position controlling the turntable rotating means for manual operation of the phonograph for selectively setting the phonograph for manual and automatic operations.

15. A multi-record phonograph comprising a vertically stationary rotatable turntable accessible for the manual deposit thereon of a record to be played, means for rotating said turntable, a stationary record magazine at one side of said turntable and adapted to receive and support a plurality of records, reproducer means manually and automatically movable to initial playing position relative to a record on said turntable, means for automatically delivering any record from said stationary magazine to said vertically stationary turntable, means for automatically moving said reproducer means to its initial playing position upon the deposit of a record on said turntable by the automatic delivery means, and selectively operable control means having positions controlling the turntable rotating means, the automatic delivery means and the moving means of said reproducer means for automatic operation of the phonograph and for manual operation thereof respectively for setting the phonograph for manual and automatic operations selectively.

16. A phonograph comprising a vertically stationary rotatable turntable accessible for the manual deposit thereon of a record to be played, a tone arm having a normal inactive position at one side of said turntable and automatically and manually movable vertically and horizontally from said inactive position to initial playing position relative to a record on said turntable, storage means for a plurality of records, means for automatically placing a record on said turntable, manually operable control means for initiating the operation of the foregoing means, and means controlled by said control means for automatically moving said tone arm to said inactive position prior to the automatic placing of a record on said turntable by the record placing means whenever after manual movement of the tone arm to its initial playing position, it is left out of its inactive position.

17. A phonograph comprising means for storing a plurality of records, a rotatable turntable accessible for the manual deposit thereon of a record to be played, means for automatically delivering a record from the storage means to said turntable for playing thereon, reproducer means automatically and manually movable from a normal inactive position at one side of said turntable to initial playing position relative to a record thereon and thereafter movable back to said inactive position, and means for automatically moving said reproducer means to its normally inactive position after the playing of a record delivered to said turntable by the automatic record delivery means and for automatically moving said reproducer means to said inactive position prior to the automatic delivery of a record to said turntable by said automatic record delivery means whenever after manual movement of said reproducer means to its initial playing position it is left out of its inactive position.

18. In a multi-record phonograph having a multi-record magazine, a turntable accessible for the manual placement of records thereon, a reproducer, and means for moving records to be played from said magazine to said turntable and after playing for returning said records to said magazine, motor means for operating the record moving means, switch means for controlling said motor means for manual and automatic operation of the phonograph, and switch means operable by a record on the turntable for rendering the first said switch means ineffective to control said motor means for automatic operation of the phonograph whenever and while a record remains on said turntable.

19. In a phonograph a turntable, record delivery means for automatically placing disc records of different diameters on said turntable for playing, a movable tone arm having a variable initial playing position relative to a record on said turntable, movable stop means having a normal position for determining the normal initial playing position of said tone arm and another position for determining the initial playing position for records of larger diameter than those having the initial playing position corresponding to the normal position of said stop means, means for constraining said stop means to movement from its normal position to its other said position, releasable latching means for normally retaining said stop means in its normal position, means for releasing said stop means during the operation of said record delivery means in placing a record of larger diameter on said turntable, and tone arm moving means controlled in part by said stop means for moving said tone arm to the initial playing position determined by said stop means and for returning said stop means to its normal position both before each operation of said delivery means in placing a record to be played on said turntable and after the playing of each record is completed.

20. A phonograph for playing disc records having sound recordings on their opposite sides comprising means for storing a plurality of disc records in horizontal positions one above the other, reproducer means at one side of the storage means, selector means operable in advance of playing for selecting for playing the underside of any record in said storage means, selector means operable in advance of playing for selecting the upper side of any record in said storage means, and vertically movable and horizontally swingable delivery means controlled by both said selector means for automatically removing from said storage means each record bearing a selected recording, thereafter reversing each such record where the under side thereof was selected by the first said selector means and preventing the reversal of each said record when only the upper side thereof was selected by the second said selector means, delivering each said record to said reproducer means for playing, and after playing returning each played record to said storage means.

21. In an automatic phonograph having a turntable, record supporting means for supporting a plurality of records one above the other at one side of said turntable, a vertical shaft at one side of said record supporting means, a gripper unit slidable along and horizontally swingable about the axis of said vertical shaft and having a horizontal pivot about which it is oscillatable to remove a record from said supporting means, reverse the same through an angle of 180°, de-

posit the record on said turntable for playing the reverse side thereof, and return the played record to its original position in said supporting means, means for controlling the operation of said member, and optionally operable means for controlling the operation of said member and preventing reversal of the record whereby to cause the record to be deposited on said turntable in position for playing the obverse side thereof.

22. A multi-record, automatic phonograph comprising a plurality of horizontally disposed individual record supporting trays, means for individually and pivotally supporting marginal portions of said trays to maintain the same in vertically spaced relationship relative to each other, horizontally disposed, vertically spaced guide means individually and slidably supporting other marginal portions of said trays, record playing means spaced laterally from said record supporting trays, a vertically adjustable horizontally movable record gripper adjustable to the respective elevations of said record supporting trays, horizontally swingable at each such adjusted elevation and vertically reciprocable thereafter for moving the record from the record supporting tray to playing position relative to said record playing means and after playing returning it to the corresponding record supporting tray, means for operating said record gripper to grip and release the record when said gripper is swung horizontally at an adjusted elevation before and after playing and when said record gripper moves a record to playing position, and means operable in advance of playing controlling said record gripper for predetermining one or more records for playing.

23. A multi-record phonograph comprising a plurality of horizontally disposed individual record supporting trays, means for individually and pivotally supporting marginal portions of the said trays to maintain the same in vertically spaced relationship relative to each other, horizontally disposed vertically spaced guide means independently and slidably supporting other marginal portions of said trays to facilitate individual movement thereof for the purpose of placing records thereon and removing the same therefrom, means for normally resiliently maintaining said trays in vertical alignment, record playing means at one side of the normally vertically aligned record trays, and selectively controlled record engaging means for removing any record from its supporting tray, moving it to playing position relative to said record playing means and after playing returning the played record to its record supporting tray.

24. In an automatic phonograph, a vertically stationary turntable, a reproducer, a plurality of superposed record supporting members at one side and above the level of said turntable, each adapted to support a disc record in horizontal position, means adjustable to a plurality of elevations, pivoted to swing horizontally at each said elevation, and pivoted to rotate about a horizontal axis to move each record on said supporting members into vertical alignment with said turntable and vertically to playing position on the turntable, means for swinging the last said means to move a record to a position of vertical alignment with the turntable, means for lowering the adjustable means to move the record to playing position on the turntable, and means for rotating said adjustable means about the horizontal axis to reverse the record relative to the turntable while the record is in transit between its

supporting member and its playing position on the turntable.

25. In an automatic multi-record phonograph, record storage means for individually and coaxially supporting a plurality of records one above the other, record playing means at one side of and below the level of said record storage means, means for moving one of the records at a time between its position in said storage means and playing position relative to said record playing means, means for operating the record moving means to turn over the individual records after removal from said storage means and before arrival at playing position to effect the reproduction of the side of any record previously facing downwardly in said storage means, and record selecting means for selecting records for movement by the record moving means to and from playing relationship with said record playing means, including a plurality of manually operable record preselecting elements corresponding in number to the number of records in said record storage means and adapted to predetermine for selection the upper sides of the respective records in said storage means, and another plurality of manually operable record preselecting elements corresponding in number to the number of records in said storage means and adapted to predetermine for selection the lower sides of the respective records in said storage means.

26. In an automatic multi-record phonograph, a vertically stationary turntable, a turntable drive motor, a pick up, a record magazine for a plurality of records horizontally arranged one above the other therein, means operable in advance of playing for predetermining either side and both sides selectively of one or more records in said storage means, means including a second motor controlled in part by said predetermining means for automatically moving said pick-up to playing relationship with each predetermined record transferred to playing position on said turntable and, after playing, for removing the pick-up out of playing relationship with said record, and record selecting, transferring and reversing means driven by said second motor and controlled by the predetermining means for selecting each predetermined record, moving it to playing position on said turntable, returning it after playing to its original position in said storage means, and turning over every record, the lower side of which was predetermined by said predetermining means both before and after playing the lower side of said record.

27. In an automatic multi-record phonograph wherein a vertically stationary turntable is spaced horizontally and vertically from a stationary magazine of records arranged therein in horizontal position one above the other, the combination of record predetermining means operable in advance of playing for selectively predetermining for playing either side of any said record, both sides of any record, either side of a number of records in any plurality of the records in said magazine and the opposite side of the other record or records in any such plurality of records, either side of a number of records in any plurality of the records in said magazine and both sides of the other record or records in any such plurality, either side of any plurality of said records both sides of any plurality of said records, and either or both sides of each of any plurality of records, record selecting, transferring and reversing means controlled in part by said record

predetermining means and adjustable vertically, swingable horizontally about a vertical axis, and rotatable about a horizontal axis for selecting every predetermined record, moving it from said magazine to playing position on said turntable, and after playing returning the record to its original position in said magazine, and means controlled in part by said record predetermining means and operating said record selecting, transferring, and reversing means for reversing each record, the lower side of which has been predetermined by said record predetermining means before and after playing the lower side of said record.

28. A multi-record phonograph comprising a vertically stationary turntable, a reproducer movable to a variable initial playing position relative to said turntable, a plurality of vertically spaced horizontal record trays each adapted to receive and support in horizontal position a disc record of either large or small diameter and said trays constituting a record magazine for disc records of large and small diameter at one side of said vertically stationary turntable, a record gripping member adjustable vertically to the level of each record supporting tray, swingable horizontally about a vertical axis, and oscillatable about a horizontal axis for selecting any record in said magazine and placing it on the turntable with either side thereof up for reproduction and after playing for returning the record to its original position in said magazine, record predetermining means controlling said record gripping means for predetermining for play either side of any record in said magazine, means for adjusting the record gripping means to the elevation of the predetermined record in said magazine, means for swinging the record gripping means at the adjusted elevation toward the predetermined record, means for operating said record gripping means to gripping relationship with the predetermined record, means for swinging the record gripping means and the predetermined record from said magazine to a position at which the predetermined record is vertically aligned with said turntable, means for moving the record gripping means toward said turntable, means controlled by said record predetermining means for rotating said record gripping means about its horizontal axis to turn the record over relative to said turntable where the lower side of the record was predetermined, means for continuing the movement of the record gripping means toward said turntable for placing the predetermined record thereon, means for operating the record gripping means to release the record on the turntable for playing, means actuated by the record during its swinging movement from said magazine to determine the initial playing position to which said reproducer will be moved for playing said record, means for moving the reproducer to said initial playing position for playing the predetermined record after it has been placed on said turntable, means for operating said record gripping means to grip the record on the turntable after playing, means for raising the record gripping means and the gripped record to the elevation of its tray in said magazine, means for again operating the record gripping means to turn the record over while in transit between the turntable and its magazine position where the originally lower side of the record has been played, and means for swinging the record gripping means horizontally to return the played record to its initial position in the magazine.

29. In a multi-record phonograph, stationary means for supporting one above the other a plurality of disc records of different diameters having phonographic recordings on their opposite sides, record playing means including a turntable and a cooperating pick-up at one side of the stationary supporting means for reproducing one phonographic recording at a time of such records, means operable in advance of playing for predetermining each recording of every plurality of recordings of said records in said stationary supporting means including recordings at the same and opposite sides of such records, means controlled in part by the predetermining means for automatically moving said pick-up to playing relationship with each predetermined recording on every record bearing such a predetermined recording that is moved to playing position on said turntable and, after playing, for removing the pick-up out of playing relationship with said record, means controlled by the predetermining means for selecting for play each predetermined recording, and means controlled in part by said predetermining means for moving each of the records bearing a predetermined and selected recording once for each such predetermined and selected recording from said stationary supporting means to said playing position on said turntable with the predetermined recording in a position engageable by said pick-up and after playing back to its original position in said record supporting means.

30. In a multi-record automatic phonograph having cyclically operable mechanism for playing records one at a time including a driving motor, selectively operable means for initiating a cycle of operations by starting said motor, a tone arm, motor control means operable by said tone arm upon completion of the playing of a record to start said motor, a normally open switch adapted when closed to cause the energization of said motor, means driven by said motor for closing said switch and maintaining it closed during the portion of the cycle preceding the playing of the record when said motor is started by said selectively operable means, and during the portion of the cycle following the playing of the record when said motor is started by said motor control means, and for automatically opening said switch to cause the de-energization of said motor during the playing of the record and upon completion of a cycle of operations, and switch operating means manually operable to close said switch for starting said motor at any time during the playing of a record to interrupt the record playing portion of the cycle of operations.

31. In a multi-record automatic phonograph for playing records one at a time having cyclically operable mechanism for delivering one record at a time to playing position and after playing for removing the played record from playing position, including a tone arm and a driving motor, an electrical control circuit including in electrical series with said motor a manually operable control switch, a cycle predetermining switch manually operable to predetermine the number of records to be played and cooperating with said manually operable control switch to initiate each cycle of operations when no record is in playing position and a normally closed record operable switch operable by a record in playing position to open said circuit for the record playing portion of a cycle of operations initiated by said manually operable control and cycle prede-

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termining switches and to prevent the initiation of a cycle of operations by said manually operable control and cycle predetermining switches while a record is in playing position, a normally open tone arm switch electrically shunting said cycle predetermining and record operable switches in said circuit and automatically closable by said tone arm to start said motor upon completion of the playing of a record at the end of the record playing portion of a cycle of operations initiated by said manually operable control and cycle predetermining switches and at the beginning of the record playing portion of such a cycle of operations when no record is delivered to playing position during the cycle of operations so initiated, and a normally open switch electrically paralleling said tone arm switch and said cycle predetermining and record operable switches and automatically closable to continue the energization of the motor for the portion preceding the record playing portion of a cycle of operations initiated by said manually operable control and cycle predetermining switches, and to continue the energization of the motor for the portion following the record playing portion of a cycle of operations when said motor is started by said tone arm switch upon completion of the playing of a record, and to cooperate with said tone arm switch to continue the energization of the motor for the complete cycle when no record is delivered to playing position during a cycle of operations initiated by said manually operable control and cycle predetermining switches.

32. In a multi-record automatic phonograph for playing records one at a time having cyclically operable mechanism for changing records including a tone arm and a driving motor, an electrical control circuit including in electrical series with said motor a manually operable control switch and a cycle predetermining switch cooperating with said manually operable control switch to initiate each cycle of operations, record selecting means for selecting any number of the records in said phonograph, and manually operable means controlling said record selecting means for predetermining each record to be selected and played and adapted to operate said cycle predetermining switch for predetermining a number of cycles of operations equal to the number of predetermined records.

33. In a multi-record automatic phonograph for playing records one at a time having cyclically operable mechanism for delivering one record at a time to playing position including a record reproducer automatically movable to and from playing engagement with a record in playing position, and a motor for driving said cyclically operable mechanism, an electrical control circuit including in electrical series with said motor a manually operable control switch and a cycle predetermining switch cooperating therewith to initiate each cycle of operations, and a normally open switch electrically shunting said cycle predetermining switch in said circuit and automatically closable by said record reproducer to start said motor upon completion of the playing of a record during the record playing portion of a cycle of operations initiated by said manually operable control and cycle predetermining switches, and at the beginning of the record playing portion of such a cycle of operations when no record is delivered to playing position during the cycle of operations so initiated.

34. In a multi-record phonograph having a re-

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producer, a turntable on which records are automatically and manually placeable one at a time for playing by said reproducer, and means for rotating said turntable, means for automatically depositing a record on said turntable for playing, manually operable control means for actuating both the turntable rotating means and the automatically depositing means, and optionally for actuating said turntable rotating means alone to play a record manually placed on said turntable, and means operable by a record manually placed on said turntable when said manually operable control means is operated to actuate said turntable rotating means alone for rendering said manually operable control means ineffective to actuate said automatically depositing means while said record remains on said turntable.

35. In a multi-record phonograph of the type wherein records are manually and automatically movable to and from playing position on a turntable, a reproducer is manually and automatically movable to and from playing relationship with a record on said turntable, and driving means is adapted to move records and the reproducer automatically for playing, and changing records, control means including manually operable means for setting the phonograph for automatic and manual operations selectively, said control means being adapted when said manually operable means is set for automatic operation of the phonograph to cause the operation of said driving means, and means operable by a record on the turntable for rendering said control means ineffective to cause the operation of said driving means.

36. In a phonograph, the combination with a rotatable turntable, turntable rotating means for rotating said turntable, and means for automatically placing a record on said turntable for playing, of manually operable means for initiating the operation of said turntable rotating means alone and together with the automatic record placing means selectively, and normally inoperative means, operable by a record placed on said turntable before operation of said manually operable means to initiate operation of said turntable rotating means together with said automatic record placing means, for rendering said manually operable means ineffective to initiate operation of said automatic placing means while said record remains on said turntable.

37. In a phonograph, the combination with record storage means for storing a plurality of records, a rotatable turntable, turntable rotating means for rotating said turntable, reproducer means manually movable to record playing position relative to said turntable, and record changer means for automatically moving any number of the records one at a time from said record storage means to playing position on said turntable and, after playing, returning each played record to said storage means, of means for automatically moving said reproducer means to and from playing position while each record moved by said record changer means from said storage means is in playing position on said turntable, selectively operable control means, movable to one position to initiate operation of said turntable rotating means alone and to another position to initiate operation of said turntable rotating means, record changer means, and the reproducer moving means, for setting the phonograph for the manual and automatic operations, respectively, involved in moving records and said reproducer

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means to and from playing position, and means, operable by a record disposed on the turntable prior to movement of said selectively operable control means to said other position, for rendering the same ineffective to initiate operation of said record changer and reproducer moving means while said record remains on said turntable.

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