

Oct. 3, 1939.

L. J. ANDRES

2,175,142

AUTOMATIC PHONOGRAPH

Filed Sept. 14, 1936

6 Sheets-Sheet 1

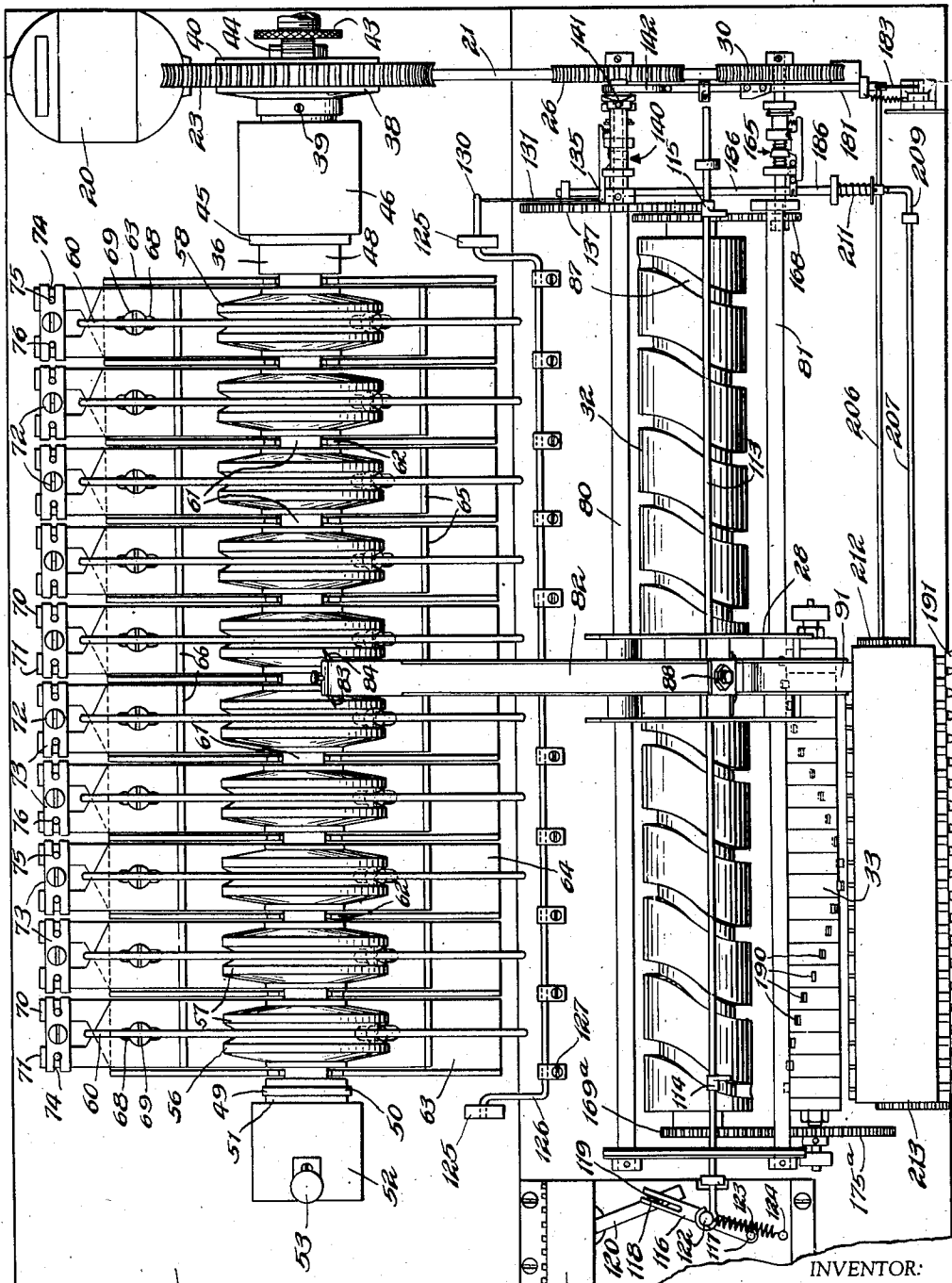


Fig. 1.

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6 Sheets-Sheet 2

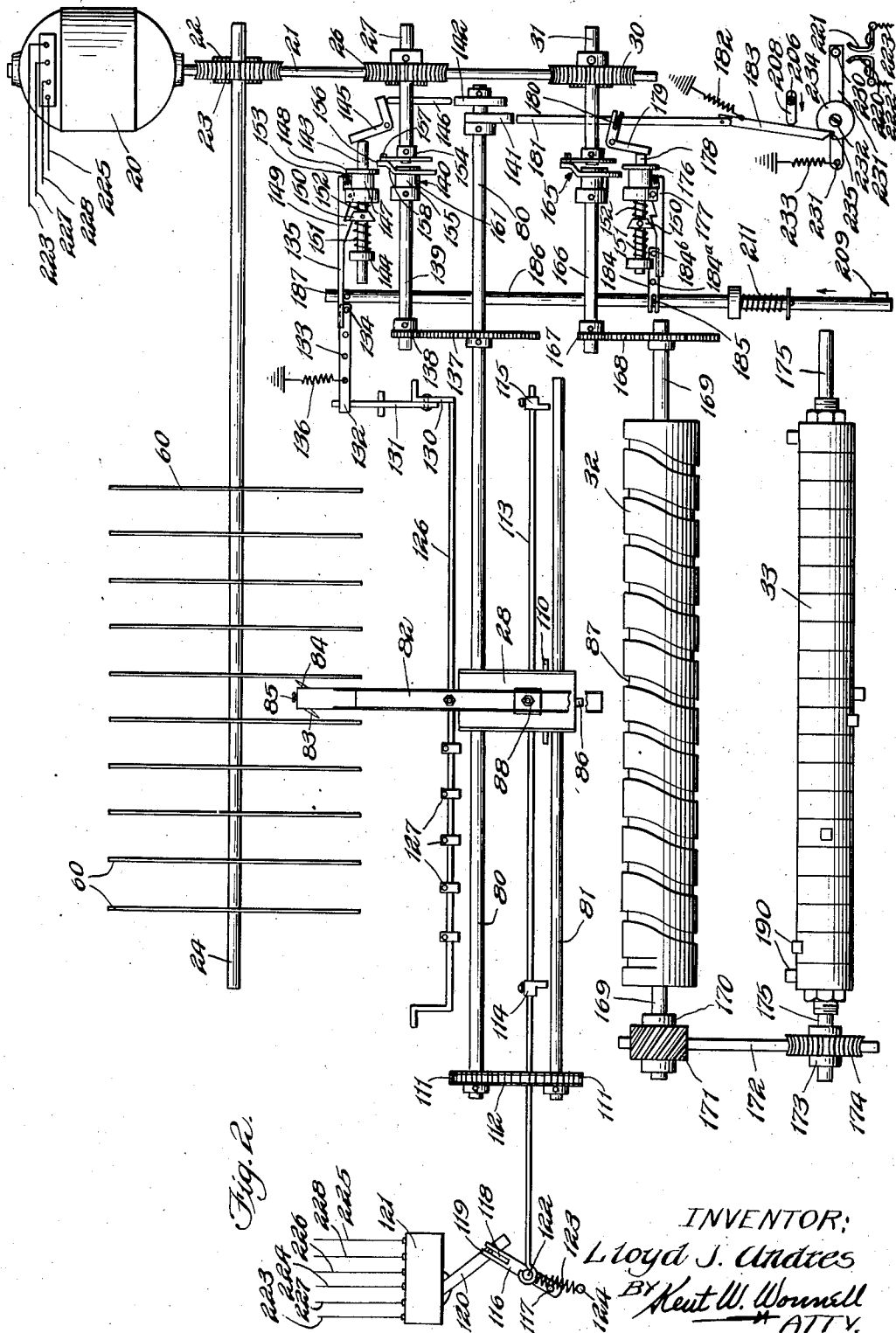


Fig. 2.

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6 Sheets-Sheet 3

Fig. 4.

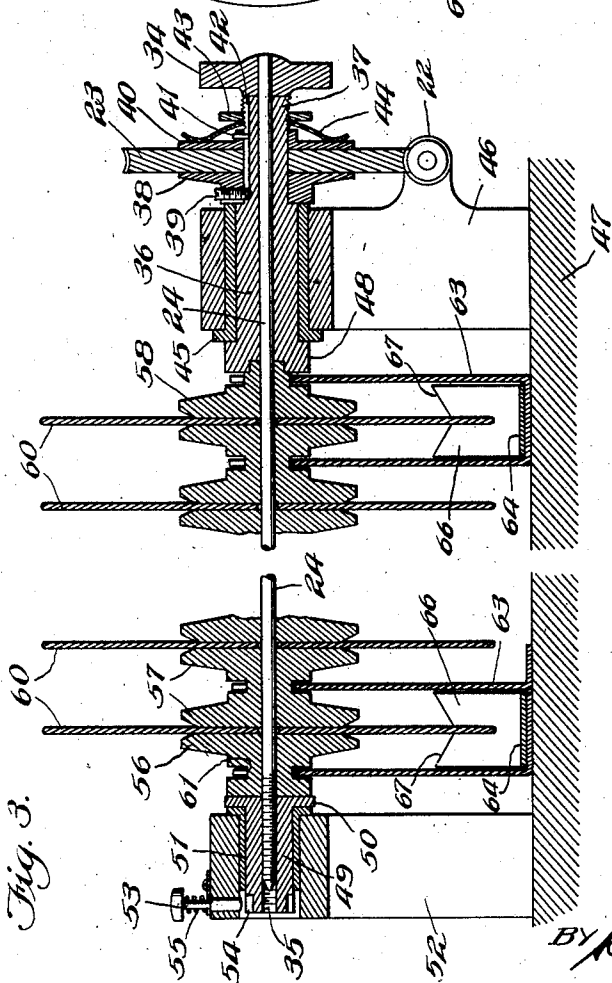
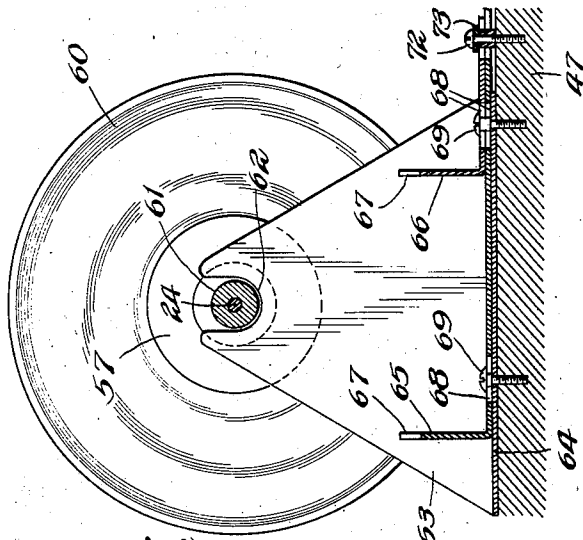


Fig. 3.

Fig. 6.

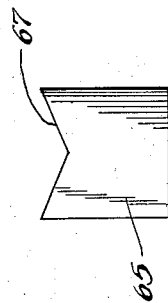
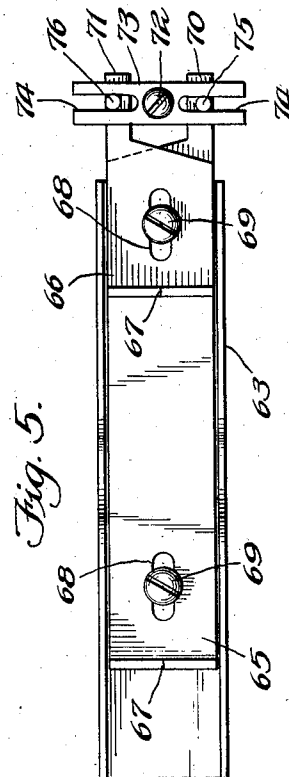


Fig. 5.



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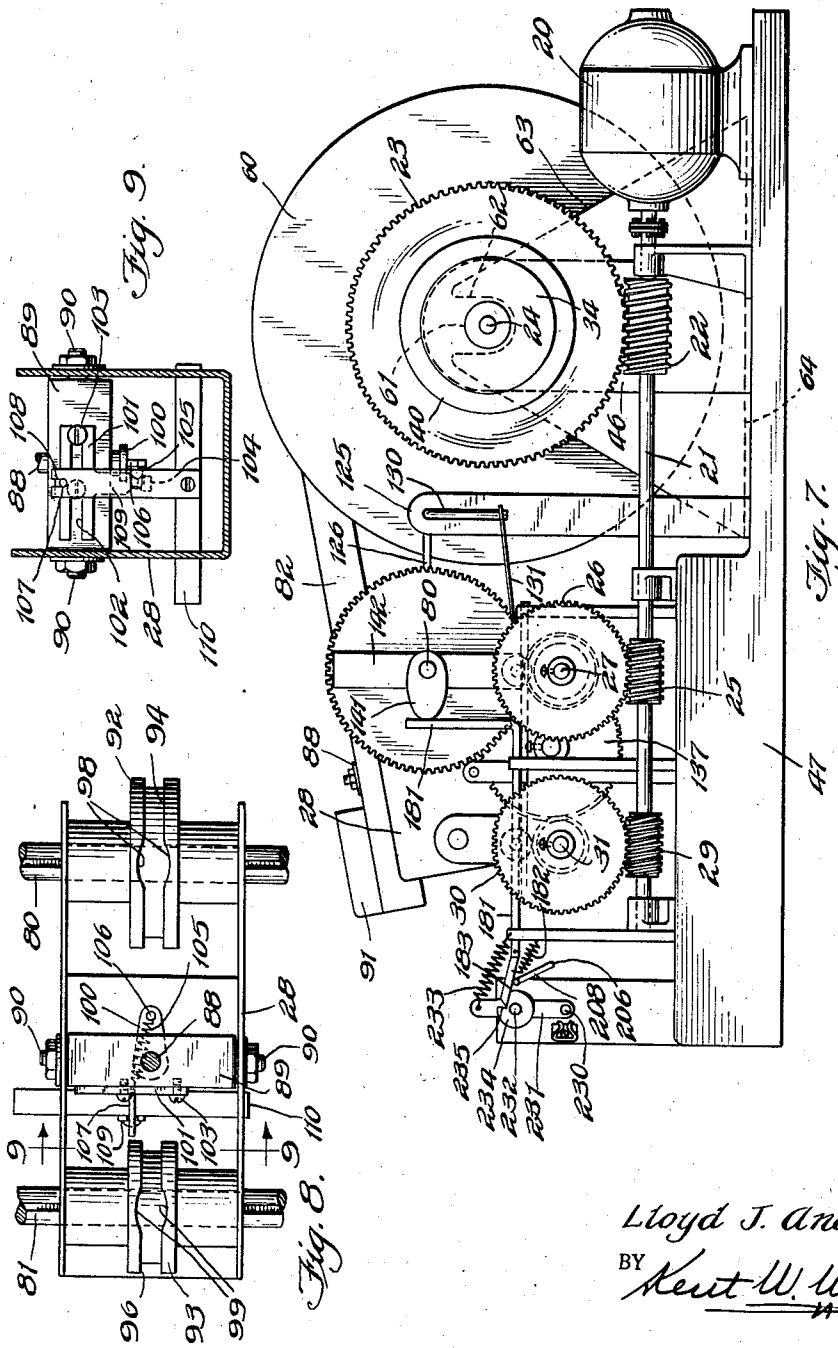
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AUTOMATIC PHONOGRAPH

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6 Sheets-Sheet 4



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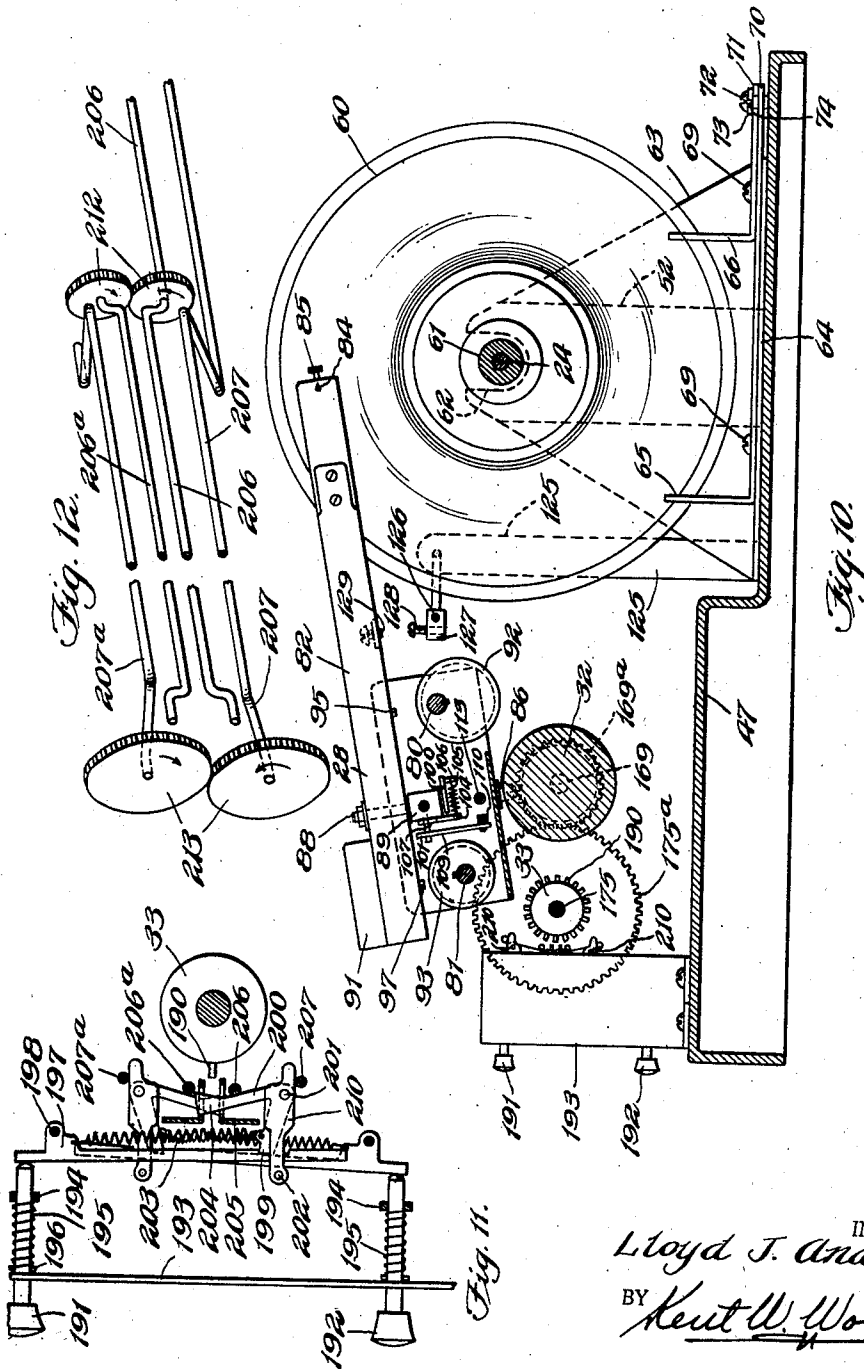
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6 Sheets-Sheet 5



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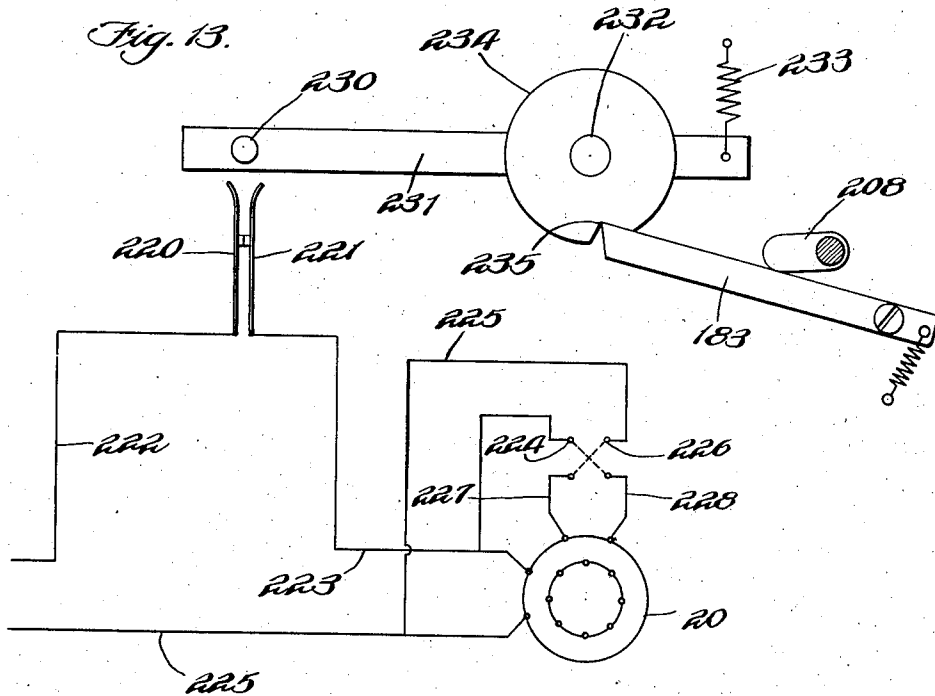
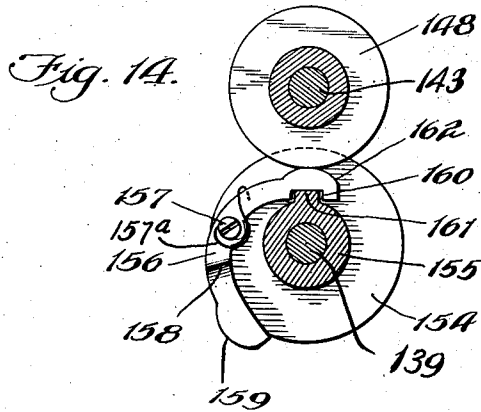
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AUTOMATIC PHONOGRAPH

Filed Sept. 14, 1936

6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

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AUTOMATIC PHONOGRAPH

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Application September 14, 1936, Serial No. 100,584

41 Claims. (Cl. 274—10)

This invention relates in general to a phonograph and has more particular reference to a selective rotary record type of mechanism in which the records are held in spaced apart position so that a sound pick-up mechanism may be inserted between any adjacent records for playing a record selection on either side of any record.

An important object of the invention is therefore in the provision of a multiple record holder in which the records are mounted upon a single shaft with which all of the records are rotatable when any one of them is played.

Other and further objects of the invention are: to provide a mechanism which will select and play both sides of a plurality of standard records without the attention of an operator after the selection is made; to provide a record holder in which either side of the record may be played without transferring the record to a separate turntable or holder; to provide a tone pick-up arm having two needles for playing opposite sides of records which will double the time usually required for replacement of the needles; to provide an inertia factor in the mounting of all records upon a single holder which stabilizes the rotation of any record which is being played; to provide a multiple record holder in which records may be removed or replaced with ease and automatically aligned by the insertion of the main driving shaft; to provide a mechanism in which a relatively short space of time elapses between the finish of one selection and the beginning of a subsequent selection; to provide a machine in which the reproducer arm and the records will not be damaged by rough handling in moving or shipping; to provide a machine with a minimum number of adjustments; to provide a mechanism in which the reverse side of any record is automatically played through the action of a simple reversing switch; to provide a phonograph mechanism which will play both sides of successive records in progressive sequence at one setting; to provide a mechanism in which a simple cut-off adjustment is provided for each individual record; and in general to produce the mechanism herein shown and described.

In the accompanying drawings illustrating a preferred embodiment of the invention,

Fig. 1 is a plan view of the playing mechanism;

Fig. 2 is a somewhat diagrammatic view of the parts shown in Fig. 1 in spaced apart relation to more clearly illustrate the necessary structure and operation;

Fig. 3 is a sectional view of the record holder;

Fig. 4 is a transverse sectional view through one of the record holders of Fig. 3;

Fig. 5 is a plan view of one of the record holders;

Fig. 6 is an end view of one of the record holder supports;

Fig. 7 is an end view of the mechanism in Fig. 1 showing the driving connections;

Fig. 8 is a detail plan view illustrating the needle pressure movement of the tone arm;

Fig. 9 is a sectional view taken on the line 9—9 of Fig. 8;

Fig. 10 is a sectional view taken through the machine and the tone arm thereof;

Fig. 11 is a detail view illustrating the selector mechanism for the selection at both sides of one record;

Fig. 12 is a perspective of the selecting latch mechanism;

Fig. 13 is a diagram showing the electrical connections and switch operations; and

Fig. 14 is a detail view of the two-way clutch mechanism.

General structure.—This invention comprises a mechanism having a rotatable holder for a number of records rotatable together in opposite directions and spaced apart so that a movable tone arm may be inserted therebetween which carries two needles for engaging the selection on either face of any record.

The pickup arm carriage is moved parallel with the record shaft and is raised and lowered between adjacent records and the two needles are provided to engage opposite faces of two records without moving the carriage to a new position. As an alternative two separate pickup arms may be arranged on the pickup arm in the form of a fork so as to straddle and play both sides of a selected record without movement to a new position.

As the direction of rotation of the records must be in opposite directions to play selections on their opposite sides, all rotating parts are reversible without destroying the selective function of the mechanism. The selector latches may be actuated manually or by the use of electromagnets energized from a distance or by the impact of coins utilizing conventional multiple chutes. It will also be understood that the vibrations picked up by the tone arm may be electrically transmitted by means of flexible conductors to an appropriate amplifier and loud speaker system (not shown).

Referring more particularly to the drawings, a reversible electric motor 20 has a driving shaft 21

connected by a worm pinion 22 with a driving gear 23 for a record holder shaft 24; a worm pinion 25 meshing with a gear 26 connected to a shaft 27 for actuating a tone arm carriage 28; and a worm pinion 29 meshing with a gear 30 secured to a shaft 31 for operating a tone arm drive cam 32 and a selector drum 33.

Rotary record holder.—At one end of the record holder shaft 24 is a hand wheel 34 secured thereto and the other end of the shaft is threaded and formed with a pointed extremity 35. At the hand wheel end is a bearing 36 through which the shaft is inserted until a reduced portion 37 of the bearing abuts the hand wheel. Mounted on the reduced portion is the driving gear 23 which has a contact plate 38 at one side secured to the bearing 36 by a set screw 39 and at the other side of the gear is a frictional contact plate 40 engaging the gear and having a projection 41 engaging a keyway 42 on the reduced portion 37 of the bearing so that it will not rotate with respect to the bearing 36. To press this plate 40 yieldingly against the gear 23 the outer end of the reduced portion 37 is threaded to receive a nut 43 which engages the central portion of a spring 44 mounted on this reduced portion 37 having its outer edge or ends bearing against the outer portion of the plate 40 so that tightening the nut against the spring clamps the gear 23 yieldingly between the plates 28 and 40.

This bearing 36 is mounted in a bearing sleeve 45 carried by a standard 46 supported on a common base 47. At its inner end the bearing has an enlarged portion 48 which limits its movement with respect to the support 46 and permits the insertion and removal of the shaft 24 without disturbing its mounting.

At the other end of the shaft is a bearing block 49 having a threaded bore to receive the correspondingly threaded end of the shaft, and a flange 50 at its inner end to limit the movement of the block with respect to a bearing sleeve 51 carried by a bearing support 52 also mounted on the base 47.

Mounted at the top of the support 52 is a headed plunger 53 adapted to engage slots 54 at the end of bearing block 49 when the plunger is pressed inwardly against the tension of a spring 55 which tends to hold it out of such engagement with the slots.

Mounted on the shaft intermediate the bearings are spacers 56, 57 and 58 by means of which a number of records 60 are clamped in position along the shaft.

Each record is placed between clamping faces of adjacent spacers and each spacer has a reduced neck 61 adapted to be engaged by a notch 62 at the upper end of a spacer support 63 which has a bottom portion 64 adapted to be upheld and secured to the supporting base 47.

Adjustably mounted in the spacer support are record supports 65 and 66 each having a base portion and an upwardly extending portion with a central notch 67 movable below a record to position the central perforation of a record so that it is approximately in alignment with the axis of the shaft 24.

These supports 65 and 66 are provided with slots 68 through which fastening screws 69 extend for securing them to the base 47 once they have been adjusted properly in position for any record, and the ends of these supports are provided with extensions 70 and 71 at opposite sides of a central pivot 72 extending into the base 47 upon which is mounted a bar 73 having oppo-

site slots 74 for engaging projections 75 and 76 at the ends of the extensions 70 and 71 respectively.

This structure provides an easily adjusted means for varying and supporting extremities of the holders 65 and 66 toward and from each other at the same time.

These record holders, together with the spacer holders, are secured to the base in proper record holding position between the bearings for the shaft 24. To insert a new set of records the shaft 24 is removed by disengaging the threaded end from its bearing 49 by pressing the plunger 53 into engagement with one of the slots 54 and turning the hand wheel 34. The removal of the shaft allows the spacers and records to drop slightly until they are engaged by their respective supports 63, 65 and 66. Any one or all of the records may then be removed, changed in position, and new ones substituted in their respective supports. The insertion of the shaft 24 engages the central perforations of all of the records and lifts them and the spacers from their supports because of the pointed extremity 35 which easily engages the perforations of the parts and raises them slightly so that they are free from contact with the supports. The shaft is tightly threaded in its bearing 49, clamping the records and spaced parts together between the bearings on the shaft.

The gear wheel 23 drives the record assembly through the friction provided by the plates 38 and 40 which are under the tension of the spring 44. As it is necessary to reverse the direction of the driving shaft and the motor this friction drive is employed to eliminate excessive shock from the driving motor which would result from the inertia of the rotating records.

Pickup carriage.—Slidably mounted on two slotted shafts 80 and 81 is the pickup carriage 28 which carries a pickup arm 82 adapted to extend between any two adjacent records 60 and having oppositely inclined pickup needles 83 and 84 at its free extremity adjustably secured in place by one or more fastening screws 85. The pickup carriage preferably comprises a U-shaped metal plate carrying a bottom projection with a follower roller 86 adapted to engage in a continuous spiral cam groove 87 in the spiral cam 32. Rotation of the cam moves the carriage along the rods 80 and 81 which extend transversely through the carriage.

The pickup arm is mounted upon a substantially vertical pivot shaft 88 mounted in a trunnion block 89 extending transversely of the carriage 28 and mounted at the ends upon pivot screws 90 so that the arm is free to rotate with the trunnion in an up and down movement between and with relation to the record discs. The arm is statically balanced by a counterweight 91 so that the movement of the tone arm for playing with the needle in the spiral grooves of the record is restricted only by the slight friction of the pivot screws 90.

Pickup arm movement.—Mounted upon the shafts 80 and 81 within the carriage 28 are eccentric cams 92 and 93 having a keyed engagement with the shafts so that they can be rotated with the shafts regardless of the position of the carriage as determined by the movement of the cam 32. The cam 92 has a groove 94 for engaging a follower pin 95 at the bottom of the pickup arm 82 and the cam 93 has a groove 96 for engaging a follower pin 97 at the under side of the tone arm 82. The opposite sides of the cam 75

groove 94 are formed with recesses 98 and the opposite sides of the cam groove 96 are formed with recesses 99 so that the follower pins 95 and 97 engageable in the grooves will permit a lateral movement of the tone arm about the axis of its pivot pin 88 for playing purposes.

The tone arm cams have two limiting positions 180 degrees apart and as shown in Fig. 10 they are in the playing position in which the follower pins 95 and 97 are free from engagement with the cams. In the rest position the cams are both rotated 180 degrees and as they are eccentric to their shafts the cam 92 engages the tone arm 82 and raises the needle end out of engagement with the records so that the carriage may be moved to set the tone arm in position for any selected record; the cams are then rotated approximately to the positions shown in Fig. 10, and as the direction of rotation of the cams is dependent upon which side of the record is to be played, the action of the cam 93 in contact with its follower pin 97 causes the pickup arm to assume the start of play position adjacent the rim of the selected record 60.

The shafts 80 and 81 are driven at the same speed and in the same direction by sprockets 111 of the same size attached to the shafts and connected by a sprocket chain 112, and the shafts are positioned at opposite sides of the cam 32.

Lateral tension of the pickup arm.—To provide proper needle pressure a toggle mechanism is mounted on the carriage and in connection with the recesses in the cams 92 and 93 provides the necessary movement and pressure.

At the bottom of the pickup arm pivot shaft 88 is attached an arm 100 located below the trunnion block 89 and projecting at one side thereof. Attached to the other side of the block is a plate 101 having slots 102 through which screws 103 extend for holding it in connection with the block but permitting its sliding movement. Extending below the plate is a projection 104 with a spring 105 attached at one end to the projection 104 and at the other end to a projection 106 at the end of the arm 100.

Also projecting from the plate 101 is a pin 107 engageable in a slot 108 at the upper end of an arm 109 attached at its lower end to a plunger 110 extending through the sides of the carriage 23. When the plunger is moved to the left as shown in Fig. 9 the slotted arm engages the pin 107 and moves the sliding plate 101 which carries the spring 105 past the center of the pivot shaft 88 thus causing the spring to exert a lateral pressure on the arm 100 which in turn gives a pressure to turn the needle end of the tone arm 82 toward the left in engagement with the record at that side.

When the plunger 110 is moved in the opposite direction, a reverse action takes place and pressure is exerted to turn the tone arm in the opposite direction.

When the tone arm is moved by the cams 92 and 93 to the start of play position, the recesses 98 and 99 in the cams are moved so that the contact pins 95 and 97 are adjacent thereto which permits a sufficient lateral movement of the tone arm under the pressure of spring 105 to move either pin 93 or 94 yielding into engagement with the proper record.

When the tone arm is at the lower end of its movement at the inner end of a record, the follower pin 95 engages in the groove of cam 92 and the first movement of the cam centers the tone arm between any two adjacent records

and moves it out of contact therewith so that the tone arm may then be raised beyond the periphery of the records so that it can be moved to a new selected position by its carriage.

Reversing switch.—Also extending loosely through the carriage at one side of the plunger 110 is a reversing rod 113 which carries adjustable limit stops 114 and 115 in the path of movement of the plunger 110 so that the plunger will be engaged at either end of its movement by one of the stops.

One end of the rod 113 is attached intermediate the ends of a lever 116 mounted upon a pivot 117 at one end and having a slot 118 at the other end for engaging a pin 119 on the operating arm 120 of a motor controlling switch 121. Also attached to a projection 122 on the lever 116 to which the rod is also connected is one end of a spring 123, the other end of which is attached to a fixed projection 124 just beyond the pivot 117, and the movement of the rod is sufficient so that when engaged by the plunger 110 of the carriage, the spring is pressed over the pivot center 117 causing the lever 116 and the switch arm 120 to act as a toggle connection, cushioning the movement of the bar 113 and holding the switch either in one position or in the other, and thereby reversing the electrical switch connection to the motor 20.

Stop mechanism.—Mounted in upright supports 125 carried by the base 47 at the ends of the records is a cut-off bail 126 with crank ends positioned below the pickup arm 82 and having a number of adjustable stops 127 connected thereto, one for each record. Each stop member 127 has a separately adjustable screw 128 for engaging a stop screw 129 carried by the pickup arm 82, the screws 128 being separately movable to provide a different cut-off for each record.

At the motor end of the bail 126 is a crank arm 130 connected by a link 131 with one end of an opening lever 132 mounted on a pivot 133 intermediate its ends and having a projection 134 at the opposite end for actuating a clutch tripping latch 135. This lever 132 is pulled in a direction to restore the bail 126 by a spring 136 attached at one end to the lever and at the other end to a fixed portion of the machine.

As soon as the stop bail 126 is engaged by the pickup arm at the end of any record the movement of the bail cuts off the current to the motor as hereafter set forth, but not before the pickup arm 82 is centered and raised out of engaging position by its cams 92 and 93.

Carriage cam drive.—One of the carriage cam drive shafts 80 has a gear 137 secured to it and meshing with a pinion 138 secured to a shaft 139 which is connected to the drive shaft 27 by a two-way clutch 140.

Secured at the end of shaft 80 are restoring cams 141 and 142, the former having a single lobe or projection and the latter having two opposite projections approximately 180 degrees apart.

For controlling the clutch 140 a bar 143 is mounted for endwise movement in a fixed guide 144 and one end is engaged by one arm of a bell crank 145 the other end of which is engaged by a link 146 which bears against the double lobe cam 142.

A collar 147 slidably mounted on the bar 143 has a flange 148 for operating the clutch 140. To this collar is pivoted the latch bar 135 having

a tooth 149 for engaging a beveled collar 150 secured to the bar 143 with a spring 151 between the beveled bar 143 and the guide 144 tending to press the collar against the bell crank 145 and with a spring 152 between the fixed collar 150 and the movable collar 147 and considerably weaker than the other spring 151.

The pivoted latch bar 135 is held in latched position by a spring 153 inserted between the collar 147 and the adjacent end of the bar and the free end of the latch bar extends a sufficient distance beyond the engaging pin 134 to permit the movement of the bar 143 without disengaging the latch bar 135.

The clutch 140 (see also Fig. 14) comprises a clutch plate 154 secured at the end of shaft 27 and a toothed clutch member 155 secured to the end of the shaft 139. To the plate 154 a latch 156 is pivoted intermediate its ends upon a pivot 157 and having an offset 158 at one side of the pivot and a projection 159 at this end out of line with the other end in which is an inner notch 160 for engaging a tooth 161 on the clutch member 155. A spring 157a tends to hold this lever so that the notch 160 is in engagement with the tooth 161. The portion opposite the notch has a projection 162 corresponding to that on the tail piece so that when the flange 148 of the adjacent clutch operating bar is in line with the notched end of the latch it will press it into engagement with the tooth 161 in either direction of rotation and when the flange 148 is opposite the other end 159 it will knock the latch out of such engagement for either direction of rotation of the driving shaft 27.

Record cam drive.—A similar two-way operating clutch 165 connects the driving shaft 31 with a driven shaft 166 to which is secured a driving pinion 167 meshing with a gear 168 secured to a shaft 169 upon which the record cam 32 is mounted.

Rotation is imparted to the selector drum 33 from shaft 169 by a spiral pinion 170 on shaft 169, a gear 171 on a cross shaft 172, and a pinion 173 on shaft 172 meshing with a gear 174 on shaft 175 upon which the selector drum is mounted.

Instead of this driving connection the cam 32 may be directly connected to the drum 33 by means of a gear 169a mounted on the shaft 169 for the cam 32 and meshing with a gear 175a secured to the shaft 175 on which the drum 133 is mounted.

The clutch 165 is operated by the same kind of a mechanism as described in connection with the clutch 140, including a collar flange 176, a latch member 177 pivoted thereto, and a bar 178 on which the collar is mounted. The bar is engaged by a bell crank 179 having a pin and slot connection 180 with a switch restoring rod 181 which is slidably mounted and held in contact with restoring cam 141 by a spring 182 connected to a latch 183 pivoted at the end of the rod. The latch 177 is also actuated against its retaining spring by a lever 184 having a pivot 184a intermediate its ends and having a projection 184b at one end to engage the tail piece of the latch bar 177 and having a pin and slot connection 185 at the other end with a controlling bar 186 which also carries a projection 187 for operating the latch bar 135 for the other clutch 140.

Thus the record cam 32 and the selector drum are driven in timed relation from the motor shaft and in opposite directions depending upon the direction of rotation of the driving motor 20.

Record selector mechanism.—The record selector drum comprises a number of spaced projections 190 spirally arranged about the drum and one for each of the selections on both sides of the records 60. The selector mechanism as shown in Figs. 11 and 12 comprises a plurality of push buttons arranged in upper and lower sets 191 and 192 and corresponding to the selections on the left and right hand faces of the records as they are mounted in the record holder. The latch mechanism corresponding to the right hand faces is inverted with respect to that of the left hand faces and the inverted selector mechanisms are alternately spaced with respect to the opposite ones. Each selector mechanism comprises a push button 191 (or 192) extending through a front plate 193 and a rear guide plate 194 and having a spring 195 mounted on the push button and bearing against the guide 194 at one end and against a bearing pin 196 at the other end tending to hold the push button outwardly.

The inner end of each push button engages one end of a lever 197 mounted on a pivot 198 adjacent its upper end and having a notch 199 at its other end for engaging one end of a bell crank 200 pivoted at its angle upon a bearing pin 201 near the free end of an arm 210 which is mounted upon a pivot 202 at its other end. A spring 203 is connected at one end to the lever 197 adjacent its pivot and at the other end to the notch engaging extremity of the bell crank 200. The other end 204 of the bell crank 200 is movable in the slot of a guide 205 into and out of the path of its particular projection 190 carried by the selector drum 33.

When the push button is operated the lever 197 is moved to release the bell crank latch 200 moving its extremity 204 into the path of its projection 190 on the selector drum where it is held resiliently by the spring 203. If the drum is rotated in a clockwise direction (Fig. 11) the projection 190 will simply engage the extremity 204, rocking the bell crank outwardly against the tension of its spring 203, but if the drum is rotated in the opposite direction the projection 190 will engage the end 204 of the bell crank, pressing it and its mounting arm downwardly for operating it.

These movements of the bell crank and its supporting arm cause the operation of an inner crank 206 which engages the side of the arm 204 of the bell crank, and an outer crank 207 which engages below the outer or free end of the arm 210. The crank 206 has an extension with a crank arm 208 for engaging the switch operating latch 183 (Fig. 2) and the crank 207 has an extension with a crank 209 (Fig. 1) for operating the controlling bar 186 against the tension of its restoring spring 211. The restoring spring 211 and the restoring spring 182 of the switch tend to return the cranks 207 and 206 respectively to their at rest or unoperated position.

Selector operation.—As a record selector drum is rotated in opposite directions the selector latches the operating buttons for the ten upper selectors correspond to the selections on the right hand sides of the record 60 but the lower ten selectors and corresponding push buttons 192 are the same as the upper latches and mechanism but are simply inverted and correspond to the selections on the left hand sides of the records. As the upper and lower selector buttons are alternately spaced, the selector buttons are in the same order as the selectors on the records.

As the upper set of latches is simply inverted with respect to the lower set of latches, a separate description of the latches is not required but the upper set of latches does require an inner crank 206a corresponding to the crank 206 and an outer crank 207a corresponding to the crank 207 for simultaneous movement and operation. The cranks 206 and 206a are therefore connected by gears 212 (Fig. 12) and the cranks 207 and 207a are connected by gears 213.

Thus when any one of the upper or lower selector latches are operated, the cranks 206 and 206a are engaged and moved to actuate the switch releasing pawl 183 and when the projection 190 for any one of the selected records engages the corresponding latch arm, in the proper direction, the latch together with its supporting arm 210 is moved outwardly, actuating the crank 207 (or 207a) to operate the bar 186.

Motor operating circuit.—Any suitable switch closing mechanism may be used for controlling the motor in connection with the reversing switch 121. A somewhat diagrammatic arrangement is shown in Fig. 13 which comprises spaced contacts 220 and 221 having conductors 222 and 223 connected to a source of power and to one central contact 224 of a reversing switch respectively. Another conductor 225 extends from the source of power to the other central contact 226 of the reversing switch. Conductors 223 and 225 are connected directly to motor terminals and conductors 227 and 228 are also connected to the motor and are reversed by the switch for reversing the direction of rotation of the motor in a well known manner. The reversing switch is operated by the arm 120 in connection with the operating bar 113 as previously explained.

The circuit closing switch comprises a contact 230 for engaging between and connecting the contact members 220 and 221 and thereby closing a circuit from the source of power to the motor for operating it in either direction as determined by the position of the reversing switch. This contact is carried at one end of an arm 231 mounted on a pivot 232 intermediate its ends and having a spring 233 attached at its other end and drawing it in a direction to close the circuit between the contacts 220 and 221. Mounted on the lever or forming a part of it is a disc 234 having a notch 235 engaged by the end of the spring pressed latch 183 which in turn is operated to push the latch out of the notch by the crank arm 208 of the crank 206. When the latch is pushed out of engagement with the notch 235 the spring 233 moves the contact 230 to make the electrical connection starting the motor. When the playing of a selection is complete the cam 141 on the shaft 80 is moved to engage the end of the operating bar 181 against the tension of spring 182 which causes a movement of the latching pawl 183 and the engagement of the end of the pawl with the notch 235 pushing the lever 231 so that the contact 230 is moved out of engagement with the fixed contacts 220 and 221.

Summary of operation.—Assuming that the machine has just played a right hand selection on one of the records and is at rest the following conditions are found in the machine; (a) all selector latches are restored; (b) clutch 140 is disengaged; (c) clutch 165 is engaged; (d) clutch latches 135 and 177 are in latched position; (e) motor switch is held in open position by latch 183; (f) reversing rod 113 and reversing switch is in its right hand position.

Assuming now that it is desired to play the left

hand selection of record number six the following actions take place:

The operator trips the latch for the left hand selection on record number six by pressing the corresponding lower push button 192. This operation actuates the crank 206 and moves the switch pawl 183 by means of its crank arm 208 disengaging the pawl from the switch lever 231 which permits the spring 233 to rotate the switch lever and its contact 230 to close an electrical connection to the motor 20.

The driving motor starts and runs in a counter-clockwise direction facing the shaft end of the motor because of the right hand position of the reversing switch arm 120.

This rotation of the motor causes a counter-clockwise rotation of the record shaft 24 and the records mounted thereon as viewed from the right hand or motor end of the shaft.

The spiral carriage operating cam 32 is rotated in a clockwise direction with respect to the motor end of the cam which moves the pickup carriage 28 to the left. This rotation is transmitted from worm wheel 30 through shaft 31, clutch 165, shaft 166, gears 167 and 168, and shaft 169 to the cam 32. One rotation of the cam moves the pickup carriage from one playing position to the next adjacent playing position and there is a sufficient overrun of the cam groove 87 at each end to add sufficient movement to the pickup carriage to operate the reversing rod by means of the plunger 110.

The selector drum 33 is rotated in an opposite or counter-clockwise direction by means of the driving connection between the shafts 169 and 175 for the spiral cam and selector drum respectively. The pickup carriage is moved from one end of the cam 32 to the other end thereof while the selector drum 33 makes one complete rotation so that there is a definite timing relation between the spiral cam and the selector drum.

As the left hand selection of record number six requires a clockwise rotation of the selector drum 33, the selector latch will not engage its corresponding selector lug 190 until the drum 33 rotates in a clockwise direction.

As the pickup carriage moves to its extreme left hand position the plunger 110 engages reversing stop 114 and because the toggle spring 105 in the carriage is weaker than the reversing toggle spring 123, the plunger 110 moves to the right hand position throwing the needle tension in the proper direction for playing the left hand side of the records. Continued movement of the pickup carriage finally overcomes the resistance of the toggle spring 123 and the reversing rod is thrown over to its left hand position which operates the reversing switch and reverses the direction of rotation of the driving motor and all of its connected rotating parts.

The records are now rotating in a clockwise direction as referred to the driving end of their shaft 24, and the rotation of the other parts as described is correspondingly reversed.

The record carriage now travels toward the right until the lug number six on the selector drum 33 engages the number six selector latch. As the latch is moved by the rotation of the drum the following actions take place:

a. The common selector operating shaft 207 70 is rotated by its connection with the crank 207a and the connected gears 213, and the crank arm 209 actuates the controlling bar 186 tripping the clutch latches 177 and 135;

b. The lowering of the latch bar 177 now 75

allows the spring 152 to move the operating collar so that its flange 176 is in its right hand position to engage the operating lever of the clutch 165 to release the clutch for disconnecting the shaft 166;

5 c. The spiral cam 32 and the selector drum 33 now cease rotating and the pickup carriage 28 is at rest in its playing position between records five and six;

10 d. When the latch bar 135 of the clutch 140 is operated by the selector bar 186, the collar 147 moved to its right hand position which caused the engagement of the clutch 140 connecting the shaft 139 for rotation by means of the shaft 27;

15 e. Just before the selector drum 33 ceased rotating the selector latch number six was restored to its normal position by the returning action of the spring 211 on the operating bar 186 and its movement of the crank rod 207 of the selector mechanism.

20 Shafts 80 and 81 are now rotated in the same direction at the same rate of speed by pinion 138 on shaft 139 which meshes with gear 137 on shaft 80.

25 The rotation of the pickup arm lowering cam 92 allows a downward movement of the tone arm and the similar rotation of the cam 93 rotates and lowers its surface downwardly from the arm 82 to provide sufficient clearance for the playing action of the cam 82.

30 Near the end of the 180 degrees rotation of cam 92, the follower projection 97 enters the left side recess 99 of its cam 93 because of the action of the spring 105 and thus moves the needle 84 into contact with the first playing grooves in the left side of record number six.

35 During the first ninety degrees of rotation of the shaft 80 the spring 151 of the clutch bar 143 applied pressure by means of the bar to the bell crank 145 and thence through push rod 146 in contact with cam 142 which caused the shaft 143 to assume its extreme right position and permitted latch 135 to re-engage with its collar 150.

40 During the next ninety degrees of rotation of the shaft 80 the cam 142 moves the push rod 146 and bell crank 145 to restore the shaft 143 to its first position at the same time moving the collar 147 because the bar 135 was latched with the collar 150. This latter movement causes the clutch 140 to be thrown out of engagement, thus stopping the rotation of the shafts 80 and 81.

45 The first 180 degrees rotation of shaft 80 causes the restoring rod 181 to move to its rearmost position which permits the latch 177 to engage with its collar 150 and also retrieves the pawl 183 sufficiently so that the next forward movement will cause the pawl to engage with the latch disc 234.

50 The needle 84 is now in engagement with the playing grooves of the left side of record number six and the pickup arm is being moved downwardly as the record is played.

55 As the needle approaches the last playing grooves of the record the cut-off stop 129 engages with the set stop on the cut-off crank 126 which overcomes the slight tension of spring 136 and permits the link 131 and lever 132 to again trip the latch lever 135 which causes re-engagement of the clutch 140 which connects the shafts 27 and 139 for operating the cam shafts 80 and 81.

60 This rotation of shafts 80 and 81 rotates the cams 92 and 93 for engaging the pickup arm 82,

first centering the arm between the records as the projections 95 and 97 move out of the cam recesses 98 and 99 and then raising the arm from between the two adjacent records.

During the return 180 degrees rotation the switch restoring rod 181 moves the clutch bar 178 to the left by means of the bell crank 179 which is timed to cause a re-engagement of the clutch 165.

At the end of this same 180 degrees rotation the switch restoring rod 181 moves the switch pawl 183 to engage in the notch 235 of the switch operating disc on the lever 231 which opens electrical connections between the contacts 222 and 223 and thereupon stops the motor 20 so that the machine is again at rest ready for a subsequent operation.

Other conditions.—When the side of a record is played opposite to that as described, the motor and the shafts 80 and 81 are driven in reverse directions. The pickup, lowering and raising operations are the same because the cams 92 and 93 are symmetrical in design which permits 180 degrees rotation in either direction to accomplish the same result.

When a plurality of selector latches are tripped by the operation of the buttons 191 or 192, record sides corresponding to these latches will be played in sequence as the selector drum 33 is rotated. Only when the last selector latch is restored will the selector switch release crank 208 permit the pawl 183 to engage with the switch arm latch 234 and thus open the drive motor circuit.

The selector latches and the operating buttons therefor are arranged to begin at the left and numbered consecutively, the number one button corresponding to the left side of record number one, the number two button corresponding to the right side of record number one, number three corresponding to the left side of record number two, and so on. Thus both sides of successive records may be played in progressive sequence.

The selector latches may be actuated manually or by use of electro-magnets energized from a distance or by the impact of separate coins utilizing conventional multiple chutes.

With this construction it is also possible to accommodate records of different sizes in the holder, the tone arm being lifted sufficiently to clear records of the largest size. Variation of the needle setting and cut-off is separately made for each record so that an adjustment once made for any record may be continued as long as that record is carried by the holder.

I claim:

1. In a multiple record phonograph, a rotatable shaft and means for mounting a plurality of disc records thereon at spaced distances apart, the records having selections to be played on both faces thereof; a tone arm movable between adjacent records having needles fixed thereto for playing records at opposite sides, and means including a movable carriage for mounting the tone arm and a spring on the carriage for engaging and pressing the entire tone arm in either direction until a needle engages a record depending upon which of the two record faces between which the tone arm is placed is to be played.

2. A phonograph according to claim 1 in which the records are rotatable in opposite directions, and the two needles are mounted directly upon the tone arm and are inclined oppositely to engage record grooves at opposite sides depending

upon the direction of rotation and said last named means comprising a single spring having an arm to which it is connected on the carriage movable in opposite directions to apply the tone arm.

3. In a multiple record phonograph, means for mounting a plurality of records for joint rotation, including a shaft and a bearing member therefor at one end, a driving motor and a gear driven thereby freely mounted on the bearing member, a plate fixed to the bearing member adapted to engage the gear and form an abutment therefor at one side thereof, another plate fixed to rotate with the bearing member but movable axially thereon to engage the opposite side of the said gear, and means for pressing the movable plate against the gear and the gear against the fixed plate to confine the gear yieldingly between the plates, thereby forming a frictional drive between the motor and the records.

4. In a multiple record phonograph, a rotatable shaft, spacing means between which the records are mounted on the shaft, a bearing block at one end of the shaft movable to press said means together, and end bearings on the shaft between which records and said spacing means and bearing block are clamped by the movement of the bearing block in its end bearing for holding the records in place.

5. In a multiple record phonograph, a record holder comprising a rotatable shaft to extend through the central hole of disc records, spacing clamps free on the shaft for engaging the opposite central portions of records, bearings at the ends of the shaft, one fixed at one end, and the other end of the shaft being threaded into its bearing, the bearing engaging and clamping spacers and records together on the shaft between the bearings.

6. In a multiple record phonograph, a record holder comprising a shaft pointed at one end for removable insertion through record center holes, a plurality of record clamps between which the records are confined having central holes through which the shaft extends, a plurality of supports positioned below the shaft for engaging the clamps when the shaft is removed and holding them substantially in the same position to be engaged by the pointed end of the shaft and lifted free from the supports when the shaft is inserted, and end bearings for the shaft which holds the clamps above their supports.

7. In a multiple record phonograph, a record holder comprising a removable shaft, a plurality of centrally perforated disc records and centrally perforated clamps therebetween through which the shaft extends, and a plurality of supports for the records and clamps extending free of the lower edges thereof when mounted on the shaft and supporting them in place to be re-engaged by the shaft when it is removed.

8. In a multiple record phonograph, a record holder comprising a removable shaft, a plurality of perforated disc records through which the shaft is inserted, and a support for holding each record from below in position to be engaged for inserting the shaft therethrough comprising edge engaging members at opposite sides below the record having adjacent extremities, and means to engage the extremities for moving the edge engaging portions oppositely to adjust the support for records of different sizes.

9. In a multiple record phonograph, a record holder comprising a rotatable and removable shaft, means for removably clamping a plurality

of records on the shaft comprising a bearing member into which one end of the shaft is threaded, a fixed bearing support in which the bearing member is rotatable, and a plunger movable through the support into contact with the bearing member to hold it from rotation for inserting and removing the shaft.

10. In a multiple record phonograph, a plurality of disc records and spacers, a shaft inserted therethrough, a threaded bearing member into which the shaft is inserted at one end, a bearing member through which the shaft extends at the other end and against which the records and spacers are clamped by the other bearing member, a motor rotatable in either direction, and a friction drive for the shaft comprising a gear driven by the motor and freely mounted on the second bearing member, and a spring pressed contact plate engaging the gear and rotatable with the second bearing member.

11. In a phonograph, a shaft for rotatably carrying a plurality of spaced records thereon, a tone arm movable between adjacent records, a reciprocable carriage for also moving the entire tone arm to play either side of any record, a continuous cam means for moving the carriage in both directions, and cam means carried by the carriage and movable to raise the tone arm from a position between the records and to hold it above them when the carriage moves the arm.

12. In a phonograph, means for supporting a plurality of records in spaced apart relation to rotate about a common axis in either direction, a carriage movable parallel to the axis, a tone arm pivoted in the carriage and movable over the playing face at either side of any record, cam means on the carriage to move the tone arm into and out of playing position, and resilient means to press the entire tone arm in either direction depending upon which of the two faces between which the tone arm is placed is to be played.

13. In a phonograph, means for rotatably carrying a plurality of records in spaced apart relation, a tone arm movable between adjacent records, a carriage to move the tone arm, cam means for moving the arm out of playing position, resilient means for pressing the arm in either direction depending upon which of the two faces between which it is placed is to be played, and centering means comprising a projection on the arm and a groove on the cam for engaging the projection to center the arm between two records before it is moved out of playing position.

14. In a phonograph, a plurality of records mounted in spaced relation to rotate upon a common axis, a carriage movable parallel to the axis, continuous cam means for moving the carriage in opposite directions, a tone arm pivoted on the carriage, cams carried by the carriage upon an axis other than that of the arm and movable to raise and lower the tone arm between the records, and means for rotating the cams in either direction to effect either the raising or lowering of the tone arm.

15. In a phonograph, a plurality of records mounted in spaced relation to rotate upon a common axis, a carriage movable in either direction parallel to the axis, a tone arm movably mounted in the carriage to raise and lower, cams mounted in the carriage at opposite sides of the tone arm mounting and movable in either direction from their limiting positions to press the tone arm in either direction and operating means

for moving the carriage in either direction and also for moving the cams in either direction from their limiting position to effect the same movement of the tone arm, the direction of movement of the cams depending upon the direction of movement of the carriage.

16. In a phonograph, a plurality of records mounted in spaced relation to rotate upon a common axis, a carriage movable parallel to the axis, a tone arm pivoted on the carriage, cams carried by the carriage at opposite sides of the tone arm pivot and movable to raise and lower the tone arm, means for selecting a record to be played, and operating means actuated by the selecting means for operating the cams to lower the tone arm.

17. In a phonograph, a plurality of records mounted in spaced relation to rotate upon a common axis, a carriage movable parallel to the axis, continuous cam means for moving the carriage in opposite directions, a tone arm pivoted on the carriage, cams carried by the carriage and adapted to engage the tone arm at opposite sides of its pivot and movable to raise and lower the tone arm, stop means engaged by the tone arm at the lower end of its playing movement, and operating means actuated by the stop means for raising the tone arm.

18. In a phonograph, a plurality of records mounted in spaced relation to rotate upon a common axis, a carriage movable parallel to the axis, continuous cam means for moving the carriage in opposite directions, a tone arm pivoted on the carriage, cams carried by the carriage at opposite sides of the tone arm pivot and movable to raise and lower the tone arm, reversible driving means, clutch mechanism for connecting the driving means to operate the cams, manually operable means for selecting a record to be played, operating means actuated by the selecting means for engaging the clutch mechanism to operate the cams for lowering the tone arm, and stop means actuated by the tone arm at the end of its playing movement for actuating the same clutch mechanism to again operate the cams to raise the tone arm.

19. In a structure according to claim 18, a controller cam also operated with the other cams and having opposite lobes for timed operation of the said clutch mechanism to release the driving connection as soon as the tone arm cams are operatively moved in either direction.

20. In a multiple record phonograph, a reciprocable carriage, a tone arm pivoted on the carriage, cams rotatable in the carriage for raising and lowering the tone arm and including shafts upon which the carriage is moved, means for rotating the shafts in opposite directions including a clutch connection, a restoring cam on one of the shafts having opposite projections, and means operated by the restoring cam to release the clutch connection upon each half rotation of the shaft in either direction.

21. In a multiple record phonograph, a carriage reciprocable across a bank of spaced records, continuous cam means for moving the carriage in opposite directions, a tone arm mounted in the carriage to swing between any two records, resilient means on the carriage to engage the tone arm tending to swing the entire arm laterally for engagement with the playing grooves of either record between which it is inserted depending upon the direction of movement of the carriage.

22. In a multiple record phonograph, a carriage reciprocable with respect to a bank of

spaced records, a tone arm having a pivot upon which it swings laterally, a block which carries the tone arm and is pivoted in the carriage to swing the tone arm between the records; and means comprising an arm on the pivot, a slidable plate on the carriage moved reversely at the end of the carriage movement in either direction, and a spring connecting the plate and the arm and moved by the plate over the center of the pivot to swing the tone arm to either side and in engagement with either record between which it is inserted depending upon the direction of movement of the carriage.

23. A structure in accordance with claim 22 including a plunger extending to opposite sides of the carriage for actuating the sliding plate, and reversing stops engaging the ends of the plunger at the limits of travel of the carriage.

24. In a multiple record phonograph, a plurality of spaced records mounted for rotation upon a common shaft, a motor for rotating the records in either direction, a tone arm movable between adjacent records, a reciprocable carriage for said arm, resilient means carried by the carriage for pressing the arm toward either side depending upon the direction of movement of the carriage, and a reversing switch for the motor comprising stops at the end of the carriage travel engaged by said means for operating the switch.

25. In a multiple record phonograph, a plurality of spaced records mounted for rotation upon a common shaft, a motor for rotating the records in either direction, a tone arm movable between adjacent records, a reciprocable carriage for said arm, resilient means carried by the carriage for pressing the arm toward either side depending upon the direction of movement of the carriage, push button means manually operable mechanism for predetermining a selection on either side of any record thereby determining the direction in which the carriage is moved prior to the insertion of the tone arm, and reversing switch means for the motor including stops thereon engaged by the carriage at the ends of its path for reversing the direction of record rotation in accordance with the selection.

26. In a phonograph, a reversible motor drive for a plurality of spaced records upon a common shaft and a carriage reciprocable axially thereto, a tone arm mounted on the carriage, resilient means on the carriage to move the tone arm toward one of the record faces depending upon the direction of movement of the carriage, a motor reversing switch comprising an arm and a bar connected thereto having stops thereon engaged by the carriage at the ends of travel thereof for oppositely moving the bar to reverse the switch.

27. In a phonograph, a plurality of spaced records having playing faces on both sides mounted on a common shaft, a reversible motor and a yieldable clutch for driving the records in opposite directions, a carriage and means for reciprocating it axially of the records, and a reversing switch for the motor having a spring pressed operating bar with stops thereon at opposite ends of travel of the carriage and engaged thereby for reversing the direction of rotation of the records when the carriage is moved to reverse the switch and also its own direction.

28. In a phonograph, a plurality of spaced records mounted on a common shaft, a reversible motor and a yieldable clutch for driving the records in opposite directions, a carriage and means for reciprocating it axially of the records, rotating means for the records and for moving the

carriage including a clutch connection with the motor, a tone arm and means carried by the carriage for raising and lowering the arm, a clutch connection with the motor for driving the tone arm means, and clutch operating means for the tone arm clutch to operate the tone arm means to lower the arm to play the record and to raise the tone arm when the playing is completed for either direction of movement of the motor.

29. In a multiple record phonograph, a plurality of records spaced upon a common rotatable shaft, a carriage movable with respect to the records, a tone arm mounted on the carriage to engage the record faces, a record selector comprising a rotatable drum, and push button manually operable means for choosing the selections at opposite sides of the records, the carriage movement depending upon the direction of rotation of the drum.

30. In a multiple record phonograph, a plurality of records spaced upon a shaft rotatable in opposite directions, a carriage reciprocable with respect to the records, means for moving the carriage in opposite directions, a tone arm mounted on the carriage, resilient means on the carriage to move the tone arm to engage one of opposite record faces depending upon the direction of movement of the carriage, a push button manually operable record selector comprising a drum to rotate with the carriage moving means, and means for choosing to play a selection upon either side of any record, said means comprising members engaged by the drum in one direction of movement but not in the other.

31. In a phonograph for playing either side of a plurality of disc records spaced apart upon a common axis and rotatable in opposite directions, a selector drum rotatable in opposite directions, push button manually operable means for choosing the records on opposite sides of the discs, the drum having projections for each of the selections at opposite sides of the discs, and means operative so that the right side faces of the records are selected when the drum rotates in one direction and the left side faces in the other direction.

32. In a phonograph for playing either side of a plurality of disc records spaced apart upon a common axis and rotatable in opposite directions, a selector drum rotatable in opposite directions, push button manually operable means for choosing the records on opposite sides of the discs, comprising two sets of selectors, one for the right and the other for the left faces of the discs; and the drum having operating means for the selectors engaged only when the drum is rotated in the proper direction therefor.

33. In a phonograph for playing either side of a plurality of disc records spaced apart upon a common axis and rotatable in opposite directions, a selector drum rotatable in opposite directions, push button manually operable means for choosing the records on opposite sides of the discs, comprising two sets of selectors one for the right and the other for the left faces of the discs, each selector having an operating lever, a releasable latch lever engaging the operating lever, and an arm on which the latch lever is pivoted, the drum having projections for operatively engaging the released latch in one direction of movement and sliding over the latch without operating it in the other direction of movement.

34. In a phonograph for playing either side of a plurality of disc records spaced apart upon a common axis, a selector drum rotatable in oppo-

site directions, means comprising two sets of push button manually operable selectors for choosing the records on the right and left faces of the discs, each selector having an operating lever, a releasable latch engaging the lever, an arm on which the latch is pivoted and a spring connecting the latch and the lever, and the selectors for the opposite faces being oppositely disposed with respect to the drum so that the release latches of one set of selectors will be engaged by the drum in one direction of rotation, and the other set will be engaged by the drum in the other direction of rotation.

35. In a phonograph for selectively playing either side of a plurality of disc records spaced apart upon a common shaft, a selector drum rotatable in opposite directions having projections corresponding to the selections on both sides of the discs, two sets of push button manually operable selectors for choosing the right and left faces of the discs, each selector having a releasable latch and the latches for opposite sets of selectors being oppositely disposed to be engaged by the drum projectors only in opposite directions of movement thereof, and a pair of crank arms connected together and moved by the latches when any latch is engaged by the drum, and clutch operative means controlled by the crank arms.

36. In a phonograph for playing either side of a plurality of disc records spaced apart upon a common axis, a selector drum rotatable in opposite directions having projections for all of the disc selections, means comprising two sets of push button manually operable selectors for playing the records on opposite sides of the discs, each selector having a releasable latch and an arm on which it is pivoted, and the selectors for opposite sides of the discs being oppositely disposed with respect to the drum so that the respective latches are engaged only by the projections when the drum is rotated in the proper direction, a pair of connected crank arms for engaging the latches of the opposite sets of selectors, and a pair of connected crank arms engaging the opposite arms on which the latches are pivoted, each of the connected pairs of crank arms having a common operating extension for controlling the operation of the drum.

37. In a phonograph for playing either side of a plurality of disc records spaced apart upon a common shaft, a selector drum rotatable in opposite directions and having projections corresponding to the records on both faces of the discs, a common driving motor for the record and drum, means comprising two sets of selectors, one for the right and the other for the left faces of the discs, the two sets of push button manually operable selectors comprising oppositely disposed latches and arms for moving the latches, a pair of connected crank members engaged by the latches and similarly moved when any one of the latches is operated, a pair of connected crank members engaged by the arms and similarly moved when any arm is actuated, clutch mechanism for actuating the selector drum, a switch mechanism for controlling the motor operation, and operative extensions from the said two connected sets of crank levers, one for operating the said crank members.

38. In a phonograph for playing either side of a plurality of records spaced apart upon a common shaft, a driving motor for rotating the records and a switch for controlling the supply

- of current to the motor, a selector drum rotatable in opposite directions by the motor, means comprising two sets of push button manually operable selectors, one for the right and the other for the left faces of the records, the two sets being oppositely disposed and each operated by the rotation of the drum in one direction but not in the other, each selector comprising an operating lever and a releasable latch, a pair of connected crank arms for engaging the latches of the opposite sets of selectors, and having an extension on one of the cranks operated in the same direction when any of the latches are released, and the motor switch having means engaged by the extension operating to close the switch and start the motor when any one of the selectors is operated.
39. In a multiple record phonograph, a plurality of records spaced upon a shaft rotatable in opposite directions, a carriage reciprocable with respect to the records, means for rotating the records and moving the carriage in opposite directions, a selector drum rotatable with said means, means comprising two sets of push button manually operable selectors, one for the records on the right and the other for the left faces of the record discs, the selector drum having projections for engaging one set of selectors in one direction and the other set of selectors in the other direction of rotation, a switch for controlling the supply of current to the motor, means operated by any of the selectors for closing the switch to start the motor, a reversing switch operated at the limits of movement of the carriage, clutch mechanism for controlling the movement of the carriage and the movement of the record selector, and means operated by the selector drum when any selected latch mechanism is engaged thereby for actuating the clutch

mechanism to stop the rotation of the carriage and drum.

40. In a multiple record phonograph for playing either side of a plurality of records mounted on a common shaft, a motor for rotating the shaft in opposite directions, a switch for controlling the motor, a push button manually operable selector for choosing to play the selection on either side of any record, means operated by the selector to close the motor switch, a movable carriage also operated by the motor, a reversing switch actuated at the ends of travel of the carriage to reverse the direction of the motor and the records driven thereby, a tone arm mounted on the carriage and moved into and out of record playing position, and means actuated when the tone arm is moved out of playing position for opening the switch to stop the motor.

41. In a phonograph for playing either side of a plurality of disc records spaced apart upon a common shaft, a motor for rotating the records in opposite directions, push button manually operable selector means for predetermining which one of the faces of any record is to be played, switch means operated by the selector for starting the motor, a carriage operated by the motor and movable axially of the record shaft, means controlled by the selector for stopping the carriage for the selected record, a tone arm mounted on the carriage, means for moving the tone arm into and out of playing position after the carriage is stopped, resilient means mounted on the carriage and depending upon the direction of movement of the carriage for pressing the tone arm in the direction of the selected record, and means actuated by the tone arm operating means for opening the motor switch when the tone arm has been removed after playing the selected record.

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