Sept. 5, 1950 J. A. DARWIN 2,521,046

AUTOMATIC PHONOGRAPH

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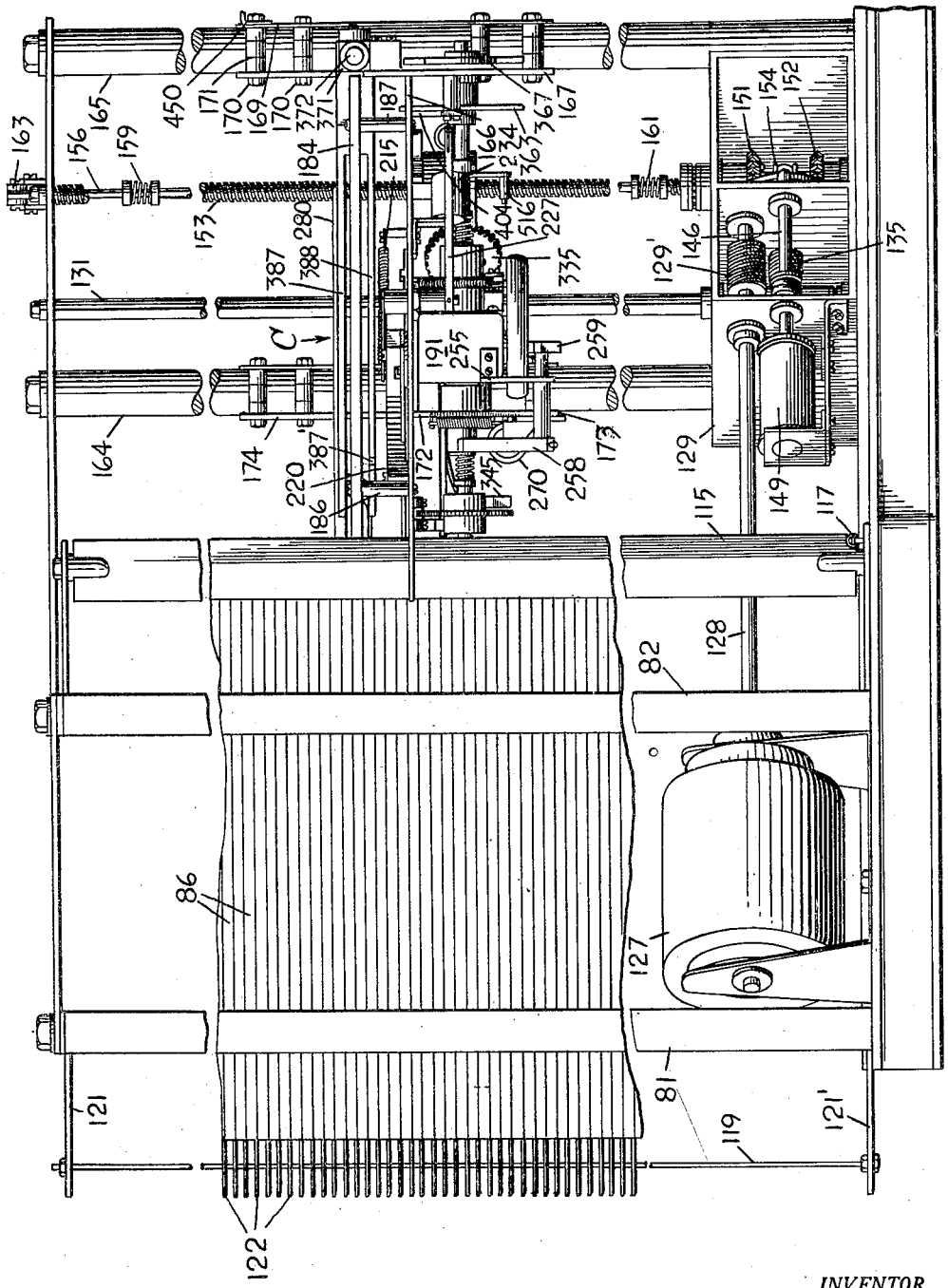

Fig. 1

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Fig. 2

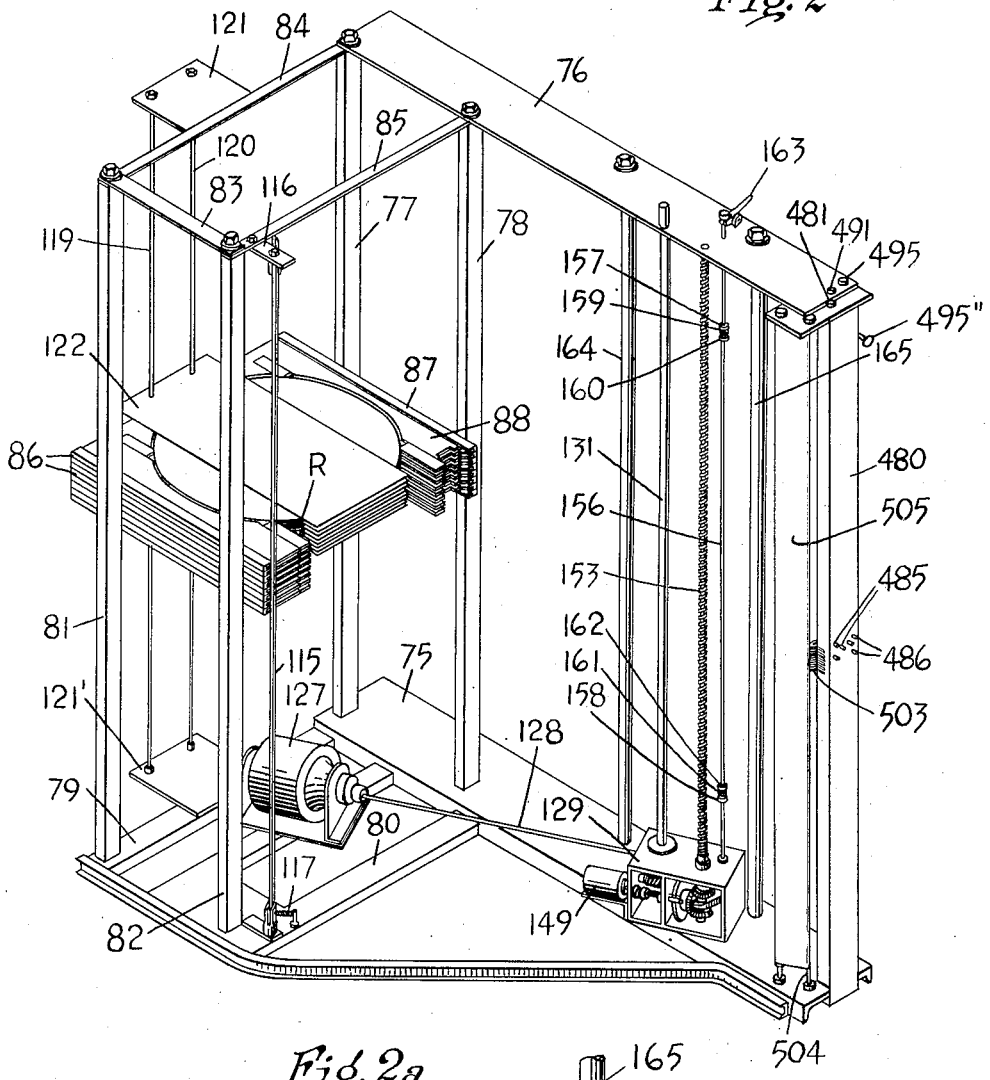
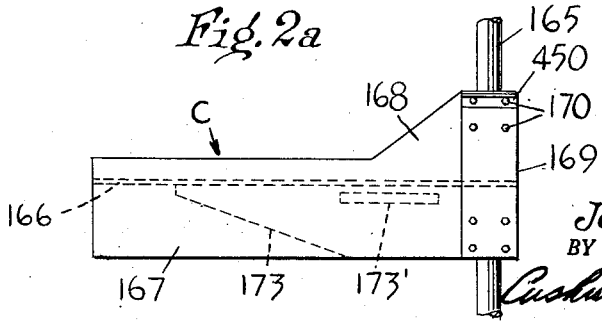


Fig. 2a



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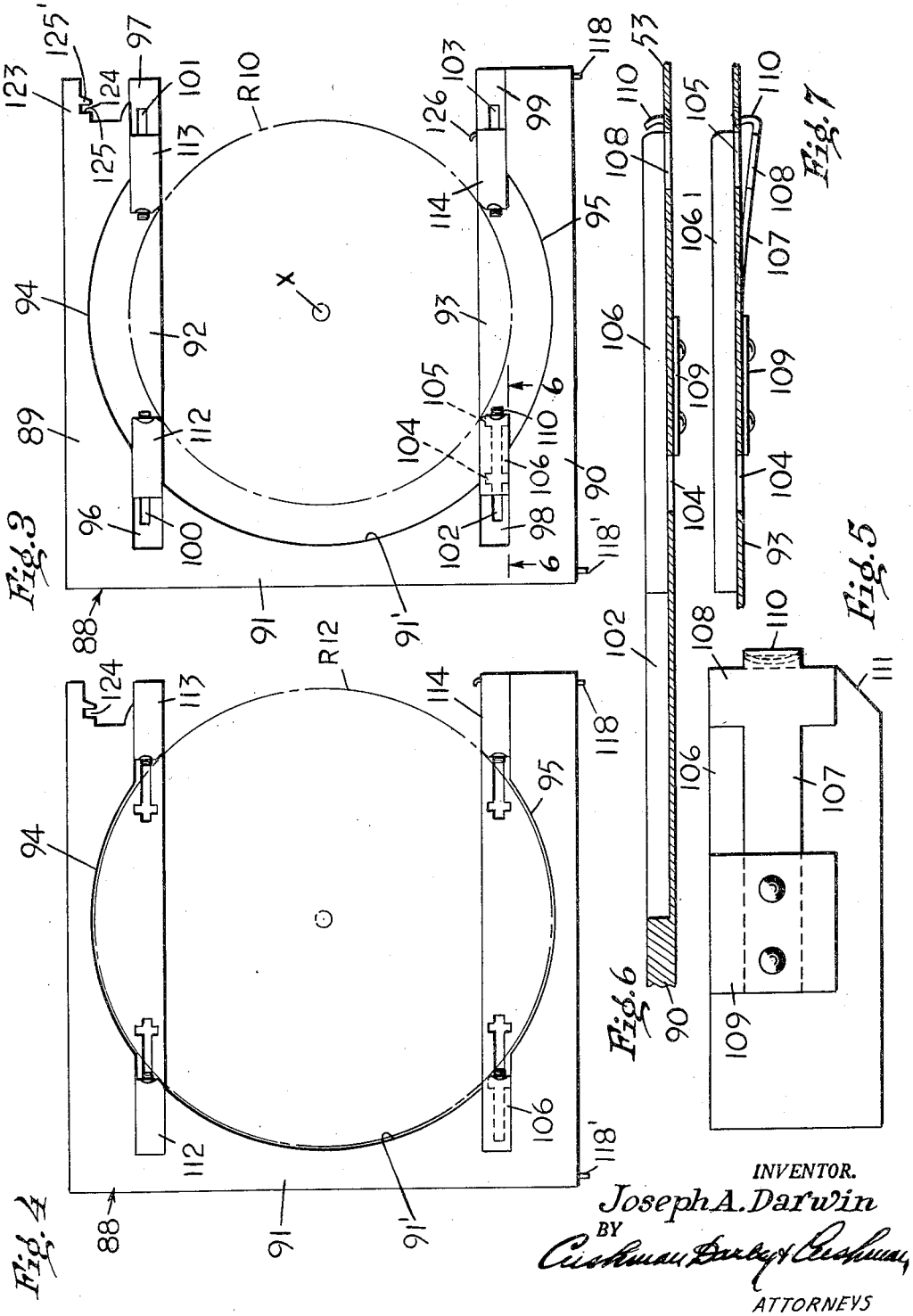

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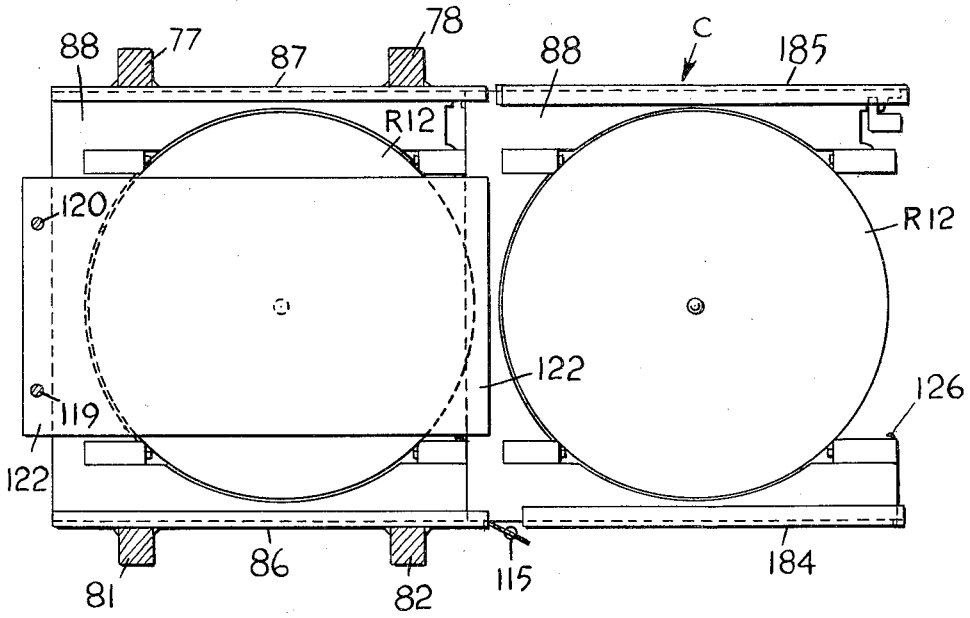
Fig. 8



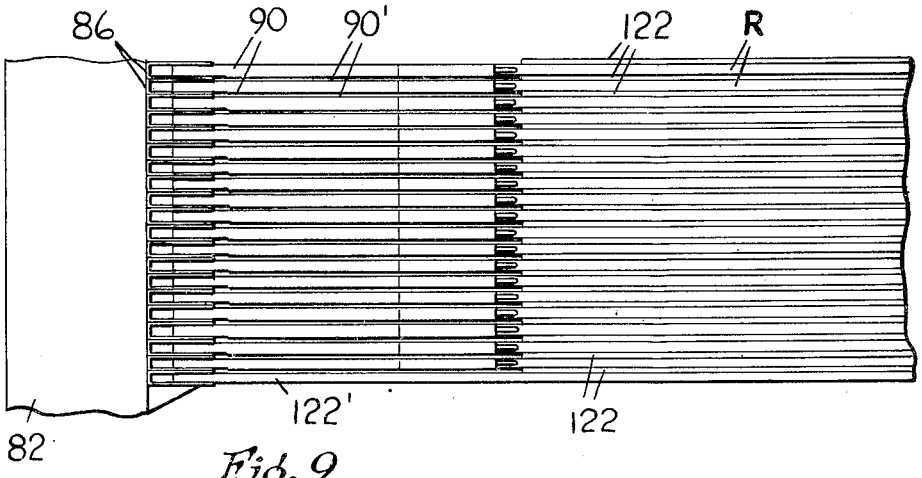


Fig. 9

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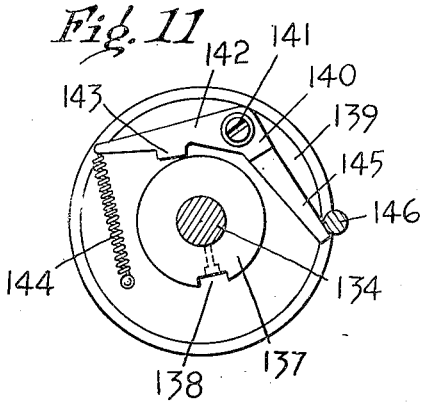
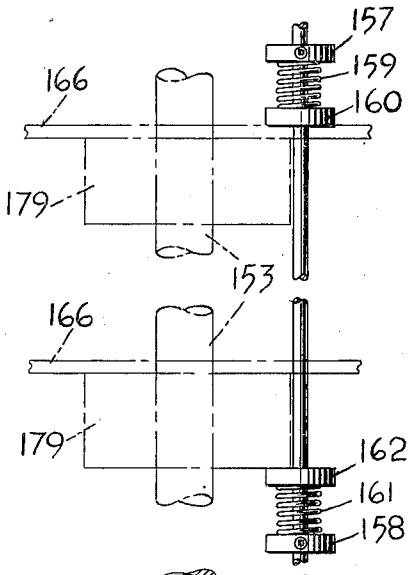
Fig. 11





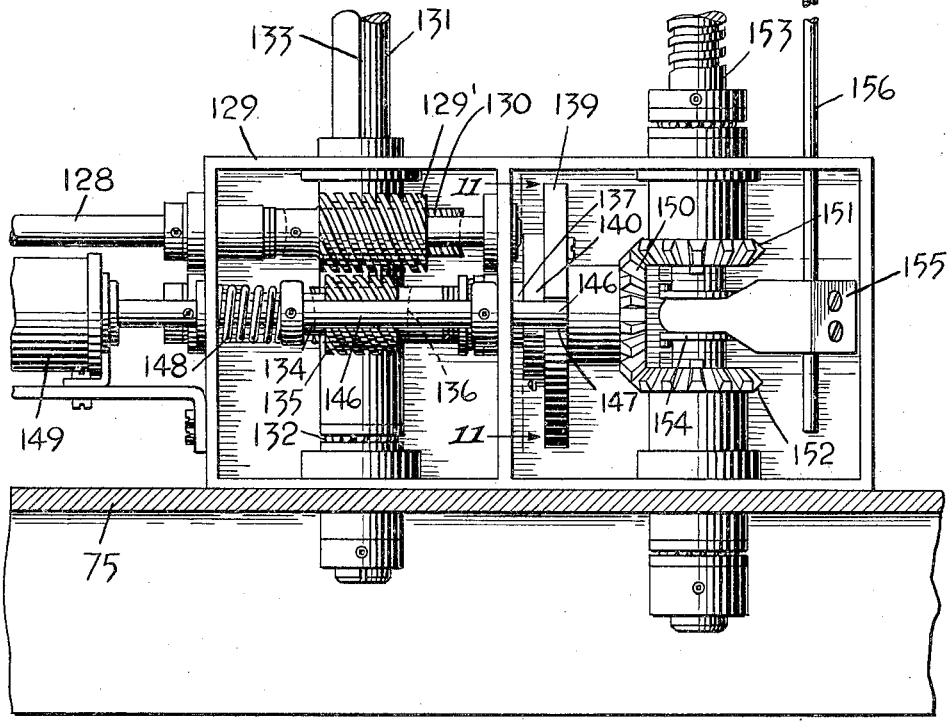


Fig. 10

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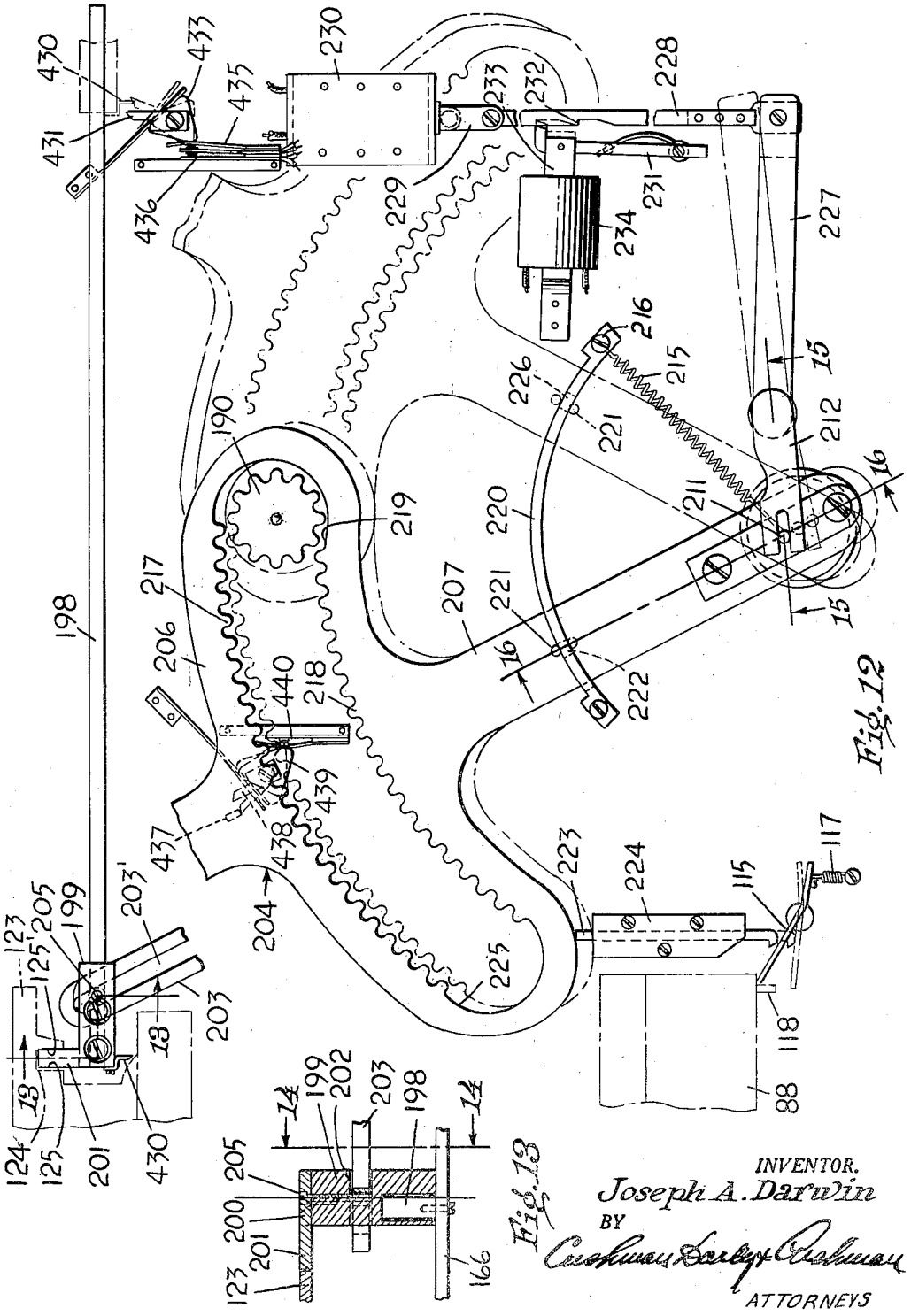

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Fig. 17

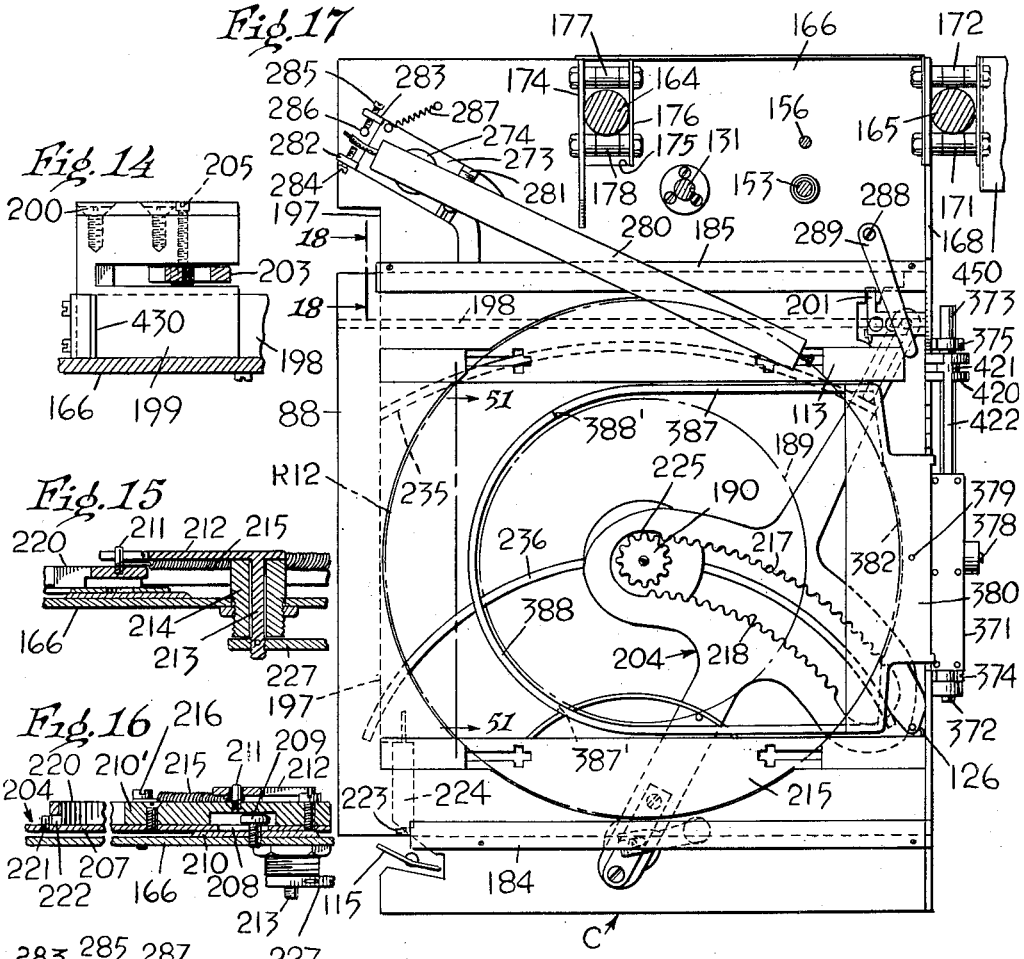

Fig. 14

Fig. 15

Fig. 16

Fig. 17a

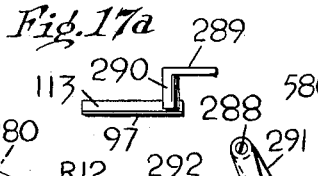

Fig. 18

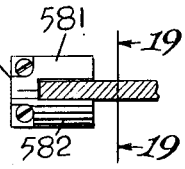

Fig. 19

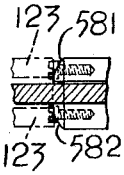

Fig. 21

Fig. 20

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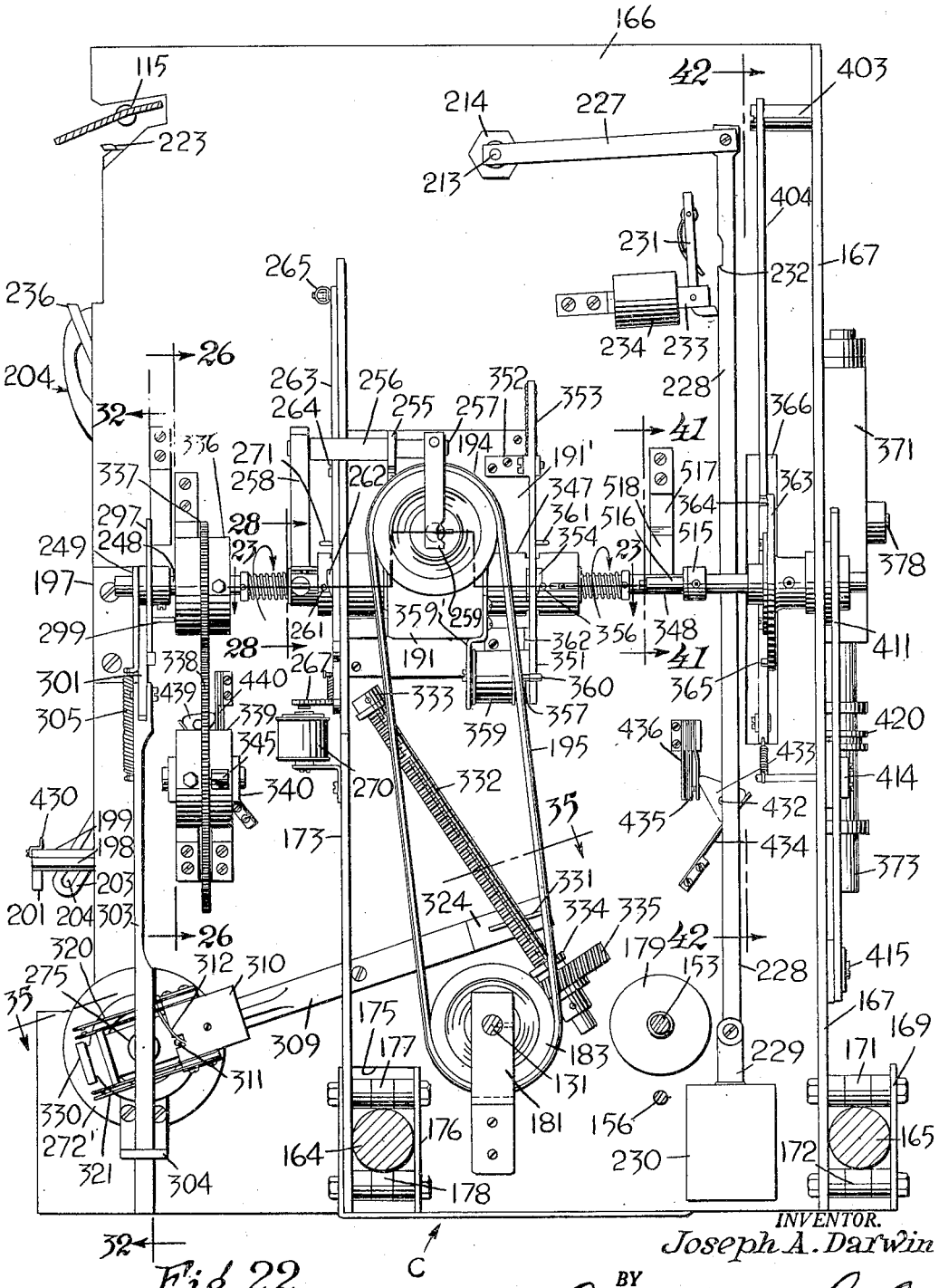

Fig. 22

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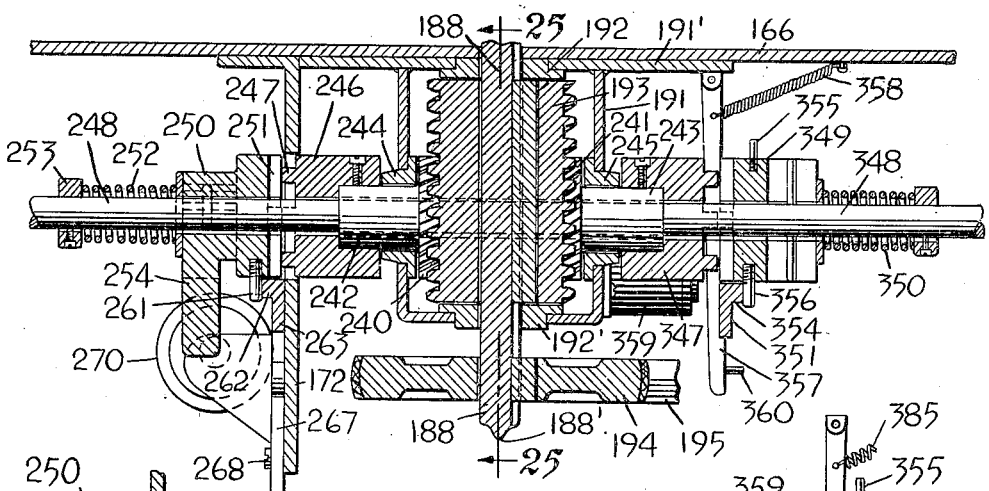
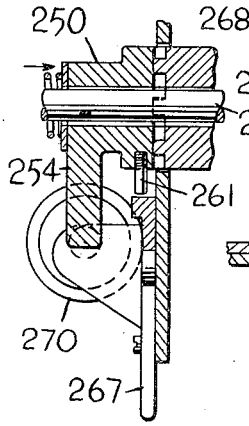


Fig. 23



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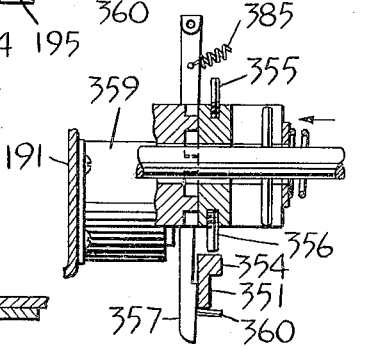
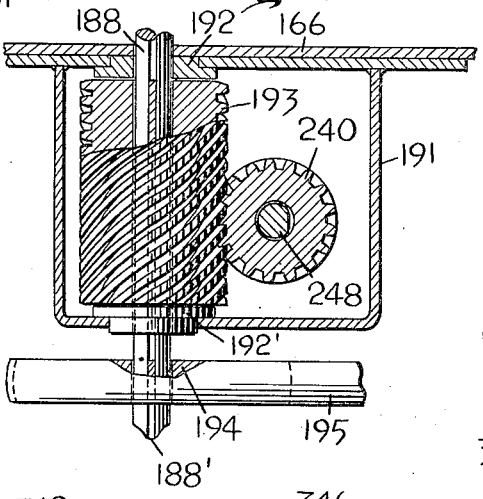


Fig. 40

Fig. 25



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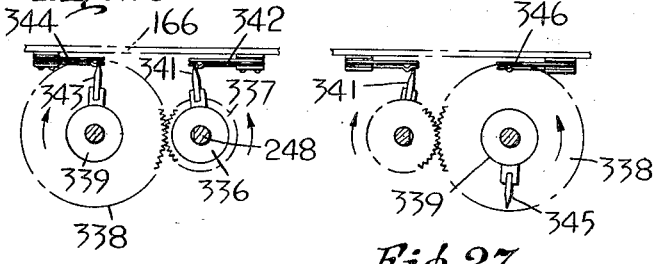

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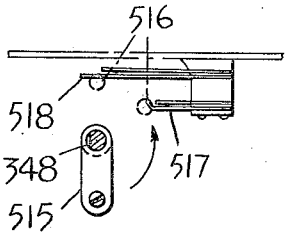

Fig. 41

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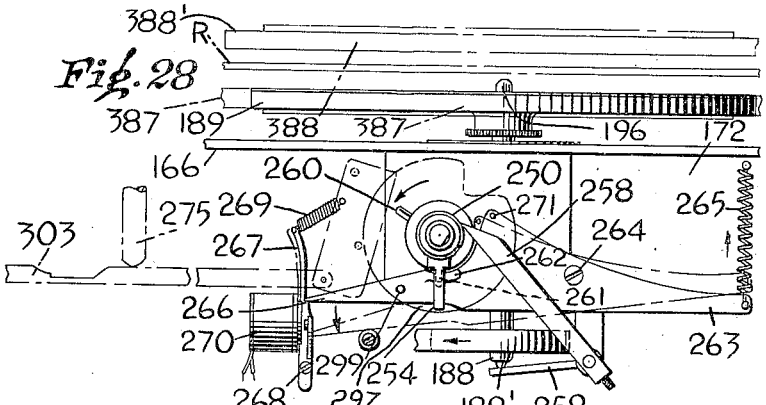
Fig. 28



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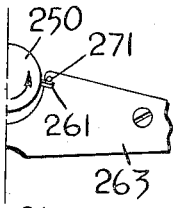
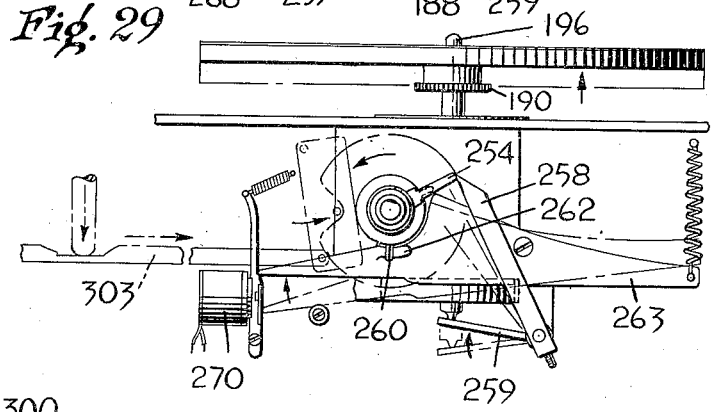


Fig. 29



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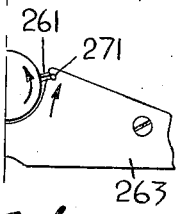

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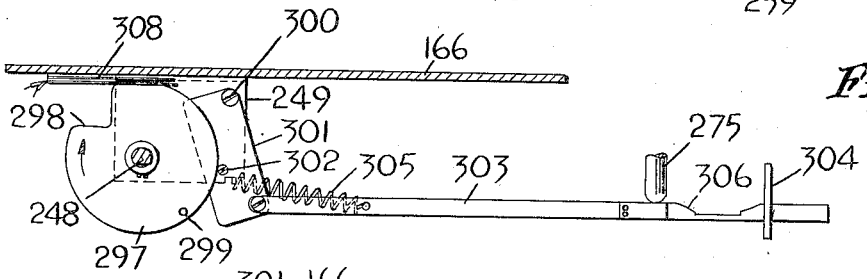

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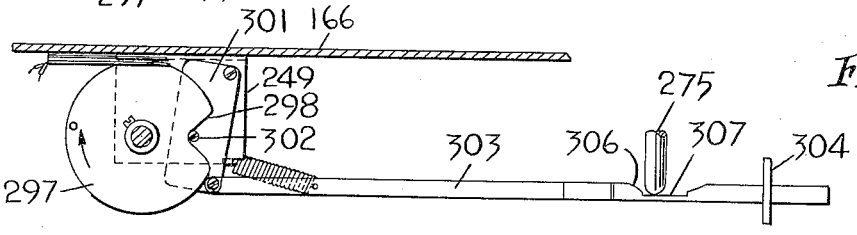

Fig. 34

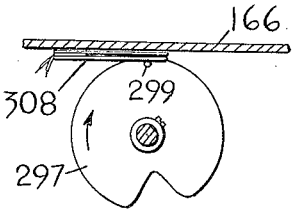

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Fig. 36

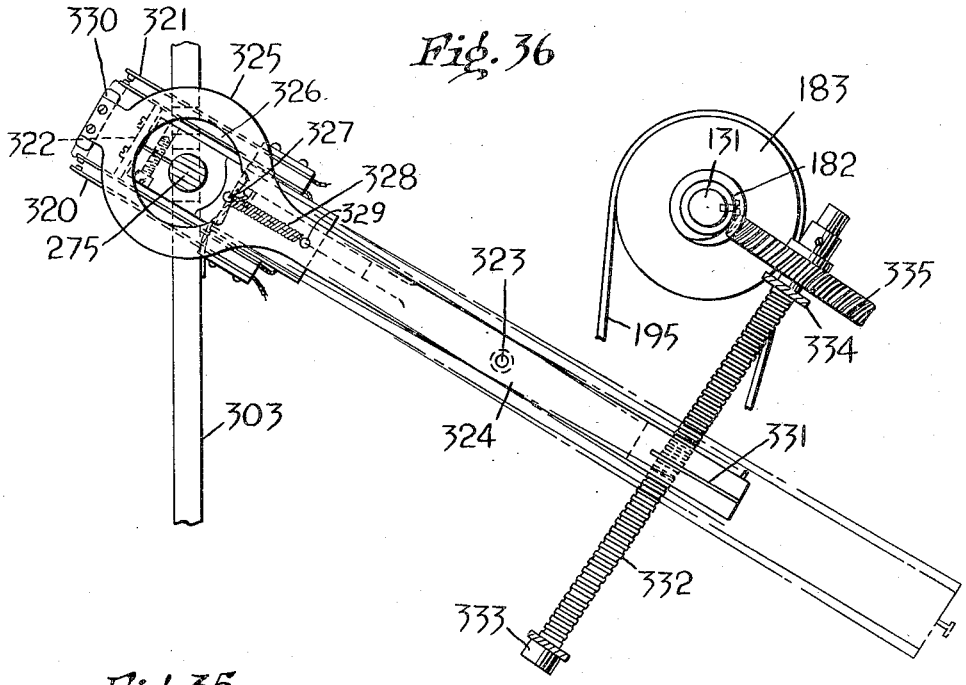
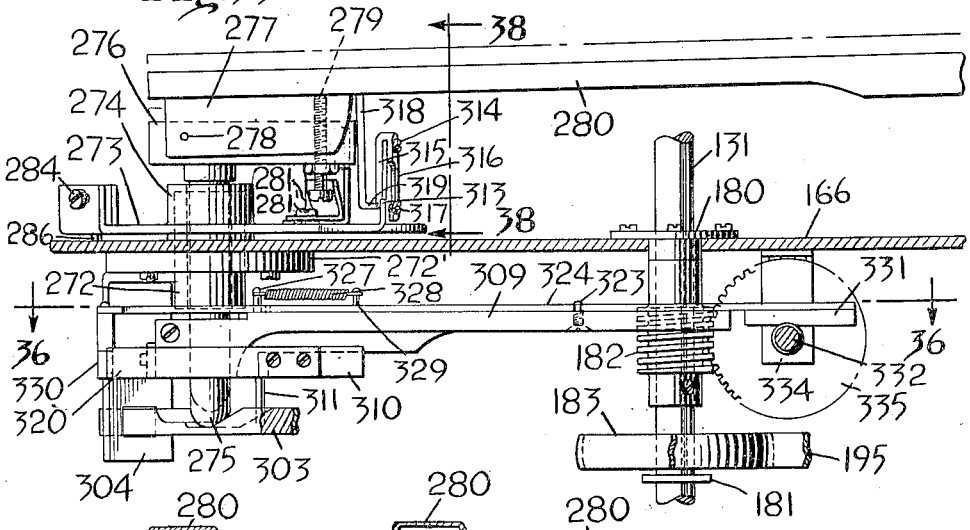
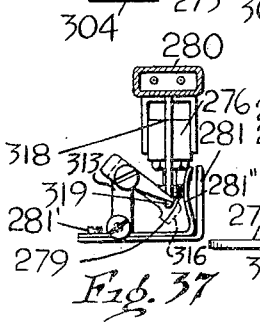


Fig. 35





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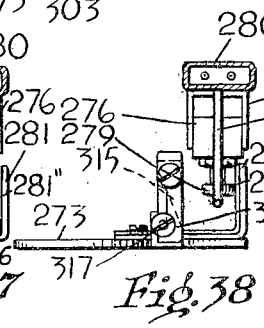

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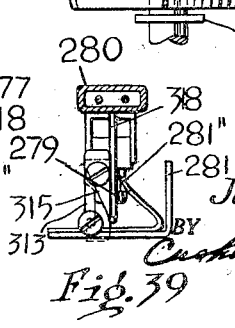

Fig. 39

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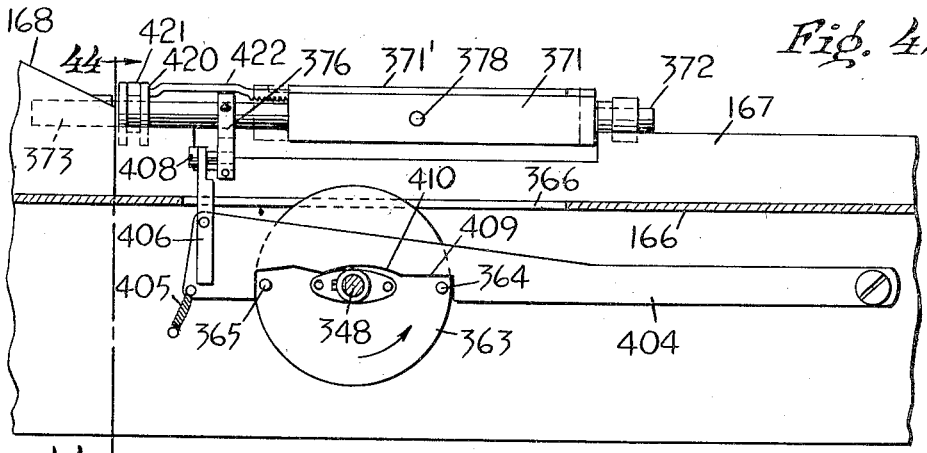

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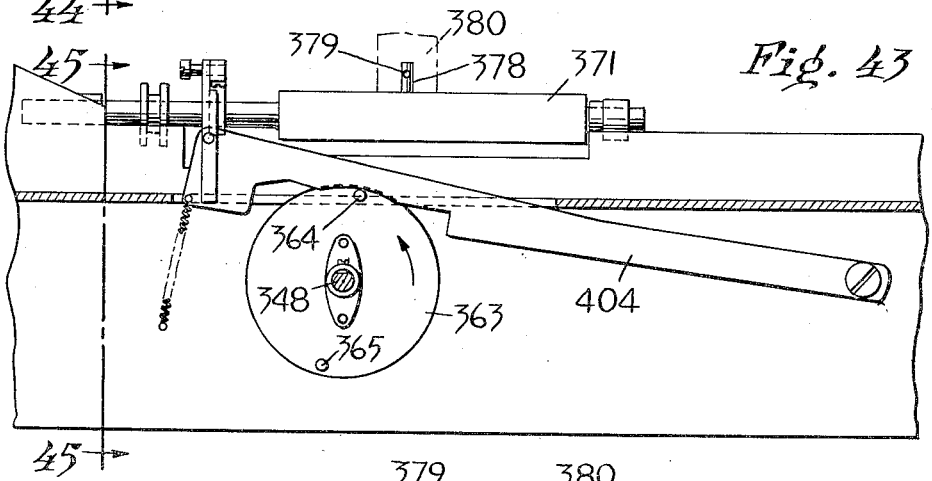


Fig. 43

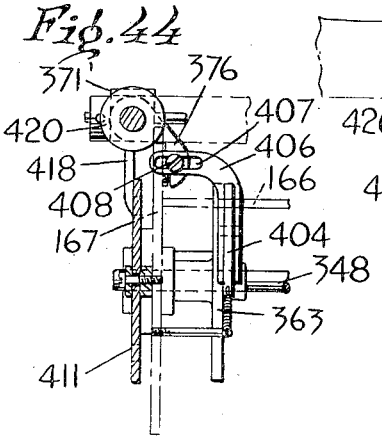
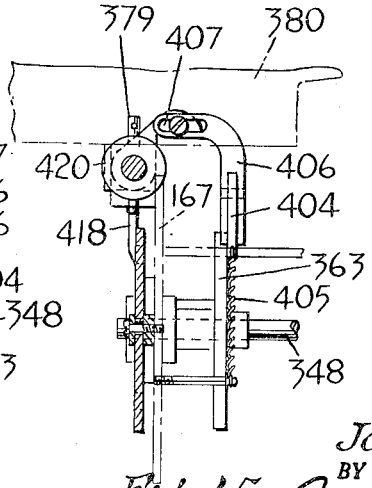


Fig. 44



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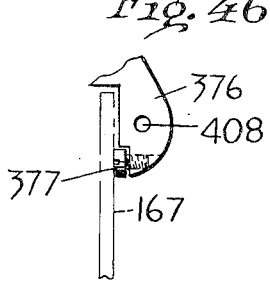

Fig. 46

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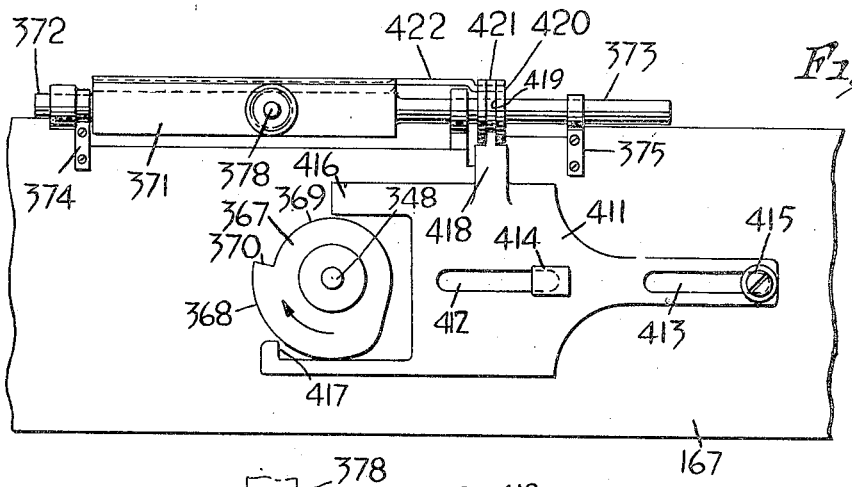

Fig. 47

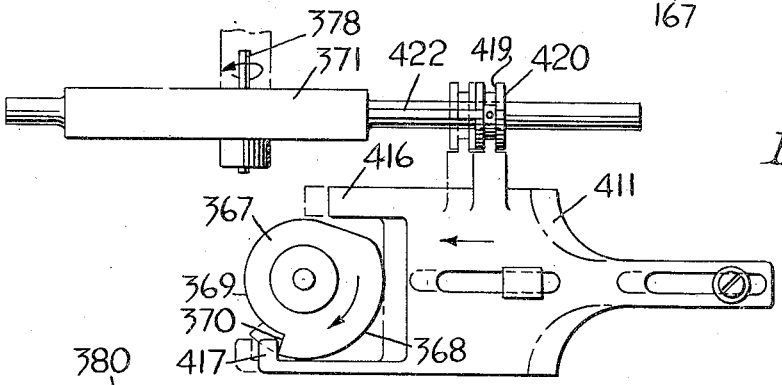

Fig. 49

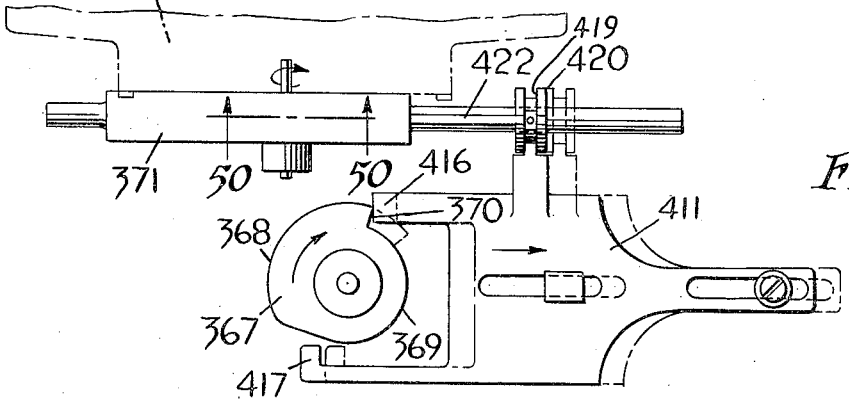

Fig. 48

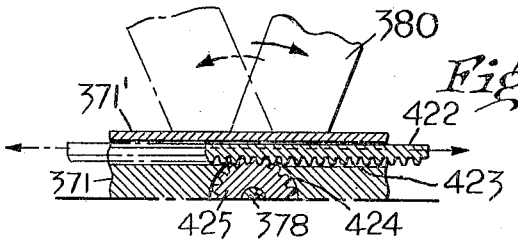

Fig. 50

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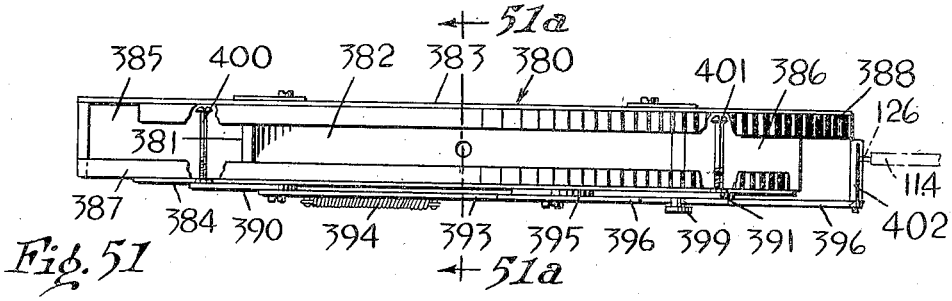
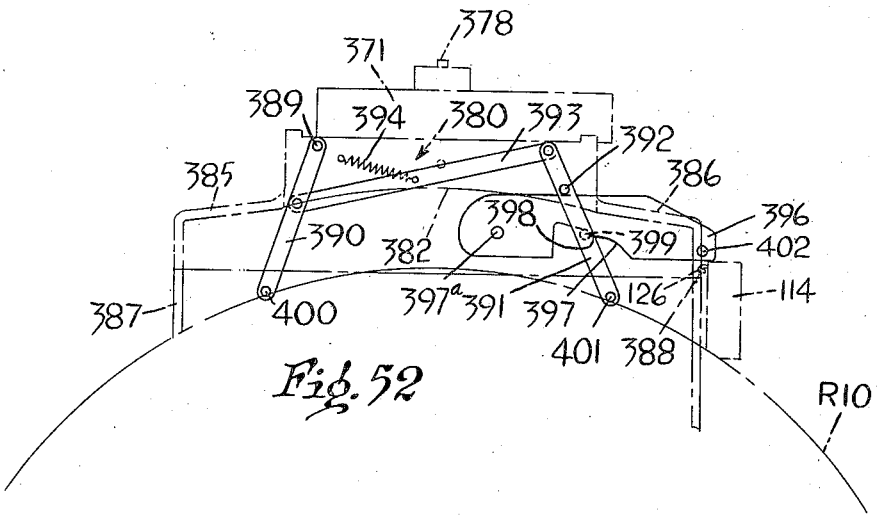


Fig. 51



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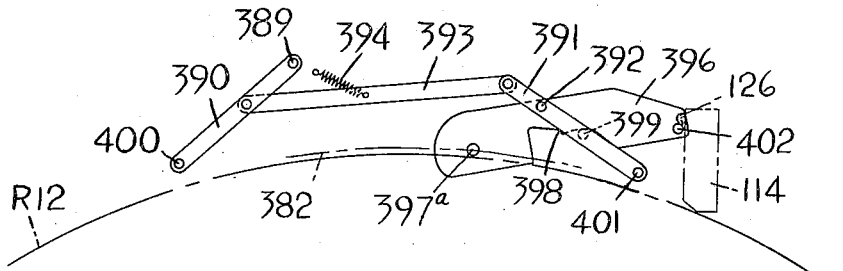

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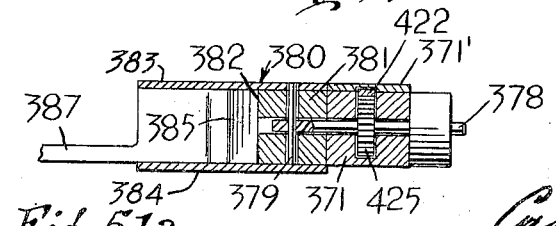

Fig. 51a

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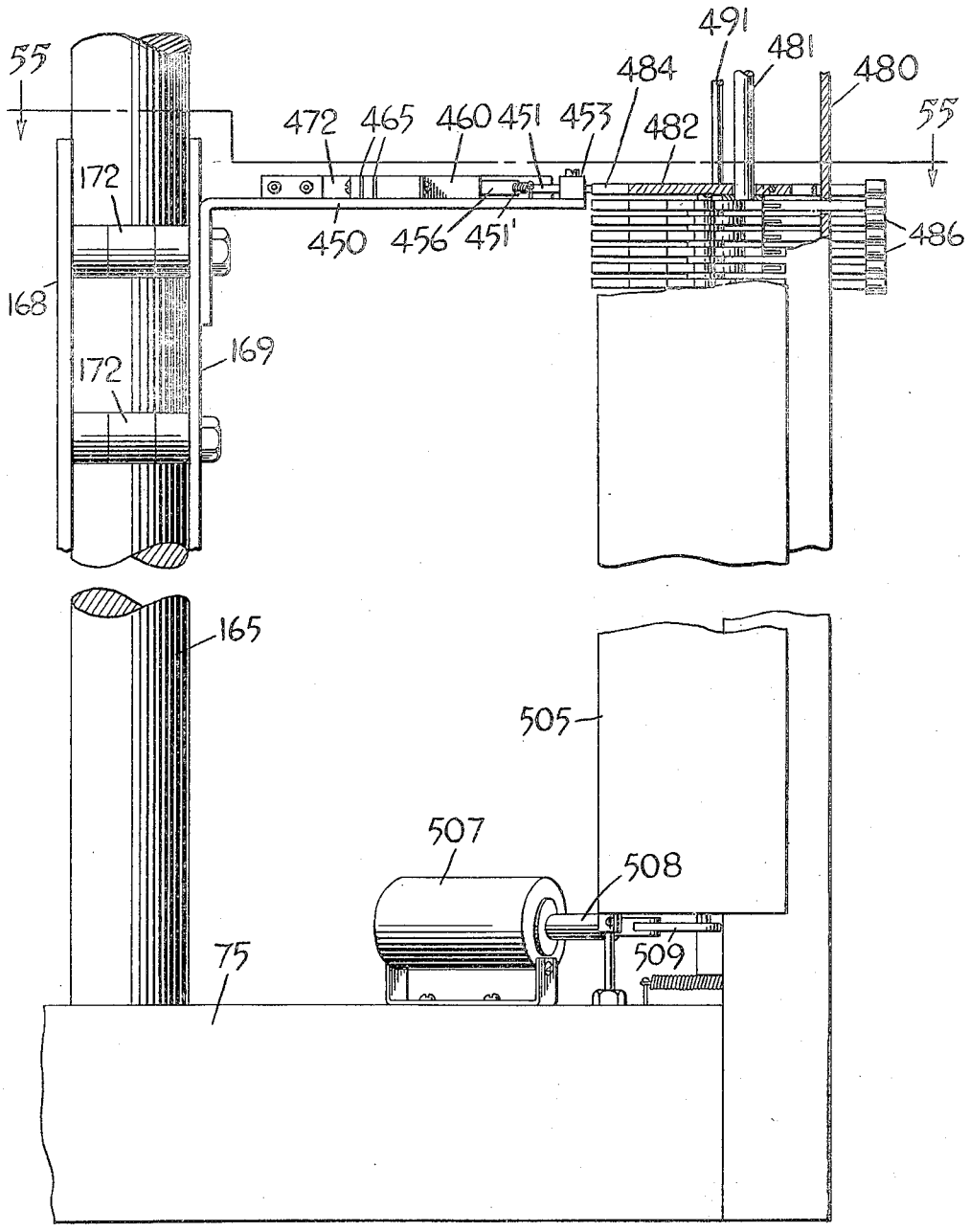

Fig. 54

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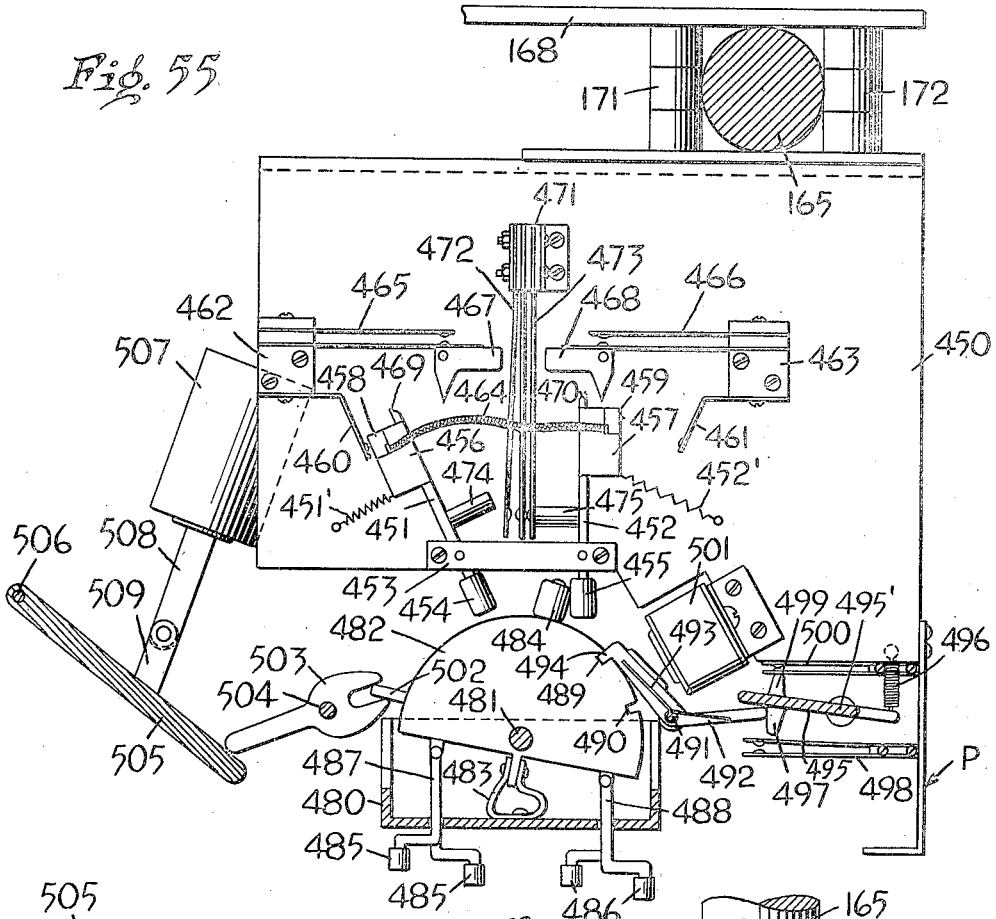
Fig. 55



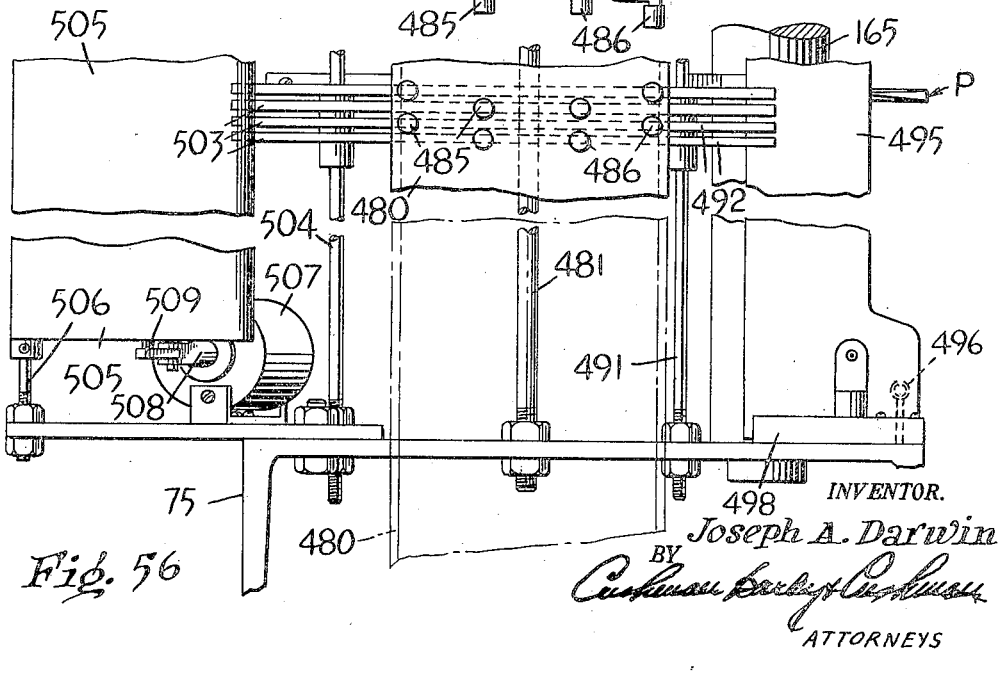


Fig. 56

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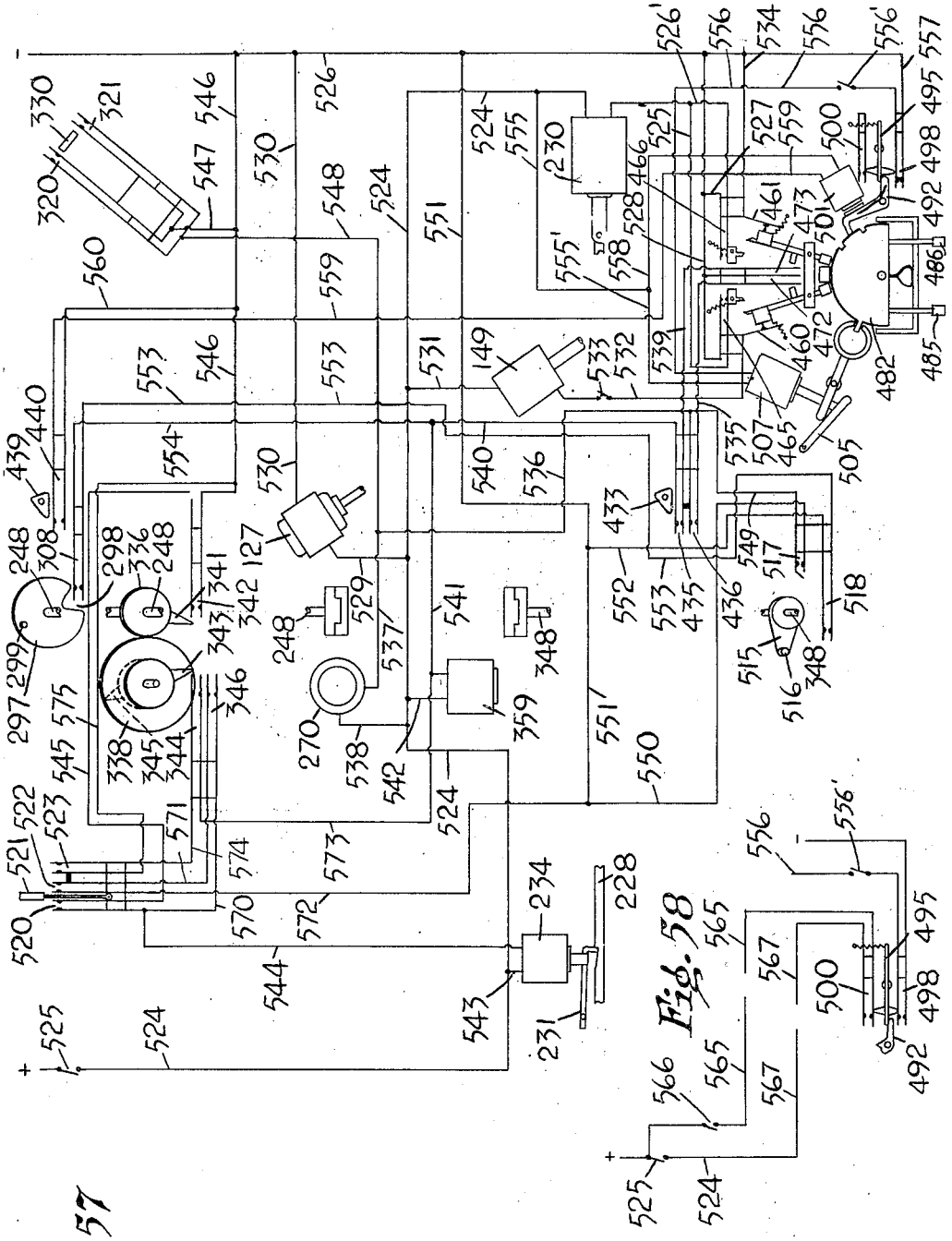

Fig. 57

Fig. 58

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Patented Sept. 5, 1950

2,521,046

UNITED STATES PATENT OFFICE

2,521,046

AUTOMATIC PHONOGRAPH

Joseph A. Darwin, East Orange, N. J.

Application December 7, 1945, Serial No. 633,418

13 Claims. (Cl. 274—10)

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This invention relates to automatic phonographs of the type comprising, essentially, storing means for disc records, and record playing means of which one is movable relative to the other for record selection, and has as a main object to provide a highly versatile machine and one which is yet of relatively simple construction so as to be economical in manufacture and reliable in use.

Inasmuch as the machine may be designed for the storage of a large number of records, the storing means is preferably stationary and the playing means, which is relatively small, is constituted as a carriage reciprocable along the records for the selection thereof. In the embodiment which will be described herein the records are stored closely in horizontal face to face relation on individual trays and are mutually supported in a manner to prevent warping. In automatic playing the carriage is stepped into selecting relation, in either direction, with successive records throughout the stack, removing each record and playing one face or both faces thereof, and then returning the record to storage. In automatic selective playing, the carriage will automatically play either or both faces of any series of selected records regardless of their position in the stack. The order in which the records are played depends in any case on the direction in which the carriage happens to be traveling, this direction being controllable in order to obtain a desired sequence. The playing mechanism automatically sets itself in any case, in accordance with the size of the record to be played. Means are also provided for repeating the playing of any record when desired.

A practical embodiment of the new machine is shown by way of example in the accompanying drawings, in which

Figure 1 is an elevation of the machine, partly broken away,

Figure 2 is an isometric view of the machine with the carriage, or playing mechanism, removed,

Figure 2*a* is an elevation of the carriage,

Figure 3 is a plan view of a record supporting tray set for a 10 inch record,

Figure 4 shows the tray of Figure 3 set for a 12 inch record,

Figure 5 is a bottom plan view on an enlarged scale of a record positioning abutment such as appears in Figures 3 and 4,

Figure 6 is a section on line 6—6 of Figure 3 and on an enlarged scale,

Figure 7 is a partial view like that of Figure 6 showing a different relation of parts,

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Figure 8 is a horizontal section through the stack showing record trays in stored and removed relation,

Figure 9 is a partial front elevation of the record storing means in substantially full size,

Figure 10 is a vertical section through a gear box which appears in Figures 1 and 2 on a smaller scale,

Figure 11 is a section on line 11—11 of Figure 10,

Figure 12 is a plan view of tray transfer means forming a part of the carriage,

Figure 13 is a section substantially on line 13—13 of Figure 12,

Figure 14 is a section substantially on line 14—14 of Figure 13,

Figure 15 is a section substantially on line 15—15 of Figure 12,

Figure 16 is a section substantially on line 16—16 of Figure 12,

Figure 17 is a plan view of the carriage and a record tray which has been transferred thereto,

Figure 17*a* shows a detail in elevation,

Figure 18 is a section on line 18—18 of Figure 17,

Figure 19 is a section on line 19—19 of Figure 18,

Figure 20 is a plan view of a tone arm, forming a part of the carriage, together with adjusting means set for a 10 inch record,

Figure 21 shows the parts of Figure 20 set for a 12 inch record,

Figure 22 is a bottom plan view of the carriage,

Figure 23 is a section on line 23—23 of Figure 22, righted,

Figure 24 is a partial view like that of Figure 23 showing a different relation of parts,

Figure 25 is a section on line 25—25 of Figure 23,

Figure 26 is a section substantially on line 26—26 of Figure 22, righted, showing certain contacts and operating wheels therefor,

Figure 27 shows the elements of Figure 26 as seen from the opposite side,

Figure 28 is a view substantially on line 28—28 of Figure 22, righted, with parts in advance of the section in phantom,

Figure 29 is a view like that of Figure 28 with a different relation of parts,

Figures 30 and 31 show details in connection with Figures 28 and 29,

Figure 32 is a section substantially on line 32—32 of Figure 22, righted,

Figure 33 shows the parts of Figure 32 in a different relation,

Figure 34 shows elements of Figures 32 and 33 in a still different relation,

Figure 35 is a section substantially on line 35—35 of Figure 22, righted,

Figure 36 is a section substantially on line 36—36 of Figure 35,

Figures 37 to 39 show different relationships of tone arm latch means which appear in Figure 35, Figure 38 being a section on line 38—38 of Figure 35,

Figure 40 is a partial view like that of Figure 23 showing parts in different relation,

Figure 41 is a section substantially on line 41—41 of Figure 22, righted,

Figure 42 is a section substantially on line 42—42 of Figure 22, righted,

Figure 43 is a view like that of Figure 42 showing a different arrangement of parts,

Figure 44 is a section on line 44—44 of Figure 42,

Figure 45 is a section on line 45—45 of Figure 43,

Figure 46 shows a detail in elevation,

Figure 47 is a view of the mechanism of Figure 22 as seen from the right of that figure, right side up,

Figures 48 and 49 show the parts of Figure 47 in different relations,

Figure 50 is a section on line 50—50 of Figure 48,

Figure 51 is an end view of a record turning fork which appears in Figure 1,

Figure 51*a* is a section on line 51*a*—51*a* of Figure 51,

Figures 52 and 53 show, in different relationships, record sizing mechanism associated with the turning fork,

Figure 54 is an elevation, partly broken away and partly in vertical section, of record selecting means,

Figure 55 is a section substantially on line 55—55 of Figure 54,

Figure 56 is a view of the mechanism of Figure 54 as seen from the right of the latter figure, and

Figures 57 and 58 are wiring diagrams.

In Figures 1 and 2 the frame of the machine is shown as including lower and upper parallel members 75 and 76 joined by spaced vertical bars 77 and 78 which are bolted to member 76. Frame members 79 and 80 project laterally of member 75 at the base of bars 77 and 78 and support upright bars 81 and 82 opposite bars 77 and 78, respectively, the uprights being at the corners of a rectangle. The upper ends of bars 81 and 82 are bolted to horizontal bars 83, 84 and 85. Referring also to Figure 9, a multiplicity of horizontal channels 86 have their backs secured to uprights 81 and 82 and their legs in contact with and secured to each other so that a multiplicity of thin but rigid supporting ledges is provided. Similar channels 87, Figure 2, are similarly associated with uprights 77 and 78, the channels of each series being directly opposed to those of the other series so that a multiplicity of horizontal tracks is provided, each track comprising a channel 86 and a channel 87 for the reception of a record carrying tray 88.

Referring to Figure 3, each tray 88 comprises side members 89 and 90 having parallel outer edges and an end connecting member 91, these members conveniently die cast to provide an integral substantially U-shaped frame. As here shown, the inner top portions of the side members are relieved at 92 and 93 to provide top recesses having a depth slightly greater than the

thickness of a record. Outwardly the recesses are bounded by arcuate walls 94 and 95 struck from a center X on a radius slightly greater than 6 inches, this same curvature being carried across the inner edge 91' of the cross portion 91. As shown in Figure 9 the side members 89 and 90 are received in the channel tracks with close sliding lateral clearance, the bottoms, inwardly of the ledges, being downwardly offset as at 90' slightly less than the thickness of the ledges.

The side members are relieved on top to provide aligned rectilinear grooves and rabbets 96, 97, and 98, 99 of the same depth as the relieved portions 92 and 93 and intersecting the arcuate lateral bounding walls of the latter. The groove 96 and rabbet 97 have aligned bottom slots 100 and 101 and groove 98 and rabbet 99 have aligned bottom slots 102 and 103. As particularly shown in connection with slot 102, each slot has longitudinally spaced lateral rectangular enlargements 104 and 105. Slidable in groove 98 is a block 106 to the bottom of which is fixed a longitudinally extending spring tongue 107 whose thickness is the same as the depth of the slot 102, the tongue having a shank portion receivable in the slot and a cross head portion 108 receivable in one or the other of the enlargements 104 and 105, the head normally lying against the head of the block, in one of the enlargements, and so locking the block in one of two positions. Reference numeral 109 designates a plate secured against the shank portion of the tongue and having marginal portions underlying the margins of slot 102 so as to hold the block against upward displacement. The tongue has an upturned extension 110 by means of which the head portion 108 can be depressed to permit adjustment of the block, as particularly shown in Figure 7, the top of the extension normally lying below the top surface of the block as shown in Figure 6.

When head portion 108 is engaged in enlargement 105, as in Figure 3, the inner oblique corner 111 of the block is tangent to a circle whose center is at X and whose radius is very slightly greater than 5 inches, and with the three other blocks 112, 113 and 114 similarly adjusted, a 10 inch record will be supported at its opposite edges by the side members 89 and 90 with its center at X, the record being indicated at R10, Figure 3. With the blocks set in their other position, they will accurately center the 12 inch record indicated at R12, Figure 4. In either case the record is maintained against radial displacement but with freedom of upward displacement and with a central bottom area exposed.

The several trays 88 are loaded with records R and then inserted in the channel guides from the front, Figure 2, suitable stops being provided so that the fully inserted trays will be in vertical register with the record holes in vertical alignment. The records are inserted past a flat universal bar 115 pivoted on a vertical axis between bottom frame member 80 and a bracket 116 projecting from top frame member 85, the bar being biased by a spring 117 and normally engaging in front of an abutment pin 118 at the outer forward end of each tray side member 90, as particularly shown in Figures 8 and 12. In this manner, the registry of the stored trays is substantially maintained. Reference numeral 118' designates a guide pin projecting from member 90 adjacent its other end and cooperating with the channel to prevent cocking of the tray when being slid in and out.

A pair of parallel vertical rods 119 and 120

extend between top and bottom brackets 121 and 121' projecting rearwardly of frame members 84 and 79 and strung on these rods are a number of somewhat yielding sheets or pads 122 which project forwardly in spaced relation to the side members of the trays, one between each pair of adjacent record faces. The sheets 122 have a core of stiff material such as fiber board and somewhat compressible facings of cloth or the like. The sheet 122 beneath the lowermost record, Figure 9, is supported on a solid cross plate 122' extended between the frame uprights. The thickness of the cushion sheets is such that each has contact with adjacent record faces so that the records are mutually supported from top to bottom and so are maintained against warping. The trays provide edge support for the records while the sheets afford central support therefor.

The forward end of each tray arm 89 is recessed to provide an outer longitudinal tongue 123 whose inner margin is recessed to provide a recess 124 having laterally extending edges 125 and 125'. With the trays in storage, all of the recesses 124 are in vertical register. For a purpose which will later be described, each positioning block 114 is provided at its inner forward end with a lug 126.

In Figure 2 reference numeral 127 designates an electric motor which, through a shaft 128, drives into a gear box 129 disposed on frame member 75 forwardly of the storage means. Within the gear box, see also Figure 10, shaft 128 has fixed thereon a worm 129' driving a worm wheel 130 fixed on a vertical shaft 131 journalled in the top and bottom walls of the box and having a thrust bearing 132. Shaft 131 has a longitudinally extending groove 133 and its upper end is journalled in the top frame member 76. When motor 127 is running, shaft 131 is driven at the normal playing speed of a record.

Journalled in box 129 in parallel relation with shaft 128 and to one side of shaft 131 is a shaft 134 on which is fixed a spiral gear 135 which is engaged by a spiral gear 136 fixed on shaft 131. Fixed on the right-hand end of shaft 134 is a collar 137 provided with an axially extending square walled notch 138, Figure 11. Freely rotatable on shaft 134 beyond collar 137 is a disc 139 on which is pivoted a bell crank lever 140 by means of a screw 141. One arm 142 of the lever is provided with a nose 143 engageable in notch 138 and pulled toward engaging relation by a tension spring 144, and the other arm 145 of the lever is adapted to be engaged by a stop rod 146 slidable in the gear box parallel to shaft 134 and engageable in a peripheral notch 147 of disc 139. The rod is urged toward the disc by a compression spring 148 and at its end remote from the disc is secured to the armature of a solenoid 149 mounted in connection with box 129. The disc 139 has coaxially fixed thereto a bevelled gear 150 meshing with a pair of bevelled gears 151 and 152 free on a vertical shaft 153 journalled in the top and bottom walls of the box, the shaft being threaded above the upper bearing and having its upper end journalled in frame member 76, Figure 2. Gears 151 and 152 are provided with opposed clutch teeth alternatively engageable by the mating teeth of a clutch member 154 splined on shaft 153 between the gears and engaged by a shipper fork 155 fixed on a rod 156 slidably guided in the top wall of the box and at its upper end in a bore in frame member 76. Rod 156 has adjustably fixed thereon top and bottom stop collars 157 and 158. A compression spring 159 surrounds the rod below stop 157 and is secured to the latter and to an abutment collar 160 which is slidable on the rod. A compression spring 161 rests on stop 158 and supports a slidable abutment collar 162. The upper projecting end of rod 156 is engaged by a manually operable shipper 163 pivoted on frame member 76.

In Figures 10 and 11 the stop rod 146 is shown as engaged in notch 147 of disc 139 and holding lug 143 free of the notch 138 of collar 137 which rotates continuously when motor 127 is operated. If solenoid 149 is energized, rod 146 is retracted so as to free notch 147 and also arm 145 of the bell crank lever. Spring 144 pulls arm 142 inwardly so that when notch 138 comes around, it will engage nose 143. The solenoid having been but momentarily operated, spring 148 returns rod 146 so that at the end of one revolution of disc 139, lever arm 145 will strike the rod to disengage nose 143 and the rod will again enter notch 147. The described clutch mechanism is merely illustrative of any clutch means which may be used to impart an equal drive at each engagement.

If during the revolution of disc 139, clutch element 154 were engaged with gear 152, a single revolution would be imparted to the latter and to shaft 153 with an up-threading effect. If member 154 had been engaged with gear 151, shaft 153 would have been driven through one revolution with a down-threading effect. As will be later explained, shaft 153 is engaged with the carriage to reciprocate the same, and the pitch of the shaft thread is such that upon each revolution of the shaft, the carriage will be moved in one direction or the other a distance equal to the distance between the central horizontal radial planes of adjacent records in the storage means. Abutment of a carriage part with abutment 160 will compress spring 159 and rod 156 will be snapped upwardly to disengage element 154 from element 152 and engage it with element 151 for down-threading effect. Similarly, abutment of a carriage part with abutment 162 will snap member 154 from member 151 to member 152 for up-threading effect. Lever 163 can be operated at any time to reverse the drive, merely swinging freely when the drive is automatically reversed through the stops.

A pair of round rods 164 and 165 have their lower ends fixed to frame member 75 and their upper ends bolted to member 76, the rods extending vertically and being spaced longitudinally of member 75 and disposed at opposite ends of the gear box 129 for guiding the playing means or carriage C. Being at one side of the paths of travel of the trays, the rods offer no obstruction to the removal of the trays for charging.

The carriage C is shown in elevation in Figures 1 and 2*a*, in top plan view in Figure 17, and in bottom plan view in Figure 22. It comprises a horizontal base plate 166 to the right-hand rectilinear edge of which, Figure 1, is secured a vertical plate or wall 167 which projects above and below plate 166 and at its right-hand end, Figure 2*a*, is widened upwardly at 168. Secured between the outer face of the widened portion 168 and a spaced vertical plate 169 on bolts 170 are a plurality of rollers 171 and 172 arranged in two vertical series spaced apart the diameter of rod 165 which is received between the two series. Arranged parallel to plate 167 beneath plate 166 and secured to the latter is a plate 173 which has an upwardly projecting portion 174 passing through a cut-out 175, Figures 17 and 22, in plate

166 and between it and a plate 176, similar to the plate 169, are arranged spaced apart vertical series of rollers 177 and 178 which engage rod 164. In this manner the carriage is positively guided for vertical reciprocation.

Fixed beneath an opening in plate 166 is a nut 179 in engagement with screw 153, and the reversing rod 156 also passes through an opening in plate 166. In Figure 10, plate 166 is shown as engaging abutment 160 during upward travel of the carriage, as enforced by screw 153, and nut 179 is shown as engaging abutment 162 in the down travel of the carriage, whereby rod 156 is operated for automatic reversal of the screw.

Shaft 131 is passed through a bearing collar 180 set in an opening in bottom wall 166, and splined on the shaft, between the bottom of the collar and a horizontal arm 181 of a bracket secured to the bottom of plate 166, are a worm 182 and a crown pulley 183.

Mounted on top of plate 166 is a pair of opposed channels 184 and 185 which are in horizontal parallel relation and spaced apart so as to be alignable with any pair of the storage channels 86 and 87. As shown in Figure 1, the channel 184 is mounted on pedestals 186 and 187 and channel 185 is similarly supported. When the carriage track, constituted by channels 184 and 185, is in register with a storage track, a tray can be pulled from the latter onto the former to the limit position shown in Figure 17. Immediately below the center of a record advanced thus to final position on the carriage, plate 166 is provided with an opening through which projects a vertical shaft 188 to the upper end of which is fixed a horizontal turntable 189 having fixed therebeneath a coaxial gear 190. Shaft 188 passes through a box 191 having a top plate 191' secured below plate 166 and is journalled in bearings 192 and 192' in the top and bottom walls of the latter, Figure 23, and between the bearings a worm 193 is splined on shaft 188 and maintained by the bearings against vertical displacement. Splined on shaft 188 beneath box 191 is a crown pulley 194 of the same size as pulley 183 and driven from the latter by a belt 195. Thus, when motor 127 is running, the turntable 189 is constantly driven at the proper speed for record playing and when a tray is advanced from storage on the carriage, the record carried thereby will be substantially centered over the turntable with the record opening above an upwardly tapering centering pin 196 on the turntable. The turntable, by means which will later be described, is movable between a lower limit position, shown in full lines in Figure 28, and an upper limit position, shown in full lines in Figure 29. When the tray brings the record over the turntable, the latter is in its lower position so that the record is clear of pin 196, as indicated in Figure 28.

Channels 184 and 185 extend up to the end 197 of a cut-out in the edge of plate 166 adjacent the stack. Secured on top of plate 166 inwardly of channel 185 is a rail 198 in parallel relation to the channel, the rail extending past the edge 197 a distance equal to the width of the cut-out. Slidable on and guided by the rail is a block 199 which has secured thereon a plate 200 having a laterally projecting finger 201. When the block is at the end of rail 198 adjacent the stack, the finger 201 is in the recess 124 of the aligned tray, as particularly shown at the upper left, Figure 12, and is adapted to engage in successive recesses upon carriage travel, the carriage always stopping with the finger flushly engaged in a recess.

At its end remote from finger 201, block 199 is provided with a horizontal slot 202 in which is received the longitudinally slotted end 203 of an arm 204, a vertical screw 205 set in block 199 extending across the slot 202 and engaging in the slot 203' of the arm portion 203. The latter projects from a laterally enlarged portion 206 of the arm from which projects a shank portion 207 aligned with portion 203. As is best shown in Figure 16, adjacent its extremity portion 207 is provided with a longitudinal slot 208 in which is engaged a screw 209 which passes through a bearing disc 210 into the plate 166. Arm 204 is thus pivotal about screw 209 with capability of longitudinal displacement.

Screwed to the top of the extremity of arm portion 207 is a block 210' provided on its underside with a cavity for the free reception of the head of screw 209, and set in the top of the block is a pin 211 engaged in the slotted end of an arm 212 integral with a shaft 213, which is journalled in a bearing 214 set in an opening in plate 166 and spaced from the outer side of arm 204. The arm 204 is swingable from the full line position shown at the left, Figure 12, to the dot and dash line position shown at the right, this latter being the position shown in full lines in Figure 17. When in this latter position, a tension spring 215 secured at one end to pin 211 and at the other to a screw 216, has a generally straight line pull away from the arm pivot.

The laterally enlarged portion 206 has an arcuate opening with edges formed as racks 217 and 218, these being concentric on the pivoting axis 209 of the arm and having teeth adapted to mesh with the teeth of gear 190, which is disposed therebetween, the racks being spaced apart a distance greater than the maximum diameter of the gear. In the left-hand position of the arm shown in Figure 12, the gear is opposite a land 219 at the right-hand end of teeth 218 and the arm is at rest although the gear is assumed to be continuously rotating. Fixed on plate 166 above arm portion 207 is an arcuate guide 220 with its lower edge spaced above the plane of the top surface of the arm portion as particularly seen in Figures 15 and 16. On top of the arm is fixed a pin 221 which as shown at the left, Figure 12, is outside of the guide 220 and in front of a bottom recess 222 of the latter. If the arm is pulled toward its pivot screw 209, teeth 217 will move to the dot and dash line position shown at the left, Figure 12, and pin 221 will pass through recess 222 to the inside of the guide. As the arm is displaced in this manner, its inner end strikes a bolt 223, slidable in a bottom channel of a block 224 fixed on top of plate 166, and pushes the bolt against the universal bar 115 to swing it outwardly and release the stop pins 118 of all trays so that the tray engaged by finger 201 can be withdrawn. Due to the meshing of teeth 217 with gear 190, the arm 204 will be immediately swung clockwise, permitting the return of the universal bar to locking position. The swinging of the arm continues until gear 190 reaches a land 225 at the left-hand end of rack teeth 217 and at this point the parts are in the position shown in Figure 17, or at the right of Figure 12, with the selected tray on the carriage and the record substantially centered with the turntable. During the swing of the arm, pin 221 was opposite the inner lower margin of guide 220 to prevent accidental disengagement of rack teeth 217 from the gear, and at the end of the swing the pin is behind a bottom recess 226.

In order to effect the described longitudinal dis-

placement of arm 204 whereby to engage teeth 217 with gear 190, shaft 213 has fixed to its lower end an arm 227 to which is pivoted one end of a link 228 whose other end is pivoted to the armature 229 of a solenoid 230. Upon energization of the solenoid, arms 212 and 227 are swung to displace arm 204, and a spring pressed pivoted detent 231 engages in a notch 232 of link 228 to hold the latter in actuated position. The detent is pivoted to the armature 223 of a solenoid 234 and when the latter is energized the detent is withdrawn and spring 215 immediately acts to displace arm 204, pin 221 passing through recess 226 to the outside of guide 220, so that rack teeth 218 will be engaged with gear 190 and the tray and record will be returned to storage. Thus, by longitudinal reciprocation of arm 204, the opposed rack teeth are alternately engageable with gear 190 for the lateral reciprocation of the arm and hence the rectilinear reciprocation of block 199 and, consequently, the advance and return of a record carrying tray. In order to reduce sliding friction of arm 204, thin arcuate rails as at 235 and 236 may be provided on top of plate 166.

In Figure 12, upper left, and in Figure 14, reference numeral 430 designates an inwardly projecting lug on block 199 and as the tray approaches record centering position, the lug strikes a trip 431, the trip being on the upper end of a shaft 432 projecting through and journalled in plate 166 and having fixed to its lower end a triangular piece of insulation 433, see also Figure 22, against one face of which a leaf spring 434 freely bears. Member 433 has a nose portion adjacent a pair of normally open spring switches 435 and 436. As lug 430 strikes trip 431, member 433 is turned and momentarily closes switches 435 and 436, which open as the lug passes beyond the trip. When the tray is moving off of the carriage, engagement of lug 430 with trip 431 is without effect on the switches, which remain open. Just before the tray is completely off the carriage in its return to the magazine, a lug 437 on the bottom of arm 204, Figure 12, strikes a trip 438 and swings an operator 439 to close a normally open spring switch 440, see also Figure 22, which opens as lug 437 passes beyond the trip. Switch 440 remains closed when arm 204 is serving to withdraw a tray.

Figure 8 shows at the right a tray moved onto the carriage and at the left an underlying tray. It will be seen that the tray on the carriage does not entirely leave the storage track and that the sheets 122 are long enough so as to remain in engagement with the adjacent margins of a removed tray. Consequently, upon return of a tray, it slides smoothly back between the adjacent sheets so that the solid stack condition is resumed.

As above stated, when a tray is moved onto the carriage the turntable is in a lowered position and the same condition must, of course, exist when the tray is returned. For the playing of the record, means are provided for elevating the turntable to lift the record clear of the tray. In other words, means are provided for the relative adjustment of the turntable and the tray on the carriage whereby to free the record from the tray and then restore it, and this is accomplished, as here shown, by appropriate vertical displacement of the turntable.

Referring to Figure 23, worm 193 drives, in the same direction, mitered worm wheels 240 and 241 having tubular hubs 242 and 243 journalled in bearings 244 and 245 set in opposite walls of box 191, the axis of the wheels being in a vertical plane parallel to the carriage track, i. e., channels 184 and 185. Fixed on hub 242 is a hollow clutch member 246 having teeth 247 on its outer face, web 172 having an opening clearing the clutch member. Extending through the clutch member and journalled in hub 242 at one end is a shaft 248 whose other end is journalled in the vertical leg 249, Figures 22 and 32, of a bracket fixed beneath plate 166. Splined on shaft 248 is a clutch member 250 having teeth 251 cooperable with teeth 247 and member 250 is urged toward clutching relation by a compression spring 252 surrounding shaft 248 and bearing at one end against the clutch member and at the other against a stop collar 253. Projecting from member 250 is a radial finger 254.

A bracket 255 fixed to box 191, Figures 1 and 22, rigidly supports a bearing 256 in parallel relation to shaft 248. A shaft 257 is journalled in bearing 256 and has fixed on one end thereof an arm 258 which projects into the rotational range of finger 254. The other end of shaft 257 has fixed thereon an arm 259 whose free end extends under turntable shaft 188 so as to engage under the pointed extremity 188' of the latter, as particularly shown in Figure 28. In the latter figure, the extremity of arm 258 is shown as resting against a circular portion of member 250 and the turntable 189 is in its lower position with gear 190 in the horizontal plane of the rack teeth 217 and 218.

Clutch member 250 has two radial pins 260 and 261 adjacent teeth 251, these being spaced 120° apart. In Figure 28, pin 261 is behind the finger 254 but appears clearly in Figures 23 and 24. In Figures 22 and 28, pin 261 is shown bearing against a cam or wedge formation 262 on the outer face of a lever 263 pivoted at 264 on the vertical web 173 and urged counter-clockwise by a tension spring 265. At its end 266 opposite the spring, the lever is engaged by a shoulder on a trip arm 267 pivoted at 268 and pulled clockwise against the lever end by a spring 269. Arm 267 has an armature portion adjacent the core of an electromagnet 270 mounted on web 173. In Figures 22, 23 and 28, the clutch member 250 is being held in disengaged relation by pin 261 and cam portion 262 but upon energization of magnet 270, arm 267 is swung to the left, Figures 28 and 29, and frees lever 263, which is swung by spring 265 to pull the cam portion 262 downwardly out of engagement with pin 261, thereby permitting clutch member 250 to be engaged with member 246 due to the action of spring 252, Figure 24. As member 250 now rotates, finger 254 engages arm 258 and swings it clockwise, causing arm 259 to push shaft 188 upwardly and thereby elevate the turntable 189 so that it lifts the record clear of the tray, Figure 29. Lever 263 has a laterally projecting pin 271 which, when the lever is in the released dotted line position, Figures 28 and 29, projects in the path of pin 261. In Figure 30 pin 261 is shown as engaging pin 271 and, upon continued rotation of clutch member 250, lever 263 is swung clockwise until its end 266 is re-engaged behind the shoulder of arm 267, whereupon pin 261 leaves pin 271, as shown in Figure 31. At this point, pin 260 is beginning to engage the cam portion 262 and, as the rotation continues, clutch member 250 is forced outwardly to disengage it from member 246 and comes to rest just before finger 254 is about to leave arm 258, Figure 29. Re-energization of magnet 270 will again cause engagement of the clutch members and clutch member 250 will be returned to the position of

Figure 28, arm 258 being immediately released by finger 254, pin 260 returning arm 263 to cocked position, and pin 261 being then forced outwardly by the cam formation 262 to open the clutch. Upon release of arm 258 by finger 254, the turntable immediately gravitates to lower position so that the record is replaced on the tray.

Set in an opening in plate 166 outwardly of rail 185, and near the end of the latter, which is adjacent the stack, is a vertical bearing 272 which projects above and below the plate, as most clearly seen in Figure 35, and is secured to the plate through a flange 272'. Reference numeral 273 (see also Figures 17, 20 and 21) designates a platform having an inverted cup shaped bearing portion 274 supporting the platform for rotation on the upper end of member 272, the top wall of member 274 having an opening as large as and coaxial with the bore of member 272. Rotatable and reciprocable in the bearing member is a shaft 275 which has fixed to its upper end a horizontal block 276 straddled by an inverted channel 277 pivoted to the block on a horizontal transverse pin 278, the downward swing of the channel relative to the block being limited by a vertical screw 279 set in the block. Reference numeral 280 designates a tone arm or pickup member whose rear end is fixed on top of channel 277 in parallel relation thereto, the tone arm being connectable in any suitable manner (e. g., through the usual radio-phonograph transfer switch) into any suitable amplifying system, not shown. Counter-clockwise swinging of the tone arm relative to the platform 273 is limited by an upright stop member 281 fixed on the platform. Since this stop limits the outward swinging of the tone arm, for the purpose of freeing a record, it must be disposed in accordance with the record size.

To this end the platform has a pair of horizontally spaced projecting lugs 282 and 283, Figures 17, 20 and 21, in which are threaded aligned horizontal stop screws 284 and 285 which cooperate with a pin 286 projecting upwardly from plate 166. Reference numeral 287 designates a tension spring which, in Figure 20, is shown as pulling stop screw 284 against pin 286 and, in this circumstance, the tone arm is set for the playing of a 10 inch record.

Pivoted on a vertical shaft 288 mounted on plate 166 outwardly of channel 185 is an arm 289 which extends across the rail and has at its free end a downwardly projecting pin 290, Figure 17*a*, which terminates downwardly in the path of record positioning block 113 but above the top surface of rabbet 97, the pin being in position to be struck and moved by block 113 when the latter is in its 12 inch position but to remain unaffected when the block is in its 10 inch position. An arm 291 is in fixed connection with arm 289 therebelow and has pivoted thereto one end of a link 292 which extends beneath channel 185 with its other end guided for reciprocation by a clip 293 fixed on plate 166. Fixed on link 292 is a block 294 normally held against the clip by a tension spring 295, Figure 20, the block being in the plane of a finger 296 which projects angularly from the platform 273 directly in front of the block. When arm 289 is swung due to engagement by the record positioning block 113, Figure 21, block 294 slides under finger 296 and swings platform 273 so that the abutment screw 285 engages pin 286 and the tone arm is now set for the playing of a 12 inch record. After the playing of a record and return of the tray, spring 295 returns block 294 to the position of Figure 20 and spring 287 returns platform 273 to the 10 inch position. Thus, the tone arm is always positioned for a 10 inch record unless a 12 inch record is advanced, the tone arm then being automatically set for that size.

Fixed on shaft 248 adjacent bracket 249, Figures 22, 28 and 29 and 32 to 34, is a circular disc 297 which is shown in starting position in Figures 28 and 32, the disc having an angular notch 298 and a substantially diametrically opposite laterally projecting pin 299. Pivoted on the vertical leg 249 of a bracket by a screw 300 is a link 301 carrying a follower 302 for the disc edge. Pivoted to the free end of the link is a horizontal bar 303 which extends under the lower rounded end of the tone arm pivot shaft 275 and is supported for reciprocation in an opening in a bracket 304 secured beneath the flange 272' of the bearing 272. A spring 305 pulls link 303 toward the bracket and causes the follower 302 to bear against the edge of the disc. In Figure 32, shaft 275 is shown as resting on the flat top surface of bar 303 and this means that the tone arm, as supported by the stop screw 279, is in an elevated position in which the needle is above and clear of the record. During the first 120° movement of shaft 248, that is, until the opening of the clutch due to the engagement of pin 260 with the incline 262, follower 302 comes into the bottom of notch 298, as shown in Figures 29 and 33, and shaft 275 rides down an incline 306 onto a depressed surface 307 of bar 303 so that the tone arm is lowered to engage the needle with a record with the tone arm lifting just free of the stop pin 279. During the second movement of shaft 248, that is, until the clutch is opened by the action of pin 261 and the incline 262, follower 302 is forced out of notch 298 so that bar 303 resumes the position shown in Figure 32. Before starting position is resumed, pin 299 engages and momentarily closes a switch 308 secured below plate 106.

Fixed to the tone arm pivot shaft 275 below bearing 272 is a rigid arm 309 which extends in the same direction as and parallel to the tone arm and projects through a slot 173' in web 173, the slot being indicated in Figure 2*a*. Fixed in the underside of a hub portion of arm 309 which projects into a recess of a block 310 fixed to the under side of the arm, as particularly shown in Figure 22, is a downwardly projecting pin 311, see also Figure 35. Fixed on one side of bar 303, Figure 22, is a bent leaf spring 312 and as the bar was moved to the right from the position of Figure 33 to that of Figure 32, spring 312 engaged pin 311 to swing arm 309 so that the tone arm was swung outwardly relative to the record until arrested by the stop 281, whether in 10 in. or 12 in. setting, with the tone arm entirely at one side of the record so as to free the record to be picked up, turned over, and replaced by means which will be later described.

Mounted on the platform 273 is a post 313 on which is pivoted, through a screw 314 near the top of the post, a depending U-shaped member comprising a trip or abutment portion 315 and a stop portion 316 which cooperates with a stop screw 317 on the post. Projecting downwardly from the tone arm is a pin 318 having a horizontally bent end portion or finger 319, and as the tone arm swings toward stop 281, the tone arm being in its uppermost position, portion 319 trips the trip 315, as shown in Figure 37, and passes therebeyond, as shown in Figure 38. Stop 281 is screwed to platform 273 through a slotted

foot portion so as to be adjustable for proper positioning. Adjustably engaged between the screw head 281' and the said foot portion is a longitudinally slotted portion of a leaf spring 281'' which is bent upwardly and away from stop 281. As the tone arm continues its outward swing, the head of screw 279 engages the upright portion of the spring and carries it against the stop which thus arrests the arm. The tone arm is now entirely free of the record at the side thereof and is maintained in this position by spring 312. When bar 303 is now displaced so as to permit the tone arm to lower, the arm is pushed over by spring 281'' so that portion 319 is brought against the vertical edge of trip 315 which is prevented by the stop means from yielding. The needle is now immediately above or slightly outside the starting track of the record and as the needle engages the record, portion 319 is just below trip 315, Figure 39, so that the tone arm is released for playing. This setting of the tone arm during its descent is permited by reason of the fact that spring 312 is being moved away from pin 311 due to the displacement of bar 303. It will be seen, therefore, that while the tone arm was lifted and turned to a position outside of the record periphery, it is returned to the proper starting position above the record as it descends to engage the needle with the record. The action of spring 281'' is just sufficient to move the stop portion 319 against trip 315. That is, the action of the spring is exhausted before the needle engages the record. When the needle engages the record, blade 331 is in engagement with the lead screw 332 and if the needle is outside of the groove it will be quickly fed in.

Secured to block 310 is a pair of normally open spring switches 320 and 321, Figures 35 and 36 of which the inner members bear against the ends of an insulating block 322 secured to the end of the arm 309. Pivoted on top of member 309 by means of a screw 323 is an actuator arm 324 which has an enlargement 325 provided with an opening 326 giving substantial clearance around shaft 275. Fixed on arm 309 is an upwardly projecting pin 327 which extends through opening 326, and a tension spring 328 connects this pin and a pin 329 on arm 324 so that the latter is yieldingly held in longitudinal register with arm 309. Between spring 320 and 321 arm 324 carries a block 330 of insulating material.

At its other end, arm 324 is provided on its underside with an axially extending blade or follower portion 331 which lies above a horizontal screw 332 journalled in bearings 333 and 334 secured beneath plate 166, the screw having fixed thereon a worm wheel 335 engaging the worm 182 which is driven by shaft 131. When the tone arm is in its lower position, blade 331 engages screw 332 and the pitch of the latter is such that as the record is played, arm 324 will be traversed in parallelism with the tone arm, or at least without any such overtaking or lagging effect as would cause sufficient relative displacement to move block 330 into closing engagement with either of switches 320 or 321. However, when the record has been played, either the needle will engage the final spiral and so swing the tone arm relative to arm 324 as to close switch 320, or arm 324, continuing to be driven by the screw, will swing relative to the tone arm so as to close switch 321. Depending on the strength of spring 328, arm 324 can exert an appreciable feeding-in effect on the tone arm, without closing switch 321, so that if the tone arm is lowered onto the smooth margin of the record, the swinging effect of arm 324 will act, in conjunction with the usual slope of the smooth marginal portion, to bring the needle into the starting track. Moreover, a gentle feeding effect will be exerted through the spring during playing of the record provided the number of record grooves per inch is normal or above. In this manner the outer sides of the record grooves are substantially relieved of driving effect on the tone arm, and wear on both sides of the grooves is equalized so that the life of the record is prolonged.

Fixed on shaft 248, Figures 22, 26, and 27, is a rotary member 336 including a gear 337 which drives a gear 338 of a rotary member 339 mounted on a shaft supported in the arms of a U-shaped bracket 340 fixed to the bottom of plate 166, the number of teeth of gear 338 being exactly twice the number of teeth of gear 337 so that the latter makes two revolutions for each revolution of the former. Mounted on member 336 is a radial finger 341 of insulating material adapted to momentarily close a switch 342 once each revolution. Member 339 carries a radial finger 343 of insulating material adapted to momentarily close a switch 334 once each revolution. On the opposite side of gear 338 from finger 343, member 339 carries a radial finger 345 of insulating material adapted to momentarily close a switch 346 once each revolution. In Figure 26, the rotary members are shown in starting position, which is the position of parts shown in Figure 28 and this means that switches 342 and 344 have just simultaneously closed and opened while finger 345 is 180° from the position in which it will operate switch 346.

Reference numeral 347, Figures 22 and 23, designates a hollow clutch member fixed on the projecting end of hub 243 and passing through the clutch member with one end journalled in the hub is a shaft 348 whose other end projects through and is journalled in the vertical plate 167. Slidable on shaft 348 adjacent clutch member 347 is a cooperating clutch member 349 urged to clutching position by a spring 350. Reference numeral 351 designates a clutch operator of the same form and effect as the operator 253 for clutch member 250, member 351 being pivoted on a bracket 352 below plate 191' and having a long arm extending beneath clutch member 349 and a short arm pulled by a spring 353 so that the long arm is urged away from the clutch member. The long arm has a cam portion or incline 354 cooperable with diametrically opposed pins 355 and 356 projecting from member 349 for opening the clutch. Member 351 is held in clutch operating position by means of a latch 357 pivoted beneath plate 191' and pulled against member 351 by a spring 358. The latch has an armature portion in front of a magnet 359 mounted on a bracket 359' fixed on box 191. When the magnet is energized, the latch is disengaged from member 351 and the latter is swung away from pin 356 into abutment with a pin 360 on the latch, and the clutch closes. The clutch operator 351 is returned to clutch opening position by the engagement of pin 356 with a laterally projecting pin 361, Figure 22, on the operator, and thereafter pin 355 rides out on the cam 354 to open the clutch at the end of a half revolution. When the clutch is next closed, pin 355 will re-cock member 351 and pin 356 will open the clutch after a half revolution. The thrust exerted by pins 355 and 356 when the clutch is being opened is taken by a backing member 362 fixed to plate

166 and having a vertical leg slidably engaged by the operator.

Shaft 348, with timed energization of magnet 359, will thus make half revolutions when clutch member 347 is being driven. In starting position, pin 356 is engaged with cam 354 and the clutch is open, as shown in Figures 22 and 23.

Fixed on shaft 348 just inside wall 167 is a disc 363 which has diametrically opposite inwardly projecting pins 364 and 365, top clearance for the disc being provided by an opening 366 in plate 166. Fixed on the shaft just outwardly of wall 167 is a disc 367 which has arcuate surfaces 368 and 369 of different radius separated by a radial shoulder 370.

A horizontal block 371, Figures 17, 22 and 42 to 50 has aligned trunnions 372 and 373 engaged in bearing brackets 374 and 375 mounted on the outside of plate 167 and projecting thereabove. When block 371 is in normal or rest position, an arm 376 fixed on trunnion 373 bears against the inside of plate 167, Figures 44 and 46, through an adjustable stop screw 377. Journalled in the block is a shaft 378 which in the normal position of the block is substantially horizontal and intersects the line of the turntable axis above the turntable. Fixed on the inwardly projecting end of shaft 378 by means of a pin 379, Figures 17 and 52 is a turning fork comprising cross head 380 and a block 381 having an outer concave face 382 curved substantially on a 6 inch radius, the axis of shaft 378 being disposed as a radius of the curve. Parallel wall plates 383 and 384 are secured to block 381 and to the ends of the latter between the walls are secured oppositely extending straps 385 and 386 which are laterally reduced and rectangularly bent to provide lower and upper tines 387 and 388 which project for a distance in parallel relation, as most clearly seen in Figure 17, and then are curved toward each other so that the tines are of generally loop or hook form and are disposed in vertically spaced apart parallel planes, Figures 28 and 51, so as to lie respectively above and below, and clear of, a record of either size centered above the turntable on its tray or on the turntable. In Figure 17 it will be seen that the tines have a lateral spacing greater than the diameter of the turntable but less than the exposed area of a centered record with the edge of which the curved surface 382 of the head is just out of contact, see also Figure 53, the illustrated record being 12 inch. The curved ends of the tines are concentric with the turntable on a radius greater than the radius of the turntable, and are spaced from the cross portion of the tray on the carriage, being thus entirely clear for up and down swinging on the axis of trunnions 372 and 373.

Referring to Figures 51 and 52, pivoted at one end on a screw 389 beneath wall 384 for sliding movement thereover is a lever 390. A lever 391 is pivoted between its ends beneath the wall on a screw 392 and its end adjacent block 371 is connected with lever 390 at a point intermediate the ends of the latter by a link 393 pulled toward lever 390 by a spring 394. Also pivoted beneath the bottom wall on a pivot pin 397a extending through a spacer 395 is a latch 396. The latch projects laterally beyond tine 388 and its edge remote from block 371 is recessed to provide a curved cam edge 397 terminating toward its pivot in a shoulder 398. Cooperating with the cam edge and shoulder is a downwardly projecting pin 399 on lever 391. Fixed in the ends of levers 390 and 391 remote from block 371 are upwardly extending pins 400 and 401, and when the latch shoulder 398 engages pin 399, as shown in Figure 52, these pins are positioned just clear of the edge of a centered 10 inch record so that the latter can rotate without scraping. If member 396 is swung counter-clockwise from the position of Figure 52 to that of Figure 53, pin 399 is released and spring 394 collapses the linkage to the relation of Figure 53, wherein pins 400 and 401 are behind the curve of face 382 so as to be entirely clear of the edge of a centered 12 inch record.

The normal position of the linkage is that shown in Figure 52. At its free end, member 396 has an upwardly projecting pin 402 in the line of movement of the lug 126 on the record positioning block 114 of a tray moving onto the carriage. When the block is set for a 10 inch record and the associated tray is moved onto the carriage, lug 126 stops short of pin 402 so that the setting of the linkage is not affected. However, when block 114 is set for a 12 inch record, as the tray moves onto the carriage, lug 126 strikes pin 402, causing the collapse of the linkage, and then passes beyond the pin. When the carriage is returned, the lug strikes the pin from the other side and swings it so that cam edge 397, working against pin 399, restores the linkage to its 10 inch setting and locks it as latch shoulder 398 comes behind pin 399. Thus, the turning fork is normally set for a 10 inch record, but when a 12 inch record is advanced, the setting is automatically appropriately adjusted by the tray moving onto the carriage and restored by the tray leaving the carriage.

When only the top side of a record is to be played, the turning fork remains at rest in horizontal position with its tines clear of the record faces in both the lower and elevated positions of the latter. It will be evident from Figure 17 that the discontinuity of tine 388, which terminates at 388', provides clearance for the free swinging of the tone arm. When the fork is turned over by means to be presently described, the end 387' of tine 387 will occupy the position of the end 388' in Figure 17 so that the same clearance for tone arm movement is provided.

Pivoted to the inside of wall 167 through a spacer 403 is an arm 404 which overlies the path of the pins 364 and 365 on disc 363, Figures 22 and 42 to 45, the arm being pulled toward the disc axis by a spring 405. An upwardly projecting bar 406, secured to the free end of arm 404, has a top horizontal portion provided with a horizontal slot 407 in which is engaged a pin 408 on arm 376. As disc 363 is rotated a half revolution, pin 364 engages an edge 409 of arm 404 so that the arm is swung clockwise and block 371 is rotated 90° to a position in which the tines are upright, or substantially so. This position is retained as pin 364 moves over a curved edge or dwell 410 of arm 404, the arm then lowering on pin 364 and the latter then stopping in the position in which pin 365 is shown in Figure 42.

In Figures 47 to 49, reference numeral 411 designates a plate disposed on the outside of carriage wall 167 in the plane of disc 367, the plate having horizontal slots 412 and 413 in which are engaged fixed guide elements 414 and 415 so that the plate is guided for horizontal reciprocation. The plate includes finger portions 416 and 417 for cooperation with disc 367, the rest position of the parts being shown in Figure 47. Projecting upwardly from plate 411 is a finger 418 which engages in a peripheral groove 419

of a disc 420 slidable on trunnion 373 between bearing 375 and arm 376. Engaged in groove 419 is a block 421 on the end of a rack bar 422 which is slidable in a longitudinal groove 423 in block 371, the groove being closed by a detachable cover plate 371' forming a part of the block. Leading off of groove 423 is a recess 424 in the block which receives a pinion 425 fixed on shaft 378 and engaged by the rack teeth.

It was previously described how, during a half rotation of shaft 348, the turning fork was swung to upright position, retained briefly, and then returned to horizontal position. As pin 364 reaches the dwell 410, during this operation, shoulder 370 of disc 367 engages the end of slide finger 416 as shown in full lines in Figure 48, moving the slide to the dot and dash position, and rack 422, moving with the slide, rotates shaft 378 180° while the fork is upright. Disc 367 stops 180° from the position shown in Figure 47 and slide 411 is held against movement due to the adjacency of fingers 416 and 417 to the arcuate edges 368 and 369. After the turning of the fork, it was returned to horizontal position during the last part of the first half revolution of shaft 348, as previously described. When the shaft is next given a half rotation, the turning fork is swung up and, after a dwell, returns exactly as before. However, this time, during the dwell, shoulder 370 engages finger 417, and returns the slide 411 to the position of Figure 47 so that the fork is rotated 180° back to its original relation.

The operation of the turning fork takes place before the turntable has been elevated and, consequently, the operation causes the record to be lifted from the tray, turned over, and replaced on the tray. As the fork swings upwardly, a 10 inch record will be supported between the tines on the pins 400 and 401, while a 12 inch record will be supported on the curved surface 382. These cradling means insure that the record is returned to the tray in substantially centered relation to the turntable. When the turntable rises, the tapered centering pin will act to pull the record slightly clear of the cradling means so that dragging cannot occur.

Fixed on shaft 343 is an arm 515 having a finger 516 of insulating material extending in parallel relation to the shaft. Toward the end of the first half revolution of the shaft, finger 516 strikes and momentarily closes a normally open spring switch 517, and, at the end of 180°, closes and maintains closed a normally open spring switch 518. At the start of the second half revolution of shaft 348, finger 516 permits switch 518 to open.

In Figures 2a, 54, 55 and 57, reference numeral 450 designates a horizontal shelf fixed to the outside of carriage plate 169. Pivoted on top of the shelf adjacent an edge thereof remote from plate 169, and parallel to the latter, is a pair of similar switch arms 451 and 452 beneath a bridge 453 which is secured to the shelf, the levers being biased to normal position substantially radial to rod 481 by tension springs 451' and 452'. The outer projecting ends of the levers are provided with movable abutment means in the form of rollers 454 and 455. At their other ends the levers carry insulating blocks 456 and 457 having contacts 458 and 459 which normally, as shown in Figure 57, engage spring contacts 460 and 461 fixed to insulating blocks 462 and 463 on the shelf. Contacts 458 and 459 are connected by a flexible conductor 464. Secured to blocks 462 and 463 are normally open, horizontally disposed, spring switches 465 and 466 of which the outer arms lie against pivoted trip members 467 and 468 having nose portions in the paths of swing, respectively, of fingers 469 and 470 at the inner ends of the switch levers. Fixed to an insulating block 471 on the shelf is a pair of horizontally disposed, normally open, spring switches 472 and 473 adapted to be closed when engaged by insulating blocks 474 and 475 carried by the switch levers. In Figure 55 the switch lever 452 is shown swung counter-clockwise from normal position with the result that contact 459 is disengaged from contact 461, switch 473 is closed while 472 remains open and switch 466 was momentarily closed as finger 470 engaged and passed the nose of rocker 468. Upon return of the switch lever to normal position under the action of spring 452', switch 473 opens, member 468 is tripped without closing effect on switch 466, which thus remains open, and contact 459 again engages contact 461.

Reference numeral 480 designates a vertical channel faced toward the outer ends of switch levers 451 and 452 and within which is mounted a vertical pivot rod 481 on which are strung a series of plates or discs 482 equal in number to the number of record spaces in the magazine and spaced apart in exactly the same relation as the stored records. Each plate is yieldingly maintained in normal disposition by a spring 483 and has projecting from its inner arcuate edge a radially extending stud on which is mounted a control abutment in the form of a roller 484 which, in the normal position of the plate, lies between rollers 454 and 455 without disturbing their normal disposition. Reference numerals 485 and 486 designate pairs of buttons mounted on stems 487 and 488 passing through openings in the face of channel 480, each pair being pivoted to the outer edge of a plate 482 at opposite sides of the plate axis. In order to prevent interference when operating the buttons, those of each series are desirably alternately laterally offset in opposite directions as indicated in Figures 55 and 56. Each plate is provided on its inner arcuate edge with square notches 489 and 490.

Reference numeral 491 designates a vertically extending pivot rod on which is strung a series of bell crank levers 492, one for each plate 482. Each bell crank lever is biased counter-clockwise, looking down, by a spring 493 and has a nose 494 borne normally against the curved edge fo its associated plate 482 between notches 489 and 490, as shown in Figure 57. Each lever 492 has a tail portion engaged with a flat universal bar 495 pivoted on a vertical axis 495' and biased counterclockwise by a spring 496 which is weaker than spring 493. In the normal relation of parts shown in Figure 57, spring 496 is permitted to swing the universal bar so that an insulating block 497 thereon engages and closes a normally open spring switch 498. In Figure 55, a button 485 has been depressed and its associated plate 482 swung clockwise so that the nose 494 of the bell crank lever is engaged in notch 489. As the bell crank lever swung counter-clockwise to engage in the notch, its tail portion swung universal bar 495 clockwise so that an insulating block 499 on the bar engaged and closed a normally open spring switch 500, and block 497 left spring 498 so that the latter opened. Reference numeral 501 designates a thin electromagnet mounted flatwise on shelf 450 with its core adjacent an armature portion on the opposite bell

crank lever near the nose end thereof. Upon energization of the magnet 501, Figure 55, nose 494 of the opposite lever will be withdrawn from the plate, without affecting any adjacent levers, and the plate will return to the normal position of Figure 57, as will also the universal bar 495. From Figure 55 it will be evident that during the above-mentioned clockwise swinging of plate 482, its roller 484 engaged roller 455, swinging switch lever 452 counter-clockwise, so that contact 459 left contact 461, switch 466 was momentarily closed, and switch 473 was closed and maintained closed. Upon release of the plate, and its return to normal position, switch arm 452 returns to its normal position. If a button 486 were to be depressed, its associated plate would be swung counter-clockwise and nose 494 would engage in notch 490 with the result, as regards universal bar 495, the same as when the nose engaged notch 489. Lever 452 would remain in normal position while roller 484, engaging roller 454, would swing lever 451 clockwise and so separate contacts 458 and 460, momentarily close switch 465 and close and maintain closed switch 472.

Each plate 482 has a radially projecting pin 502 engaged in the forked end of an individual lever 503 of a series strung on a vertical pivot rod 504, the levers having tail portions engaging a flat universal bar 505 pivoted at 506 on a vertical axis. Reference numeral 507 designates a solenoid whose armature 508 is connected to bar 505 through a link 509. The universal bar is free swinging and upon depression of a button 485 exerts substantially no resistance to the swinging of levers 503, and when a button 486 is depressed, the associated lever 503 merely swings away from the universal bar. With plates 482 in normal position, if solenoid 507 is energized, all of the levers 503 will be simultaneously swung by the universal bar and all of the plates will be rocked so that the notch 490 of each will be engaged by the nose 494 of its associated lever 492. When any plate 482 is released for return to normal position by spring 483, this can occur because levers 503 can swing counter-clockwise without opposition from bar 505.

Referring to Figure 57, reference numeral 520 designates a normally open spring switch at one side of an operating member 521 and reference numerals 522 and 523 designate independent normally open spring switches at the other side of the operator. In the use of the machine, operator 521 is moved in one direction or the other, and remains, so that either switch 520 is closed and switches 522 and 523 are open, or the latter two are closed and switch 520 is open. If it is merely desired to play one face or the other of the records, switch 520 is closed and this causes the condition which will first be assumed in describing the operation of the machine.

Reference numeral 524 designates one side of a power line with a master switch 525 interposed therein, and reference numeral 526 designates the other side of the line. The lead 524 goes to one side of the solenoid 230. The other side of the solenoid is branched through conductors 525' and 526' to an arm of switches 465 and 466, respectively. The other arms of these switches, through conductors 527 and 528 go to the lead 526 so that when either of the switches 465 or 466 is closed, solenoid 230 will be energized, assuming switch 525 to be closed.

Motor 127 is connected across the line through conductors 529 and 530 and operates continuously when the master switch is closed.

A branch 531 connects lead 524 with one side of the clutch controlling solenoid 149, the other side of the solenoid being connected through a conductor 532, with interposed normally closed manual switch 533, to the fixed contact 460. Fixed contact 461 is connected through a wire 534 with lead 526. Since contacts 458 and 459 are normally in engagement with contacts 460 and 461 and are connected together by wire 464 (Figure 55) it will be evident that an energizing circuit for solenoid 149 normally exists, the circuit being broken by the operation of either of the levers 451 or 452.

Switches 472 and 473 have a common central arm in connection with lead 526 through conductor 528. The other arm of switch 472 is connected by a conductor 535 with one arm of switch 436 whose other arm through conductors 536 and 537 is in connection with one side of magnet 270, the other side of the magnet being in connection through a conductor 538 with lead 524. Thus, if switches 472 and 436 are closed, magnet 270 will be energized. The other arm of switch 473 is connected through a conductor 539 with one arm of switch 435 whose other arm, through conductors 540 and 541, is in connection with one side of magnet 359, the other side of the magnet being in connection with lead 524 through a conductor 542.

The trip solenoid 234 is connected at one side to lead 524 through a conductor 543 and at the other with a conductor 544 which goes to one arm of switch 520 whose other arm through a conductor 545 is in connection with one arm of switch 342 whose other arm is in connection with lead 526 through a conductor 546.

The inner arms of switches 320 arnd 321 are in connection with lead 526 through a conductor 547 connected to conductor 546 and the outer arms of switches 320 and 321 are in connection with conductor 537, going to magnet 270, through a conductor 548.

One arm of switch 517 is in connection with conductor 537 through conductors 549 and 536 and the other arm of switch 517 is in connection with lead 526 through conductors 550 and 551.

One arm of switch 518 is in connection with conductor 551, and hence with lead 526, through a conductor 552 and the other arm of switch 518 is in connection through a conductor 553 with one arm of switch 308 whose other arm is in connection with conductor 541, and hence with one side of magnet 359, through a conductor 554.

A conductor 555 in connection with lead 524 is branched through a conductor 555' to one side of solenoid 507 whose other side, through a conductor 556 with interposed normally closed manual switch 556' is in connection with one arm of switch 498 whose other arm is in connection with lead 526 through a conductor 557. Conductor 555 is branched through a conductor 558 to one side of magnet 501 whose other side is connected through a conductor 559 with one arm of switch 440 whose other arm is in connection, through a conductor 560, with lead 526 through conductor 546.

If switch 525 is closed with no selection having been made on the buttons, in addition to motor 127 being driven, a circuit is immediately established to solenoids 149 and 507. The action of solenoid 507 is to swing the universal bar 505 counter-clockwise so that all of the plates 482 are swung just as though all the buttons 486 had

been depressed. This breaks the circuit to solenoid 149 but since the latter had already been energized, the stop rod 146 of the one revolution clutch was withdrawn and, consequently, the carriage moves in one direction or the other, depending on the disposition of clutch element 154, Figure 10. As it comes into position opposite the next record, the roller 484 of the related plate 482 engages roller 454 to swing switch lever 451 into a position corresponding to that in which lever 452 is shown in Figure 55. In either swing position of roller 484 its axis does not pass beyond the vertical planes in which the axes of rollers 454 and 455 normally lie, although a lateral edge of roller 484 passes sufficiently beyond one of the vertical planes which includes the adjacent lateral edges of rollers 454 and 455 so that when either of the latter is engaged by roller 484, due to carriage travel in either direction, it will be fully swung. Contact 458 is thus moved away from contact 460 so that solenoid 149 is de-energized and stop rod 146 re-engages clutch disc 139 with the latter having been rotated one revolution. Finger 469 next swings trip 467 so that switch 465 is momentarily closed, thus completing a circuit to solenoid 230 and the latter moves link 228 so that arm 204 is longitudinally displaced to engage its teeth 217 with gear 190 and the record tray, engaged by the finger 201 on block 199, is pulled onto the carriage, centering the record over the turntable. The movement of link 228 causes it to be engaged and locked in displaced position by latch 231. Finally block 474 of lever 451 engages and closes switch 472 and holds it closed.

As the tray approaches its limit position on the carriage, lug 430 of block 199 strikes the trip 431 and switches 435 and 436 are momentarily closed. Switch 435 is dead but the closing of switch 436 completes a circuit to magnet 270 so that trip 267 is operated and the clutch which drives shaft 248 is closed. Disc 297 is thus rotated through its first angular range, that is, from the position of Figure 28 to that of Figure 29, so that the turntable is elevated and, notch 298 permitting spring 305 to move bar 303, the tone arm is lowered to engage the needle operatively with the record and the record is played.

As soon as playing is completed and the needle enters the usual spiral track at the center of the record, the tone arm, and therewith arm 309, will be swung relative to arm 324 since the latter is still being advanced only at record playing pace by screw 332 and, consequently, switch 320 will be closed. If the needle should not enter the spiral but should continue in a circular track at the end of playing, the continued feed of arm 324 by screw 332 causes switch 321 to close. The closing of either switch establishes a circuit to magnet 270 so that the clutch for shaft 248 is again closed. Finger 254 immediately releases arm 258, Figure 29, permitting the turntable to lower by gravity. At the same time, pin 302 is cammed out of notch 298 so that bar 303 resumes the position of Figures 28 and 32, elevating the tone arm and its appurtenances and swinging the tone arm against the stop 281 so that the tone arm is at one side of the vertical projection of the record. When the tone arm is lifted, blade 331 is, of course, also lifted out of engagement with screw 332. Soon after pin 302 leaves notch 298 of disc 297, pin 299 of the latter closes switch 308, as shown in Figure 34, but this is without effect since the switch is in series with switch 518 which, at this time, is open.

Just before the second angular drive of shaft 248 is completed, finger 341 closes switch 342 and then frees the switch as shown in Figures 26 and 57. Closing of switch 342 completes a circuit to magnet 234 so that latch 231 is withdrawn, releasing link 228 so that spring 215 acts to move arm 204 longitudinally and thereby engage its rack teeth 218 with gear 190 so that the tray and record are returned to storage. Just before the return limit is reached, lug 437 on arm 204, Figure 12, hits trip 438, thereby closing switch 440 so that magnet 501 is energized and releases the locking lever 492 from the disc 482 associated with the record just played and switch lever 451 returns to normal position, permitting switch 472 to open, and engaging contact 458 with contact 460 so that solenoid 149 is again energized and permits the one revolution clutch to act so that the carriage is driven into operative relation with the next record. Lever 451 is again swung and the described sequence repeated until switch 525 is opened.

Suppose that when switch 525 was closed the carriage was somewhere between the upper and lower ends of the magazine and that clutch element 154, Figure 10, was set for upward drive of the carriage. No selector button having been depressed, universal bar 505 will operate and consecutive records will be played in ascending sequence. When the top record has been played, the carriage will move upwardly a distance, which need be no greater than a record selecting step, reversing rod 156 will be shifted upwardly, and the carriage will then move downwardly to the record which was opposite the starting position of the carriage and this record and the records below it will be played in descending sequence. After the bottom record has been played, the carriage will move downwardly, reversing the rotation of screw 153. As soon as the carriage left the lowermost record, its locking lever 492, which at that time was the only one engaging universal bar 495, released the bar so that switch 498 closed, solenoid 507 was energized, and all of selector plates 482 were again swung and locked. Consequently, when the carriage moves back up to the lowermost record, the latter will be played again, and so on up and down throughout the stack until the master switch is opened. If in an intermediate position of the carriage it had been desired to have the carriage first move down rather than up, clutch member 154 could have been shifted for down drive by manipulating lever 163, Figure 2. This lever serves also as an indicator as to which direction the carriage is set to travel in—if the outer end of the lever is up the carriage is set to travel up, and if its outer end is down the carriage is set for downward travel.

It has been assumed that switch 533, in the circuit of solenoid 149 was closed. If it is desired to repeat the playing of a record, the switch is opened. Since the one revolution clutch is thus unable to operate, the carriage does not move and, each time the record has been played, solenoid 507 will act to cause its re-playing, the record being returned to storage and again removed between each playing.

In order to avoid confusion in the diagram of Figure 57 the circuit for switch 500 has been shown in a separate diagram, Figure 58. Switch 500 is closed when switch 498 opens due to the swinging of any bell crank lever 492 in a clockwise direction. One arm of the switch is connected to lead 524 at one side of switch 525

through a conductor 565 with interposed manual switch 566 which is normally closed. The other arm of switch 500 is in connection with lead 524 at the other side of switch 525 through a conductor 567 so that switch 500 is in a shunt circuit around switch 525. When a record is being played switch 500 remains closed and will not open until the record has been returned to storage for the reason that the locking lever 492 is swung clockwise only upon energization of magnet 501 and this occurs as the result of the closing of switch 449, as above described. Consequently, should switch 525 be opened at any time while the machine is in an operating cycle, the operation of the machine will continue until the cycle has been completed by the return of the record, thereby opening switch 500. If, when switch 525 is opened, the tone arm is on a record, the machine can be silenced by throwing the usual transfer switch to radio, which may be dead.

The above description of the operation of the machine assumed that no selector button was initially depressed. If a button 486 is depressed and the carriage happens to be opposite the depressed button, so that rollers 454 and 455 are in horizontal alignment with roller 484, then upon closing switch 525 the carriage will not move and will play and return the record which is opposite it, then moving in one direction or the other until any previously set roller 484 is encountered. When all settings have been played, if switch 525 has not been opened, solenoid 507 will take over and successive records will be played until the machine is stopped. Solenoid 507 can be put out of action by opening switch 556'.

If no manual setting has been made prior to closing switch 525 and it should thereafter be desired to change from successive selection to manual selection, switch 525 is opened and after the record being played has been returned to storage and the machine stopped, a clearing button 495'', Figure 2, having a shank pivoted eccentrically to bar 495, is manipulated so that the bar is swung to release all the engaged latches from discs 482 and the latter return to neutral position. The desired manual settings are now made and switch 525 re-closed.

For the playing of the reverse side of the record, a button 485 is depressed, as shown in Figure 55. In this case, contact 459 moving from contact 461 causes the de-energization of the one revolution clutch 149, switch 466 is momentarily closed, causing energization of solenoid 230 and the consequent pulling of the opposite tray onto the carriage, and switch 473 is closed. When trip 431 is now operated as the tray moves into limit position on the carriage, switches 435 and 436 are both closed but this time switch 436 is dead and the live switch 435 completes a circuit to magnet 359 so that trip 357 is operated and the clutch which drives shaft 348 is closed. As previously described, the shaft is driven through a half revolution before the clutch is again opened, and during this period the record on the tray is lifted, turned and replaced. Just before the end of this operation, finger 516 momentarily closes switch 517 so that a circuit is completed to magnet 270 and shaft 248 is set in operation so that the record is played. As shaft 348 completes its one-half revolution and stops, finger 516 closes switch 518 and holds it closed. After the record has been played, switches 320 and 321 act as before to energize magnet 270 so that the turntable lowers and the tone arm is swung out. When, during the rotation of disc 297, pin 299 closes switch 308, an energization circuit is established for magnet 359 through switch 518, and trip 357 is operated and shaft 348 is driven through its second half revolution so that the record is lifted, turned and replaced on the tray in its original relation. Immediately thereafter nose 341 closes switch 342 so that magnet 234 is energized and arm 204 is swung to return the record. If it is desired to repeat the same record, switches 533 and 556', controlling the circuits to solenoids 140 and 507, respectively, are opened and the same button 485 is again depressed.

The above explains how one or the other of the faces of a record is played by the machine. By moving operator 521 so as to close switches 522 and 523 and then depressing a button or buttons 486 the machine will remove one or a succession of records, play both faces of each record in succession, and only then return the played record to storage.

It will be recalled that in the playing of the top face of a record, the return of the record to storage was initiated by the closing of switch 342. If it is desired to play the other side of a record before returning the record it is only necessary to eliminate the action of switch 342 and, instead, energize magnet 359 for the operation of the record turning mechanism, energizing the latch controlling solenoid 234 only after the reverse side of the record has been played and the record replaced on the tray in its original relation.

When switch 522 is closed, conductor 544, in connection with trip magnet 234, is in connection with one arm of switch 346 through a conductor 570, and the other arm of switch 346 is in connection with one arm of switch 522 through a conductor 571 and, thence, through a conductor 572, with conductor 551 which extends to lead 529. One arm of switch 344 is in connection with conductor 541, and hence with magnet 359, through a conductor 573. The other arm of switch 344 is connected through a conductor 574 with one arm of switch 523 and, thence, through a conductor 575 with conductor 546 which extends to lead 526. Switch 520 being open, the circuit to switch 342 is broken and its operation will be without effect.

It will be recalled that gear 338 rotates at half the speed of shaft 248. Consequently, when finger 341 has made a full revolution so as to close switch 342, finger 343, moving with gear 338 has moved only 180° from the position shown in Figure 57 and hence is without effect on switch 344 which is now in control of the circuit to the trip magnet 234. However, at this point, finger 345, which moves with gear 338, closes switch 346, so that magnet 359 is energized and the sequence above described for playing the reverse side of the record is followed through, finger 343 finally closing switch 344 momentarily so that magnet 234 is energized and the record is returned. Records can be selected by depressing buttons 486 and if none is depressed, or after selected records have been played, solenoid 507 takes over so that the records will be automatically consecutively played on both faces before return to storage as long as switch 525 remains closed.

In order to remove a tray for changing the record, universal bar 115 is manually swung to release the tray and the tray is charged and returned. Universal bar 115 acts to hold one side of the trays. In order to correct any unevenness at the other side, the adjacent end of channel

185, Figures 17, 18, and 19, may have secured thereto a slotted end plate 580 having rounded top and bottom cam surfaces 581 and 582 which, as the carriage travels in either direction, can contact the adjacent ends of tongues 123 of the trays to square the trays on the tracks.

It is contemplated that the magazine may have, for example, tracks for 100 trays so that the magazine will house the entire average private record collection. If the collection includes fewer than the maximum for which the magazine is designed, the records will be stored in the lower section of the magazine in order that the support of the solid bottom plate 122', Figure 9, may be had and the entire stack will be in the previously described mutually supporting relation, through sheets 122, to preserve them against warping. In this case, the upper reversing abutment 160, Figures 2 and 10, may be appropriately adjusted downwardly on the rod 156 so as to avoid useless travel of the carriage above the top of the stack.

It was previously stated that the carriage travels beyond the end records to reverse the drive. However, stops 160 and 162 may be so adjusted that reversal will occur when the carriage comes opposite the top and bottom records, respectively. Thus in automatic playing, without manual selection, the playing of the top and bottom records will not be repeated, as will be the case if the carriage has to travel beyond these records in order to operate the reversing mechanism.

In the case of a machine designed for home use an index of the stored records will be kept, the records being given numbers corresponding with numbers associated with the selector buttons 485 and 486, the pairs of the latter being numbered from 1, beginning, for example, at the bottom of the stack. A pointer P, Figures 55 and 56, indicates at which record the carriage is standing. Suppose the pointer P shows that the carriage is opposite record number 5 and lever 163 indicates that the carriage is set for upward travel, but it is desired to play record number 4. In this case, the selector mechanism is set for record number 4, handle 163 is operated to reverse the carriage drive, and the machine is turned on. The carriage immediately descends one step and plays the selected record. Otherwise, the carriage would have had to travel all the way up the stack to reverse the drive and return to the selected record.

The instrument is also well adapted for commercial use and the usual coin controlled selecting means may be provided.

As stated at the outset, when the storage magazine is of large capacity, the relatively small playing means is preferably the traveling element. However, in the case of a magazine of small capacity, say 10 or 20 records, the magazine may well be the traveling element.

It will be understood that the disclosure herein is not intended as restrictive of the invention but that variations in the form and arrangement of parts are contemplated as under the invention as defined in the following claims.

I claim:

1. In an automatic phonograph, a base, record storing means and record playing means carried by said base, said storing means comprising a plurality of horizontal tracks supported in superposed relation, record trays supported by the tracks and movable out of one end of the tracks, each of said trays being of skeleton form and adapted to support a disc record horizontally against radial displacement but with freedom of vertical movement apart and with a central bottom area of the record exposed, said playing means being disposed on said base at said one end of the storage tracks, one of said means being movable vertically relative to the other and to said base, means for driving said movable means, said playing means having a horizontal track alignable with the storage tracks individually, means for automatically interrupting the drive of said movable means to arrest the same with the track of the playing means in alignment with one of the storage tracks, transfer means automatically operated upon arrest of the movable means to advance the tray from the aligned storage track onto the track of the playing means for the playing of a record on the advanced tray and then to return the tray and record, said playing means including a horizontal turntable underlying and centered with the exposed area of the record on the advanced tray; said transfer means comprising a member on the playing means reciprocable between limits longitudinally of the track of the playing means and engageable with a tray for the reciprocation thereof, a gear arranged coaxially with the turntable therebeneath and rotating therewith, a transmission member including arcuate horizontally opposed racks pivoted on a vertical pivot, said gear being between said racks and the racks being spaced apart a distance greater than the outside diameter of said gear, automatically controlled means for displacing said transmission member to effect alternate engagement of said racks with said gear whereby said transmission member is reciprocated, and connecting means whereby the reciprocation of said transmitting member is imparted to said reciprocating member.

2. In an automatic phonograph, a base, a magazine for disk records carried on the base, a turntable support mounted on the base at an end of the magazine, a turntable journalled on said turntable support, means for rotating the turntable, transfer means for moving a record from the magazine into horizontal centered position above the turntable for playing and then for returning the record, a fork carried by said turntable support and having a pair of normally horizontal tines of which one is above and the other below a record over the turntable, means for swinging the fork to an upright position and then for returning it to horizontal position, cradle means on the fork having two positions and engageable with the lower edge of the record during the swing of the fork so that a record of either of two sizes is maintained against any substantial radial displacement, means for turning the fork about an axis normal to its swinging axis while the fork is at the top of its swing, said cradle means normally having a position appropriate to one record size, and means operated when a record of the other size comes over the turntable for establishing the other position of the cradle means and operated as said record of other size is returned for re-establishing the normal position of said cradle means.

3. Apparatus according to claim 2 including trays on which the records are stored and transferred, adjustable abutment members on each tray for positioning a record of either size on the same center, and wherein the means for

establishing the other position of the cradle means is operated by a portion of one of said abutment members when adjusted for a record of said other size.

4. In an automatic phonograph, a base, a magazine carried by said base and comprising a plurality of horizontal storage tracks supported in superposed relation, record trays supported by the tracks and movable out of an end of the tracks, each of said trays being of skeleton form and adapted to support a disk record against radial displacement but with freedom of upward displacement and with a central bottom area of the record exposed, stiff cushion sheets interposed between the trays and anchored opposite said one end, the relation of parts being such that when the loaded trays are in the magazine each sheet as supported on a record therebelow provides central support for the record thereabove so that a substantially solid stack is provided, playing means carried by said base, and means for moving the trays singly from the magazine onto the playing means for the playing of the records and then for returning the trays, the adjacent sheets lapping a portion of the removed tray so that the latter can be returned without buckling the sheets.

5. In an automatic phonograph, a base, a magazine carried by said base comprising a plurality of horizontal storage tracks supported in superposed relation, record trays supported by said tracks in vertical register, transfer means for removing a tray for the playing of the record carried thereby and for returning the tray and record after playing, a universal bar pivoted to said base on a vertical axis and normally spring-urged against vertically registering abutment portions of the trays, and means operated by the transfer means just prior to its removing action for swinging said bar to free the trays so that the selected tray can be removed.

6. In an automatic phonograph, a base, means carried by said base for storing disk records in coaxial spaced relation, record playing means carried by said base, one of said means being movable relative to the other and to said base for record selection, means for driving the movable means, transfer means for advancing a selected record from the storage means to the playing means for playing and then for returning the record, said playing means being capable of playing either face of an advanced record, swingable members mounted on said base on an axis parallel with the axis of the stored records, there being one of said members for each record and said members being spaced apart in the same relation as the records, spring means yieldingly holding each of said members in normal position, projecting control abutments on said members respectively and aligned with each other when said members are in normal position, a pair of movable abutments on said movable means normally disposed at the sides of a normally positioned control abutment when said movable member is in a record selecting position, spring means yieldingly holding said movable abutments in normal position, means operable to swing each of said members in either direction and thereby move from normal position one or the other of the movable abutments between which a swung control abutment lies, individual means for locking any swung member in swung position, means operated by the movement of said movable abutments for determining which face of the selected record shall be played, a control circuit for said driving means, normally closed switch means in said circuit opened by the movement of either of said movable abutments from normal position whereby the drive is rendered inoperative, and means operated upon the return of a record to storage for releasing said locking means so that said circuit is closed and drive established, said abutments being so formed and related that swung control abutment will engage and move a movable abutment during the drive of said movable means whereby the drive is rendered inoperative and the movable means stops in position for the transfer and playing of a predetermined record.

7. Apparatus according to claim 6 wherein the locking means have armature portions and wherein the releasing means comprises an electromagnet which travels with the movable means.

8. Apparatus according to claim 6 wherein each swingable member has a pair of angularly spaced notches, and wherein each locking means has a nose portion normally spring-urged against its associated swingable member between the notches thereof and engages in one or the other of the notches when the said member is swung.

9. Apparatus according to claim 6 wherein each swingable member has a pair of angularly spaced notches, wherein each locking means is in the form of a lever having a nose portion and a tail portion of which the nose portion is normally spring-urged against its associated swingable member between the notches thereof and engages in one or the other of the notches where the said member is swung, and wherein the apparatus includes a universal bar pivoted on an axis parallel to the swinging axis of said members and arranged to be swung from normal position by the tail portion of any lever which assumes a locking position, spring means acting to return said bar, a self-opening switch normally held closed by said bar but opening when said bar is swung from normal position, a second universal bar substantially free-swinging on an axis parallel to the axis of the first bar, individual transmission members between said second bar and each of said swingable members, electromagnetic means arranged upon energization to swing said second bar whereby to swing all of said swingable members through said transmission members into a locked position from which they are individually releasable without interference from said transmission members and second bar, and an energizing circuit for said electromagnetic means controlled by said self-opening switch.

10. Apparatus according to claim 6 including electro-magnetic means arranged upon energization to initiate the advancing action of the transfer means, a circuit for said electro-magnetic means, and switch means controlling the last-named circuit and momentarily closed upon movement of either of said movable abutments by a control abutment.

11. Apparatus according to claim 6 including pickup means and record turning means adapted to turn a record in advanced position and wherein the means for determining which face of a record shall be played includes electro-magnetic means arranged upon energization to render the pickup means operative and electro-magnetic means arranged upon energization to render the record turning means operative, a circuit for each of said electro-magnetic means, switches in the last-named circuits selectively closed and maintained closed by said movable abutments when moved by a control abutment, further switches in said last-named circuits respectively, and means operated

at the end of the record advancing operation for simultaneously closing said further switches so that one of said electro-magnetic means is energized.

12. In an automatic phonograph, a base, record storing means and record playing means carried by said base, one of said means being movable vertically relative to the other and to said base, said storing means comprising a plurality of horizontal tracks supported in superposed relation, record trays supported by the tracks and movable out of one end of the tracks, each of said record trays including means to support records of two different sizes and an abutment member lying within the bounding planes of the upper and lower faces of the tray to contact with the periphery of a record supported thereon, said abutment member being settable in accordance with the record size, said playing means being disposed on said base at said one end of the tracks of the storing means, said playing means having a horizontal track alignable with the individual tracks of the storing means, transfer means to advance the tray from the aligned storage track onto the track of the playing means for the playing of a record on the advanced tray and then to return the tray and record, said playing means including a horizontal turntable underlying and centered with the record on the advanced tray, means operating automatically when the record is centered with the turntable for relatively adjusting the turntable and tray to engage the turntable with the record and free the record from the tray for playing and then for reengaging the record and tray for the return thereof to the storing means, means for rotating the turntable, said playing means including pick-up means, means automatically controlling the pick-up means to engage it with a record on the turntable to play the record and to free it from

the record after the playing thereof, and transmission means arranged to be engaged and actuated by said abutment member in one of its settings during the advance of the tray and which transmission means are operatively connected with said pick-up means to move the latter from one starting position to the other.

13. Apparatus according to claim 12 wherein each record tray includes a plurality of abutment members and said transmission means is arranged to be engaged by actuation of one of said abutment members.

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