Aug. 27, 1946. J. A. DARWIN ET AL 2,406,355

AUTOMATIC PHONOGRAPH

Filed Dec. 17, 1940 14 Sheets-Sheet 1

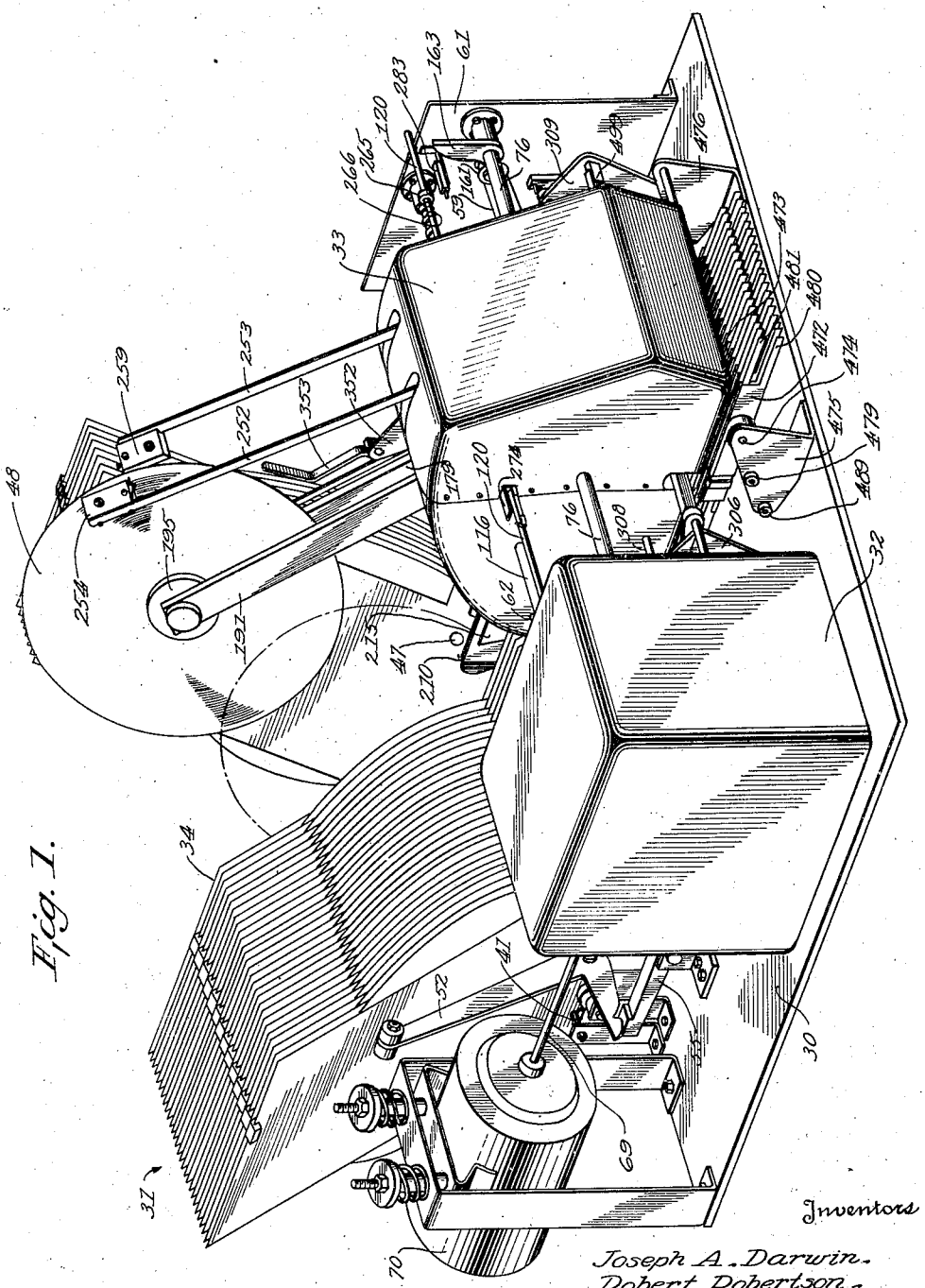


Fig. 1.

Inventors

Joseph A. Darwin.

Robert Robertson.

By Cushman Darby & Cushman

Attorneys

Aug. 27, 1946. J. A. DARWIN ET AL 2,406,355

AUTOMATIC PHONOGRAPH

Filed Dec. 17, 1940 14 Sheets-Sheet 2

Fig. 2.

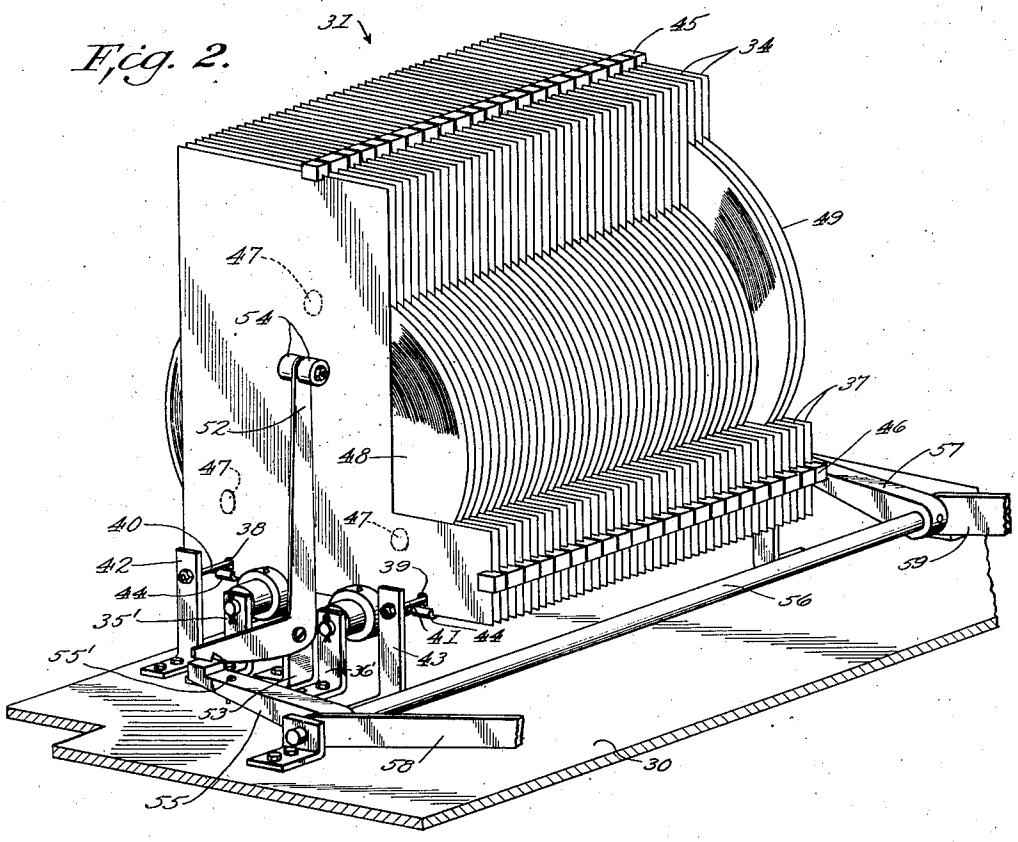


Fig. 3.

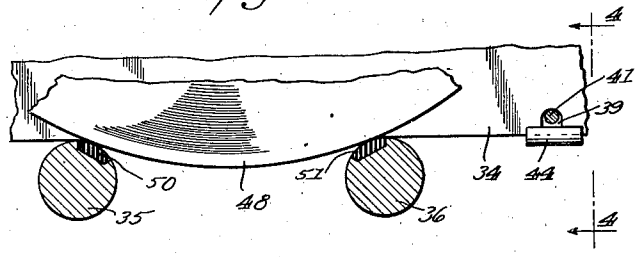
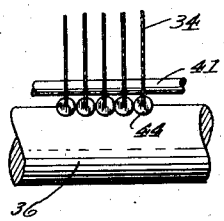


Fig. 4.



Inventors

Joseph A. Darwin.

Robert Robertson.

By Cushman Darby & Cushman

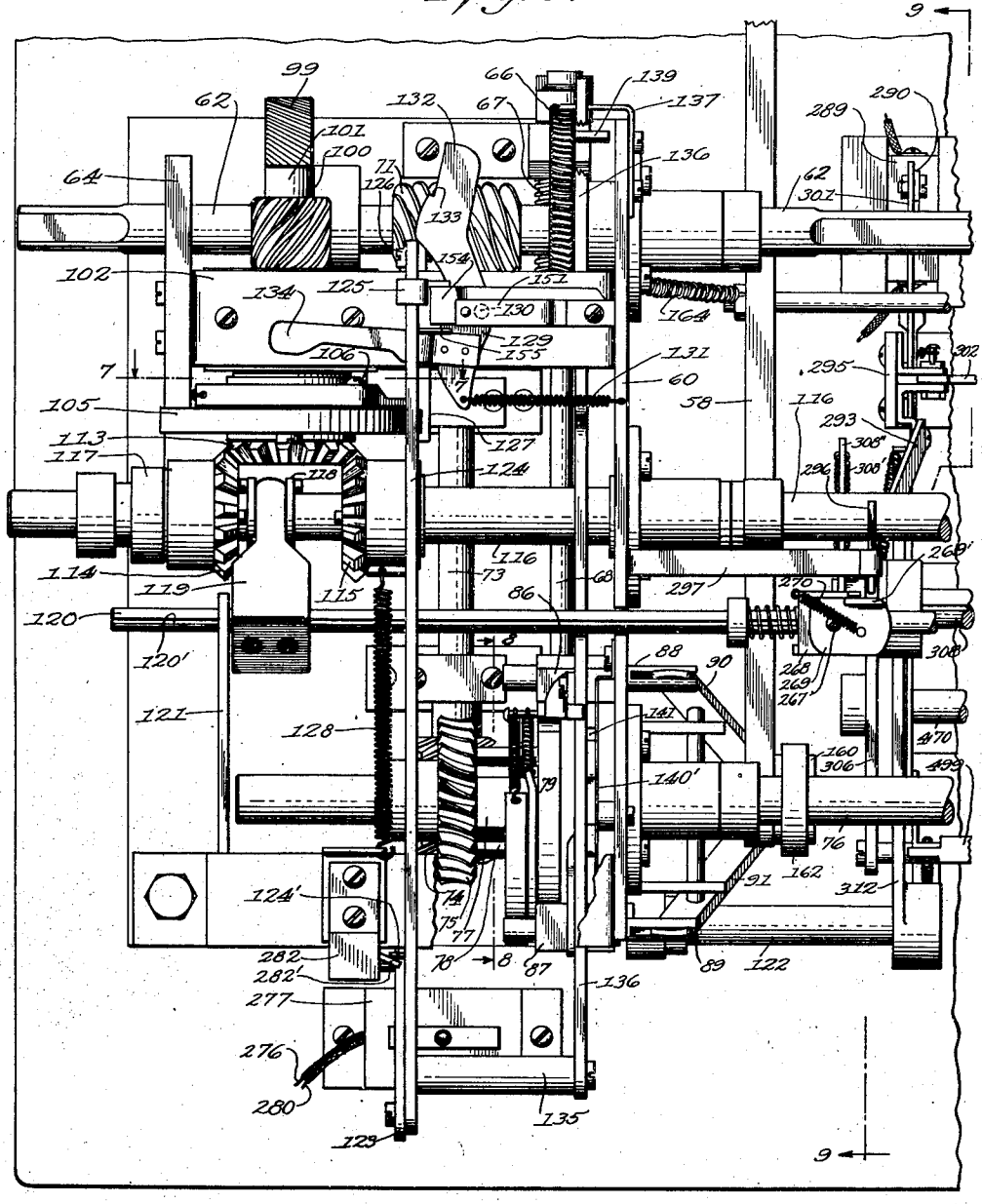
Attorneys

Aug. 27, 1946. J. A. DARWIN ET AL. 2,406,355

AUTOMATIC PHONOGRAPH

Filed Dec. 17, 1940 14 Sheets-Sheet 3

Fig. 5.



Inventors

Joseph A. Darwin.

Robert Robertson.

By Cushman Darby & Cushman

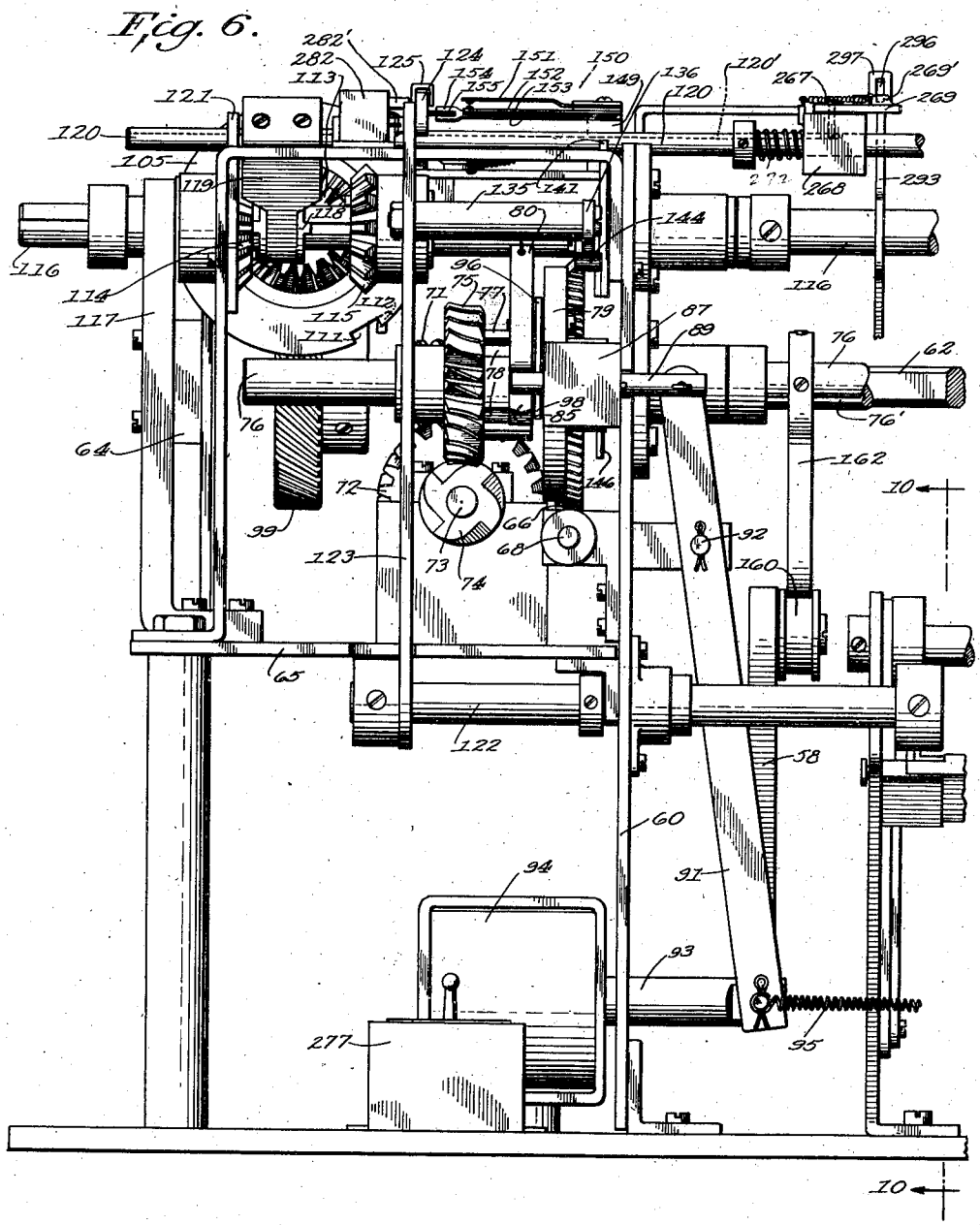
Attorneys

Aug. 27, 1946. J. A. DARWIN ET AL 2,406,355

AUTOMATIC PHONOGRAPH

Filed Dec. 17, 1940 14 Sheets-Sheet 4

Fig. 6.



Inventors

Joseph A. Darwin.
Robert Robertson.

By Cushman, Darby & Cushman

Attorneys.

Aug. 27, 1946. J. A. DARWIN ET AL 2,406,355

AUTOMATIC PHONOGRAPH

Filed Dec. 17, 1940 14 Sheets-Sheet 5

Fig. 7.

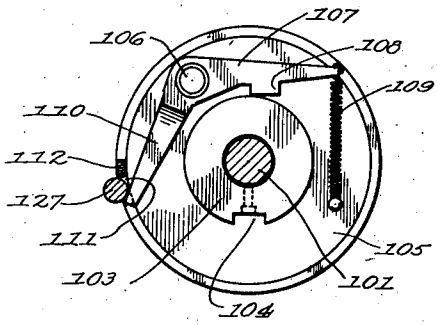


Fig. 8.

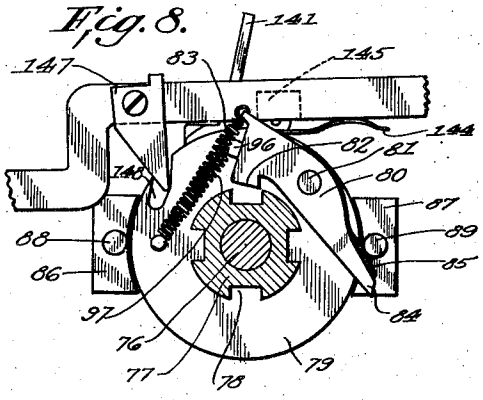


Fig. 10.

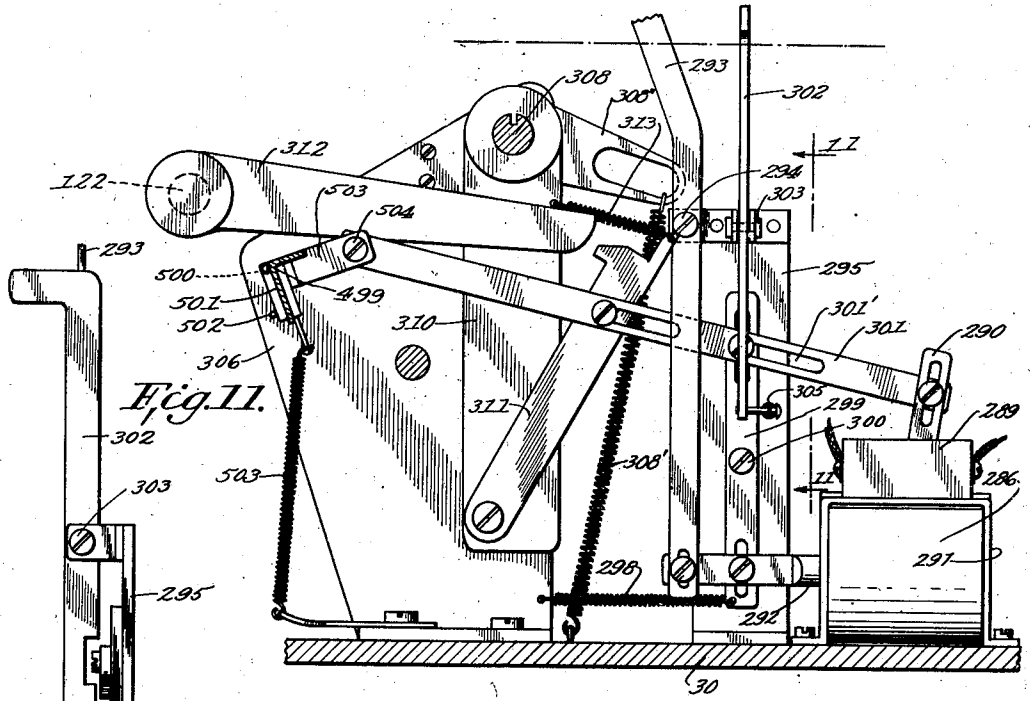
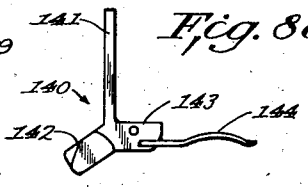


Fig. 11.

Fig. 8a.



Inventors

Joseph A. Darwin.

Robert Robertson.

By Cushman Darby & Cushman

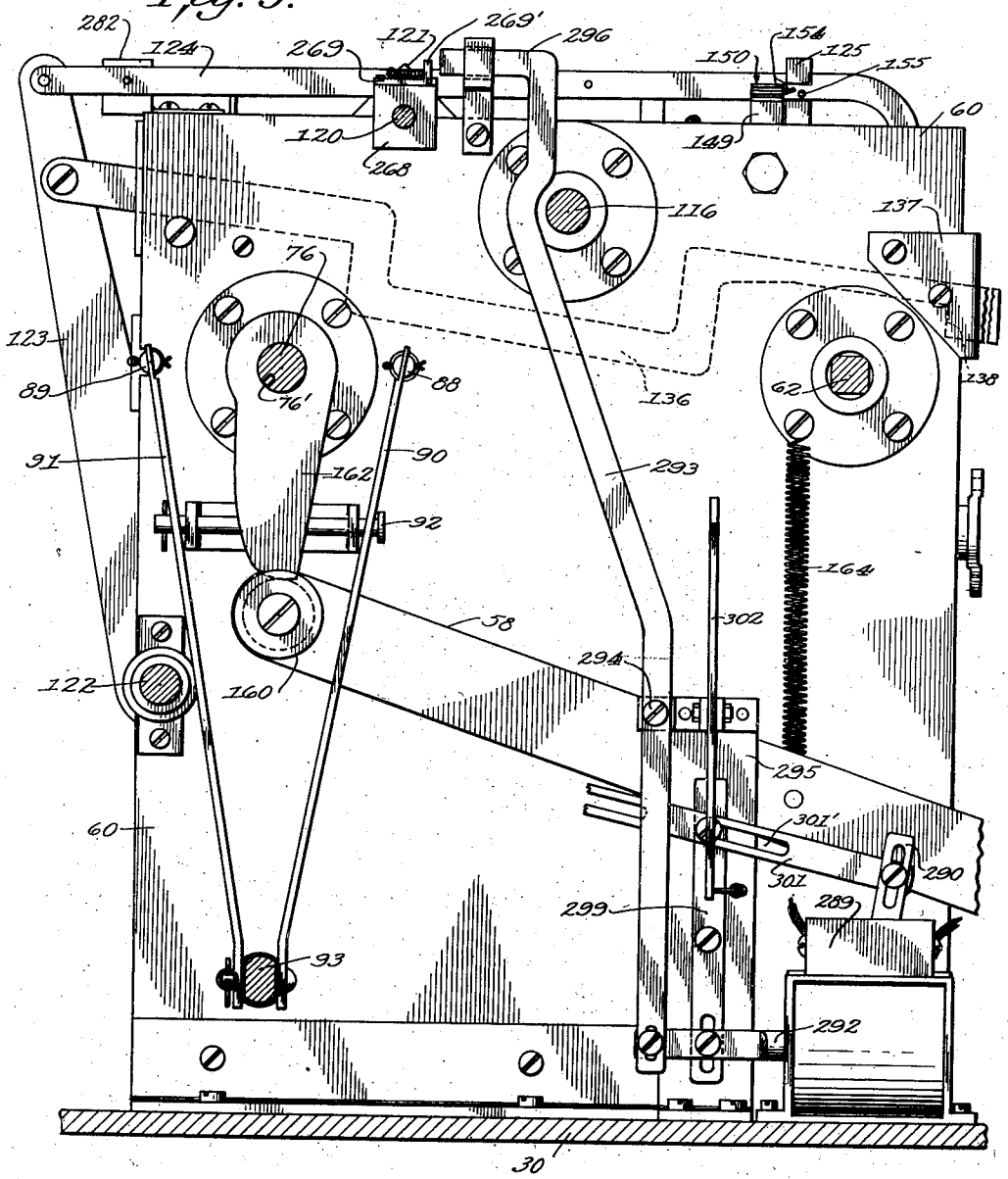
Attorneys

Aug. 27, 1946. J. A. DARWIN ET AL 2,406,355

AUTOMATIC PHONOGRAPH

Filed Dec. 17, 1940 14 Sheets-Sheet 6

Fig. 9.



Inventors

Joseph A. Darwin.

Robert Robertson.

By Cushman Darby & Cushman

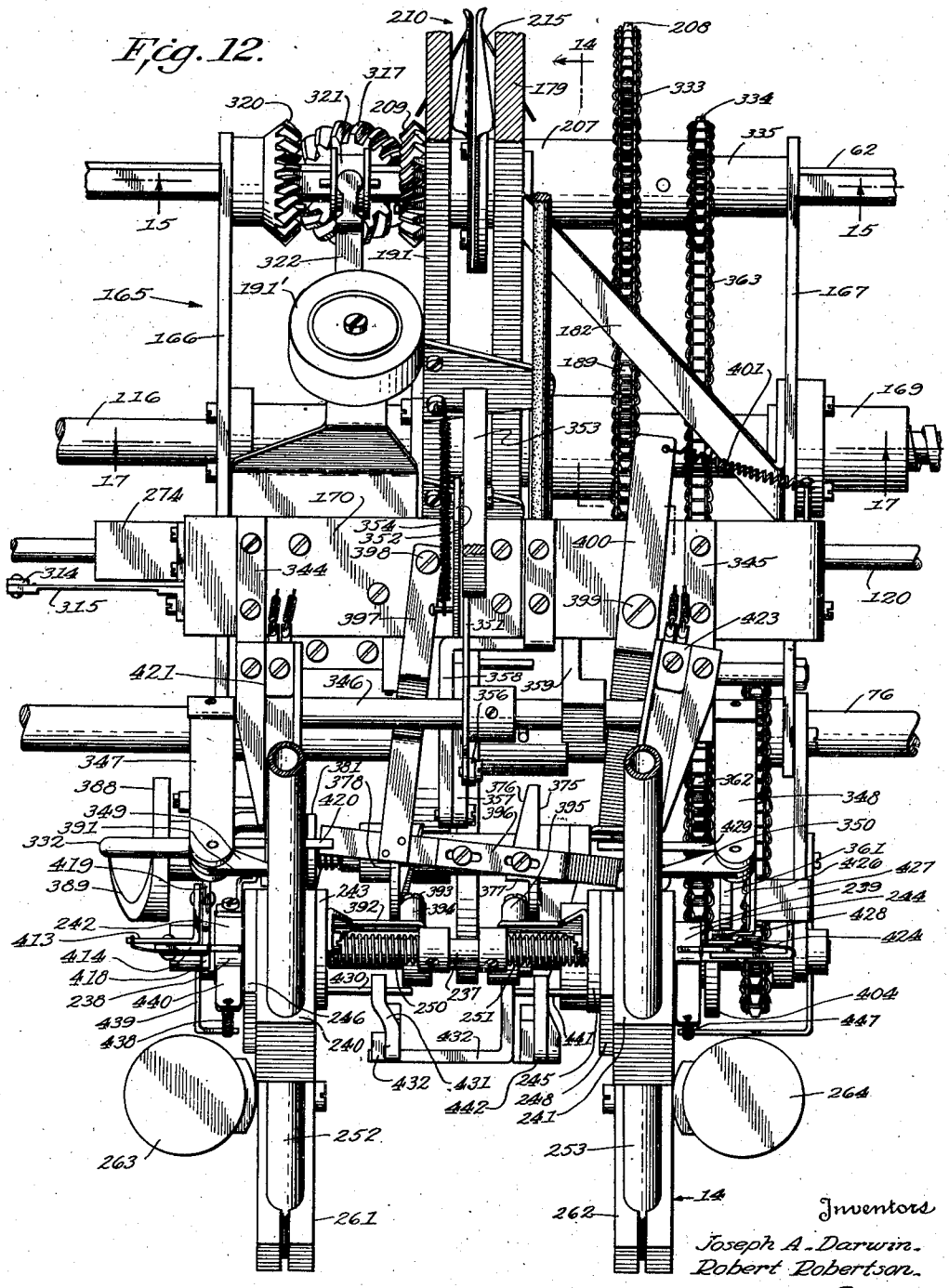
Attorneys

Aug. 27, 1946. J. A. DARWIN ET AL 2,406,355

AUTOMATIC PHONOGRAPH

Filed Dec. 17, 1940 14 Sheets-Sheet 7

Fig. 12.



Inventors

Joseph A. Darwin.

Robert Robertson.

By Cushman Darby & Cushman

Attorneys

Aug. 27, 1946. J. A. DARWIN ET AL 2,406,355

AUTOMATIC PHONOGRAPH

Filed Dec. 17, 1940 14 Sheets-Sheet 8

Fig. 13.

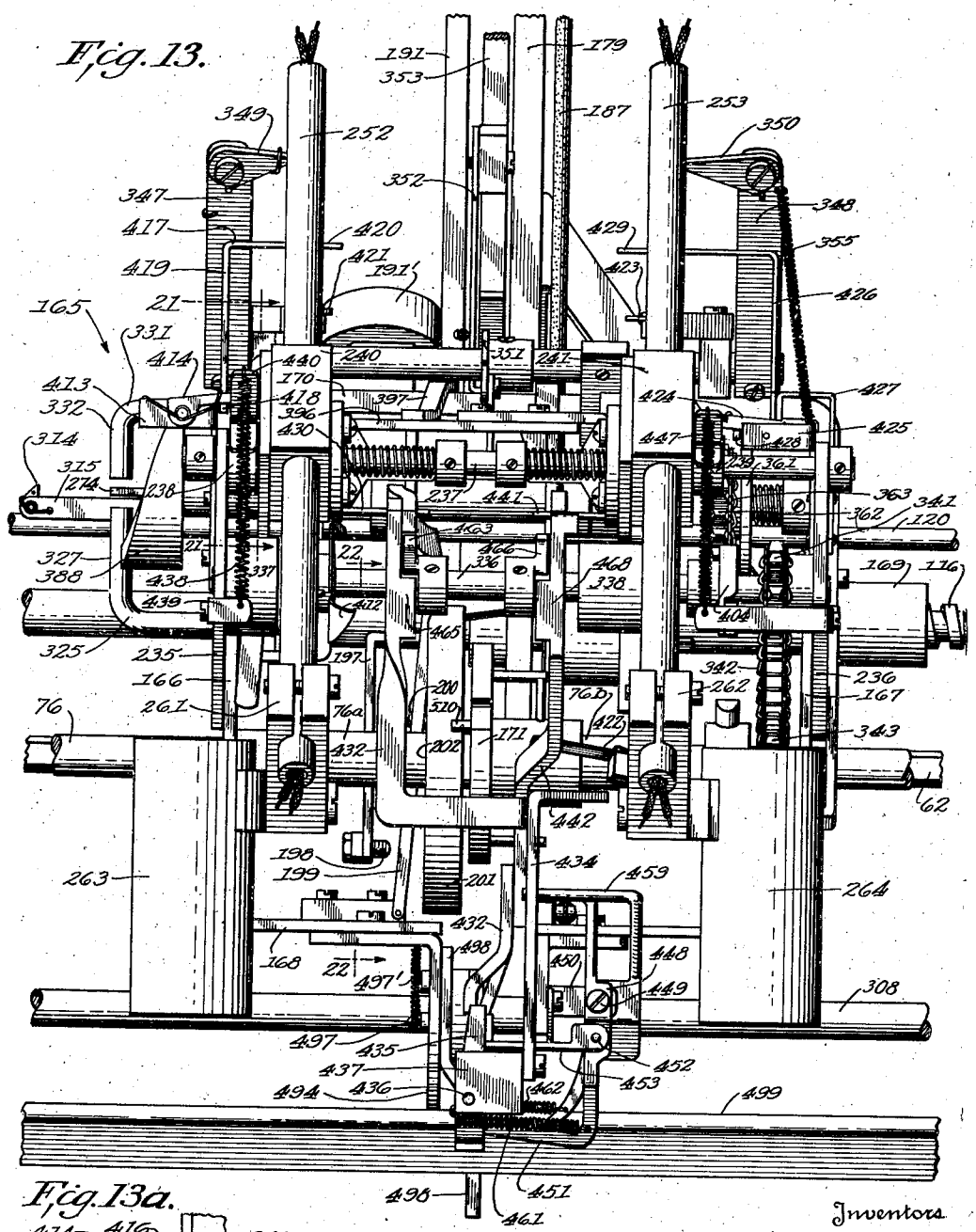
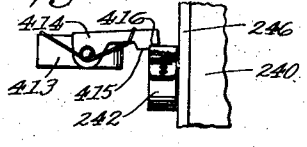


Fig. 13a.



Inventors
Joseph A. Darwin.
Robert Robertson.
By Cushman Darby & Cushman
Attorneys

Aug. 27, 1946. J. A. DARWIN ET AL 2,406,355

AUTOMATIC PHONOGRAPH

Filed Dec. 17, 1940 14 Sheets-Sheet 9

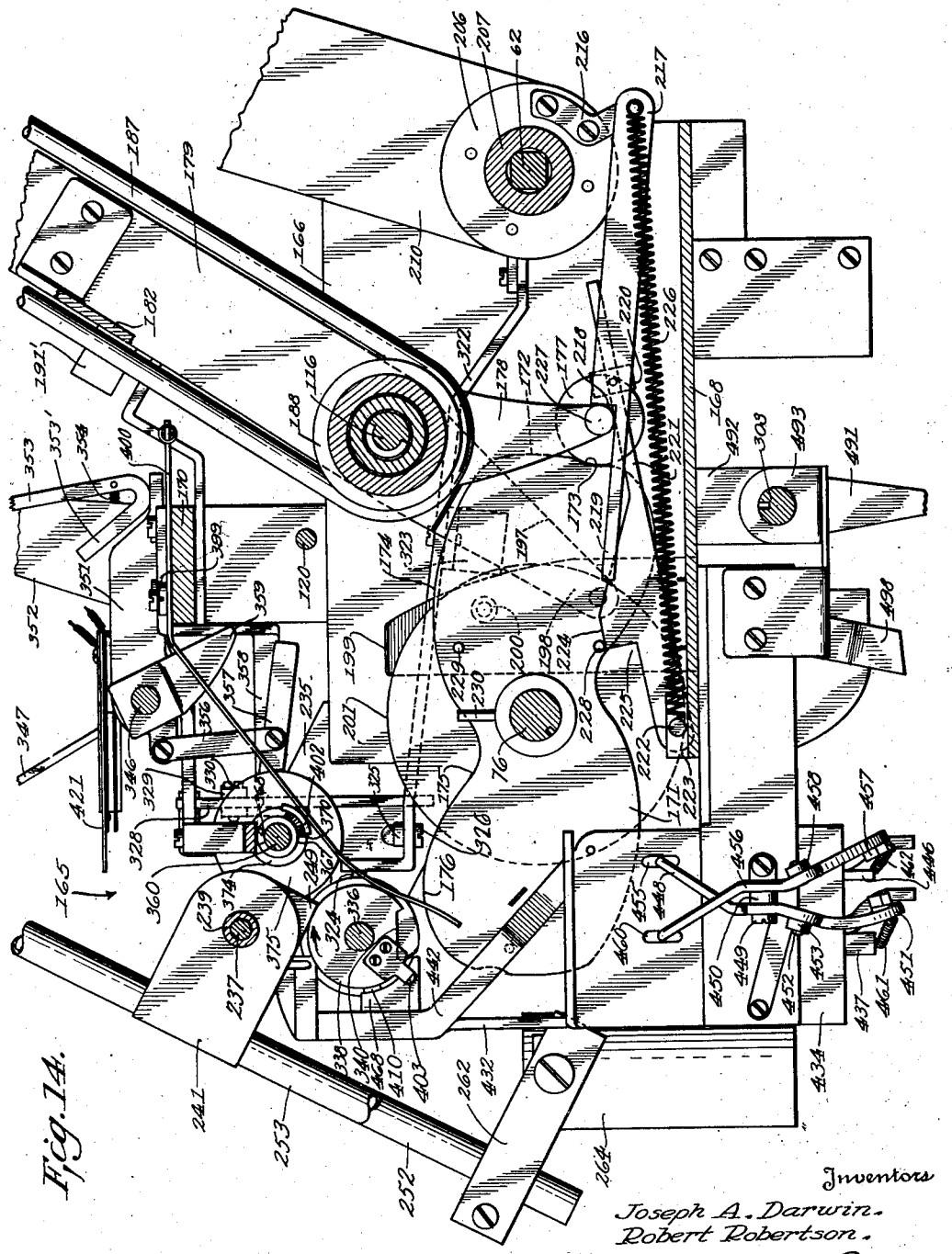


Fig. 14.

Inventors
Joseph A. Darwin.
Robert Robertson.
By Cushman Darby & Cushman
Attorneys

Aug. 27, 1946. J. A. DARWIN ET AL 2,406,355

AUTOMATIC PHONOGRAPH

Filed Dec. 17, 1940 14 Sheets-Sheet 10

Fig. 15.

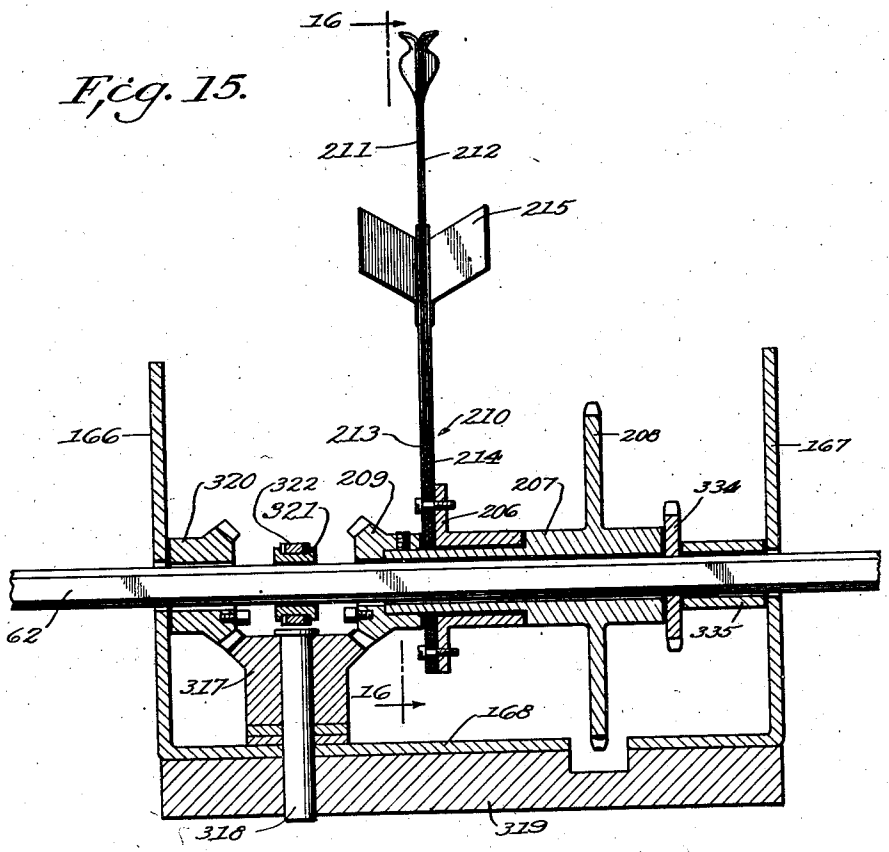
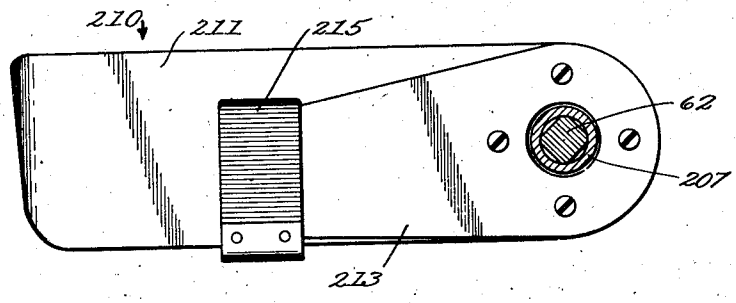


Fig. 16.



Inventors

Joseph A. Darwin.

Robert Robertson.

By Cushman Darby & Cushman

Attorneys

Aug. 27, 1946. J. A. DARWIN ET AL 2,406,355

AUTOMATIC PHONOGRAPH

Filed Dec. 17, 1940 14 Sheets-Sheet 11

Fig. 17.

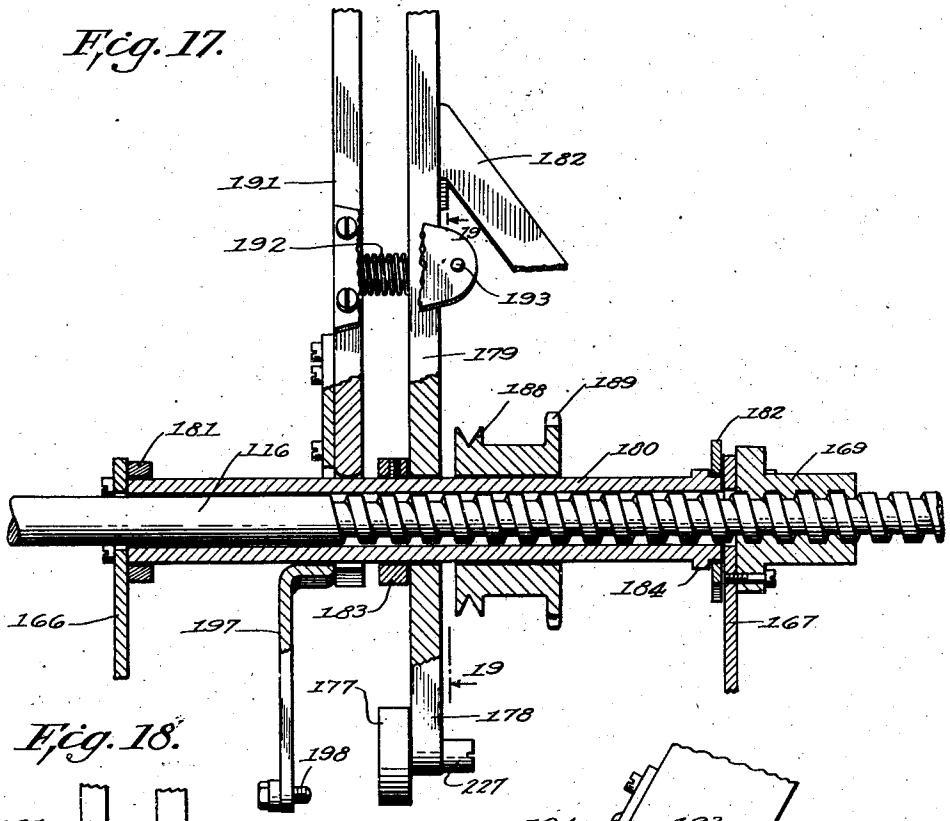
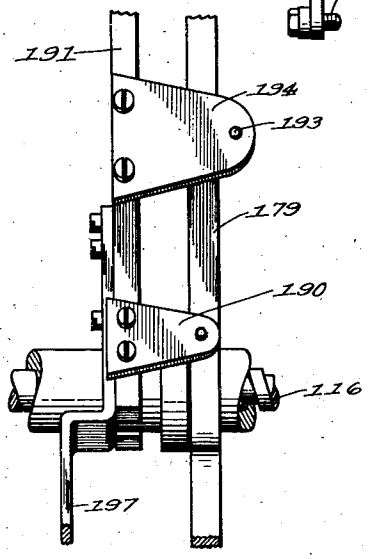


Fig. 18.



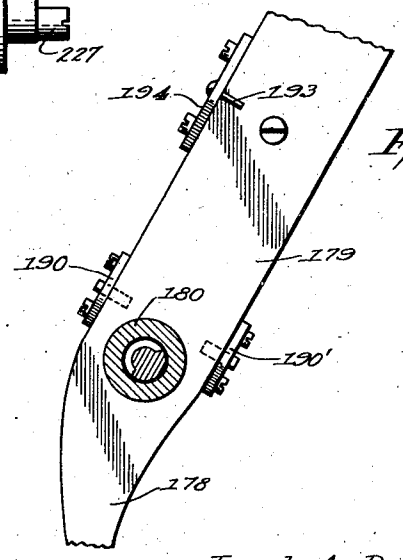


Fig. 19.

Inventors

Joseph A. Darwin.

Robert Robertson.

By Cushman Darby & Cushman

Attorneys

Aug. 27, 1946. J. A. DARWIN ET AL 2,406,355

AUTOMATIC PHONOGRAPH

Filed Dec. 17, 1940 14 Sheets-Sheet 12

Fig. 20.

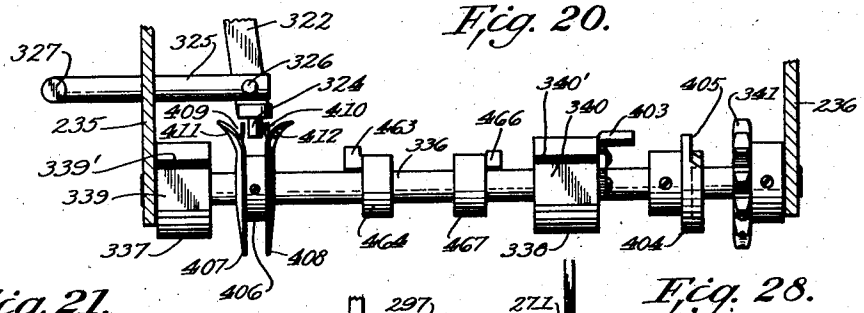


Fig. 21.

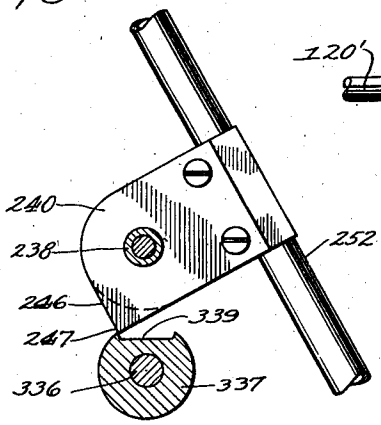


Fig. 28.

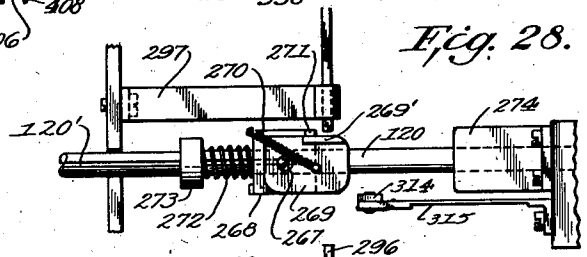


Fig. 29.

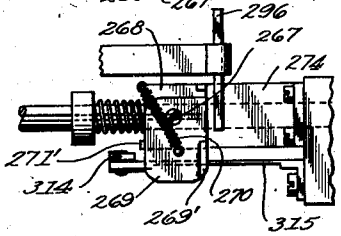
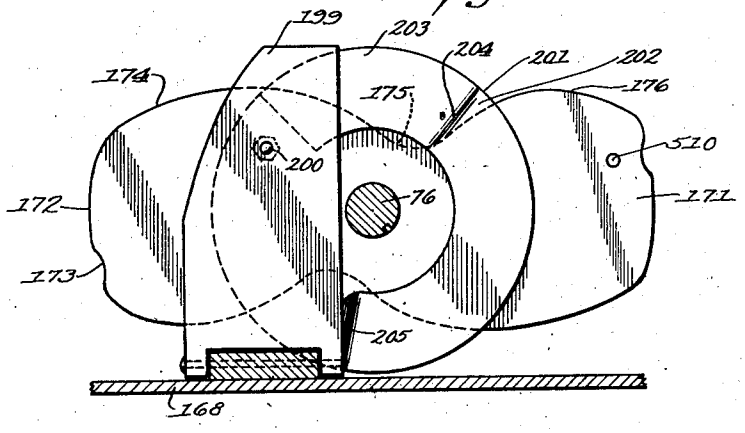


Fig. 22.



Inventors

Joseph A. Darwin.

Robert Robertson.

By Cushman Darby & Cushman

Attorneys

Aug. 27, 1946. J. A. DARWIN ET AL 2,406,355

AUTOMATIC PHONOGRAPH

Filed Dec. 17, 1940 14 Sheets-Sheet 13

Fig. 23.

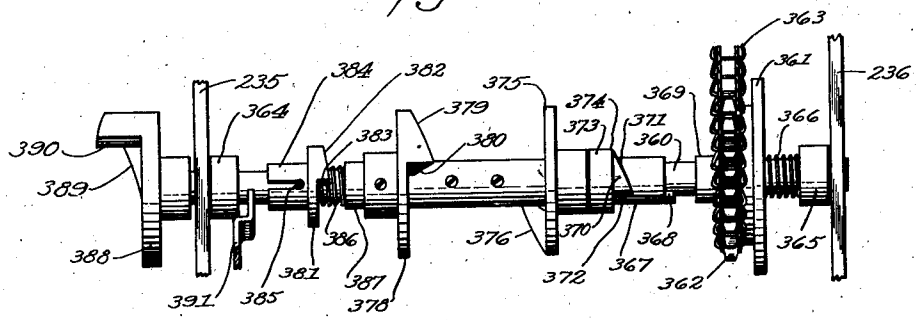


Fig. 24.

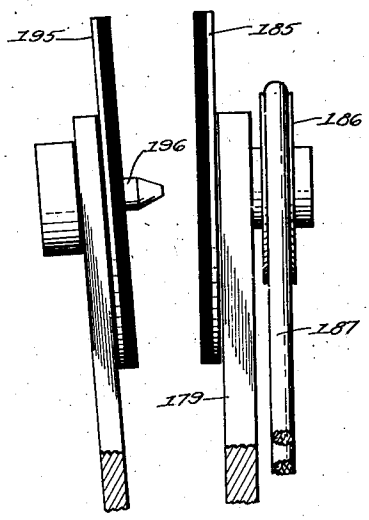


Fig. 25.

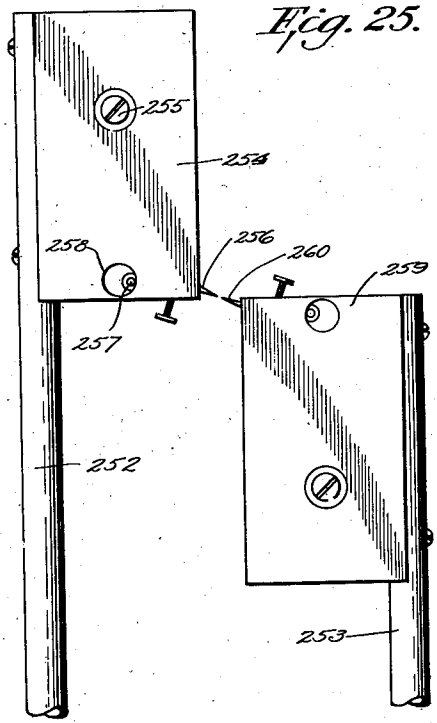
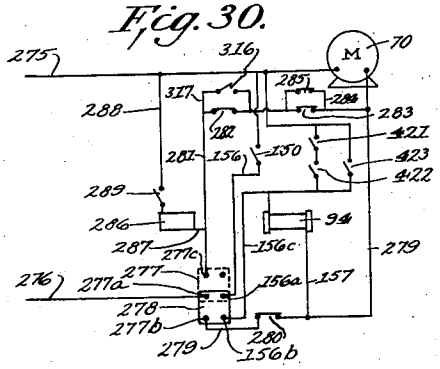


Fig. 30.



Inventors

Joseph A. Darwin.

Robert Robertson.

By Cushman Darby & Cushman

Attorneys

Aug. 27, 1946. J. A. DARWIN ET AL 2,406,355

AUTOMATIC PHONOGRAPH

Filed Dec. 17, 1940 14 Sheets-Sheet 14

Fig. 26.

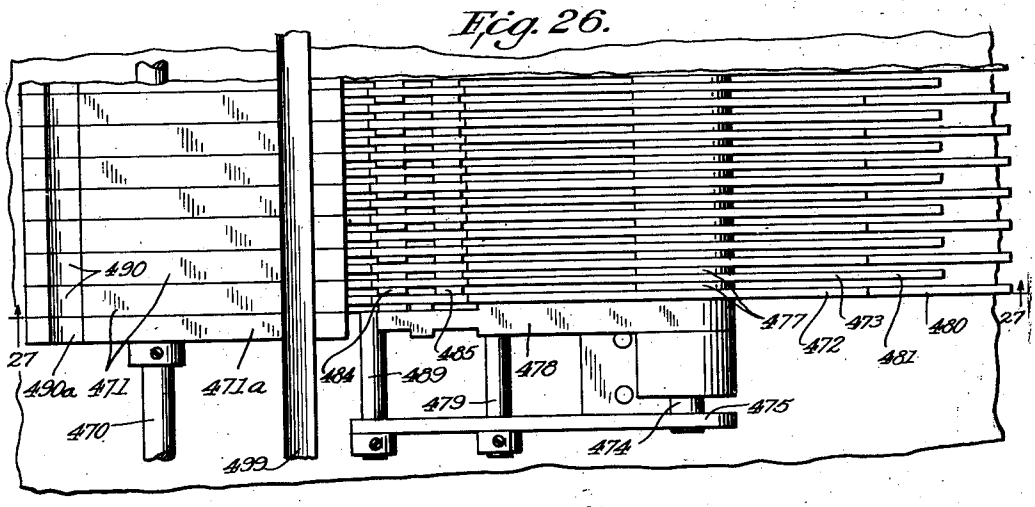
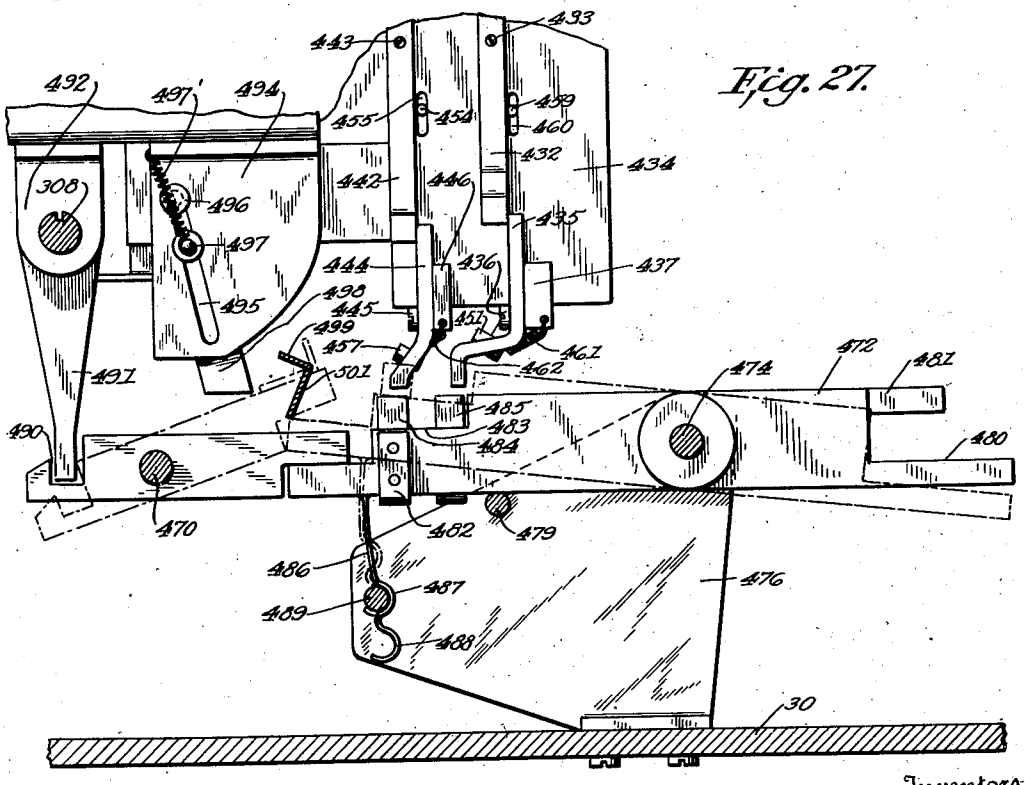


Fig. 27.



Inventors:
Joseph A. Darwin.
Robert Robertson.
By Cushman Darby & Cushman
Attorneys

Patented Aug. 27, 1946 2,406,355

UNITED STATES PATENT OFFICE

2,406,355

AUTOMATIC PHONOGRAPH

Joseph A. Darwin, East Orange, and Robert Robertson, Kearny, N. J.; said Robertson assignor to said Darwin

Application December 17, 1940, Serial No. 370,530

48 Claims. (Cl. 274—10)

1

This invention relates to phonographs of the type designed to automatically handle the records of a group of records to be played.

An object of the invention is to provide means whereby the new machine, when set for what we shall term automatic operation as distinguished from automatic selective operation, will play both sides of each record of a group of records through to one end of the group and then will play back through the group, both sides of each record, and so on until stopped.

Another object is to provide means whereby in selective operation the machine will play either or both sides of a selected record or of any number of selected records and when the selection or selections have been played will cause the machine to go into automatic operation and continue until shut off.

Another object is to provide means whereby when the machine is shut off either in automatic or selective operation it will normally automatically resume a constant starting relation to the group of records, or may be stopped in a different relation when desired.

Another object is to provide a machine which will handle both of the at present standard record sizes intermixed in any manner, the machine automatically and instantaneously adapting itself to the size of the selected record.

Another object is to provide means affording an accelerated record changing action and, in particular, to provide means for instantaneously changing from one side of a record to the other without the necessity of returning the record to storage between the playing of its two sides.

Another object is to provide a machine wherein the record group may contain any desired number of records.

With the above and other objects in view, we shall describe their manner of attainment with reference to a practical and illustrative embodiment of the invention as shown in the accompanying drawings, in which:

Figure 1 is an isometric view of the new apparatus.

Figure 2 is an isometric view of a record magazine which appears also in Figure 1.

Figure 3 is a section taken transversely of the magazine at the lower part thereof.

Figure 4 is a section on line 4—4 of Figure 3.

Figure 5 is a plan view of drive gearing and controls at the left front side of the machine, these mechanisms being concealed in a housing in Figure 1.

2

Figure 6 is a front elevation of the mechanism of Figure 5.

Figure 7 is a section substantially on line 7—7 of Figure 5.

Figure 8 is a section substantially on line 8—8 of Figure 5.

Figure 8a shows a detail in elevation.

Figure 9 is a section substantially on line 9—9 of Figure 5.

Figure 10 is a section substantially on line 10—10 of Figure 6.

Figure 11 is a section substantially on line 11—11 of Figure 10.

Figure 12 is a plan view of record and pick-up handling and controlling mechanism, this mechanism for the most part being concealed in a housing in Figure 1.

Figure 13 is a front elevation of the mechanism of Figure 12.

Figure 13a is a fragmentary elevation, in different relation, of details appearing in Figure 13.

Figure 14 is a section on line 14—14 of Figure 12.

Figure 15 is a section on line 15—15 of Figure 12.

Figure 16 is a section on line 16—16 of Figure 15.

Figure 17 is a section on line 17—17 of Figure 12.

Figure 18 is a fragmentary plan view of details appearing in Figure 17.

Figure 19 is a section on line 19—19 of Figure 17.

Figure 20 is a detached view in plan of an operating shaft appearing in Figure 12.

Figure 21 is a section on line 21—21 of Figure 13.

Figure 22 is a section, with parts omitted, on line 22—22 of Figure 13.

Figure 23 is a detached plan view of a cam shaft appearing in Figures 12 and 13.

Figure 24 is an elevation of record holding and driving mechanism also appearing in Figure 1.

Figure 25 is an elevation of pick-up devices which appear also in Figure 1.

Figure 26 is a plan view of selecting mechanism which appears somewhat to the right and at the front in Figure 1.

Figure 27 is a section substantially on line 27—27 of Figure 26.

Figure 28 is a plan view of certain stop mechanism.

Figure 29 is a view like that of Figure 28 showing the parts in different relation, and

Figure 30 is a wiring diagram.

Referring to Figure 1 of the drawings, reference numeral 30 designates a base plate on the rear portion of which is supported a record magazine generally designated by the reference numeral 31. Reference numeral 32 designates a housing for the main drive gearing and reference numeral 33 designates a housing for the record playing means, this housing being preferably made in front and rear portions and slotted for assembly over the various shafts as indicated. In the embodiment of the invention here disclosed, the record magazine is stationary and the record playing means are mounted for movement along the magazine. While this is a preferred arrangement, some aspects of the invention are not necessarily limited thereto but are equally applicable in a situation wherein, for example, the magazine is the traveling element. No attempt has been made to show an enclosing cabinet, which, of course, may be of any suitable design.

Record magazine

The record magazine, as here shown, includes any desired number of generally L-shaped plates 34 whose lower edges rest on parallel bars 35 and 36 supported in horizontal relation on the base plate 30 by means of pedestals as at 35' and 36', Figure 2, the short portions or wings 37 of the L-shaped plates being at the bottom and projecting forwardly. The bottom edges of the plates are provided with recesses 38 and 39 which receive parallel horizontal rods 40 and 41 whose ends are supported in pedestals as at 42 and 43, Figure 2. The lower ends of the recesses are closed by short cylindrical pieces 44 which are longitudinally kerfed and clipped onto the plate margins. Spacer means for the plates are here provided in the form of blocks 45 and 46 kerfed and clipped to the top and lower front margins of the plates. Also, the opposed faces are preferably provided with pads of soft material as indicated by the reference numeral 47, Figure 2.

Records 48 and 49 are supported in the compartments defined by the plates on longitudinal rubber insets 50 and 51 of bars 35 and 36. Records 48 are assumed to be of ten inch size and records 49 of twelve inch size, and the relation of parts is such that a substantial segment of either size of record projects into the angle of the L's when the records are in the magazine, being thus accessible for loading and unloading. The normal condition of the magazine is that shown in Figure 2 wherein the plates are in vertical position, being so maintained by two bell crank levers of which one is shown at 52. The plate spacing is such that the records are maintained in vertical uniformly spaced relation by the pads 47. The latter are arranged about the record centers as seen in Fig. 2, and act to prevent warping of the clamped records. The lever 52 is pivoted on a pedestal 53 and has an upwardly extending arm provided at its extremity with rollers 54 which engage the end plate. A generally horizontally extending arm of lever 52 is engaged by an arm 55 fixed on a rock shaft 56 suitably journaled on the base plate in parallel relation to the bars 35 and 36. An arm 57, exactly like arm 55 and fixed to shaft 56, similarly engages the other bell crank lever like 52. Reference numerals 58 and 59 designate forwardly extending arms fixed to the rock shaft. With these arms in the position shown in Figure 2, the bell crank levers maintain the plates 34 in vertical position with the spacers 45 and 46 in contact. If the shaft 56 is rocked under the control of arms 58 and 59 so as to depress levers 55 and 57, the magazine can be opened or parted in the manner of a book, of which the plates are leaves, at any record so that the selected record is exposed and accessible to the playing mechanism, as shown in Figure 1. Levers 55 and 57 are equipped with adjustable stop screws as at 55', Figure 2, which limit their downward movement and, consequently, the extent of opening of the magazine. When the book or magazine is opened the selected record is maintained in upright position by means which will be hereinafter described.

The magazine can be loaded or unloaded either from the front or from the rear, although front loading will ordinarily be preferred.

Main drive mechanism

Suitably journaled on main brackets 60 and 61, Figures 1 and 5, is a shaft 62 parallel to the bars 35 and 36, the shaft 62 having a squared portion between the brackets. The left hand end of shaft 62 is carried out through a bearing 64 which is supported from a horizontal part 102 projecting to the left of bracket 60, Figure 5. The extremity of shaft 62 may be squared as shown so that a crank can be applied for manual adjustment. Just outside of bracket 60, shaft 62 has fixed thereon a worm wheel 66 which is engaged by a worm 67, Figure 5, fixed on suitably journaled horizontal shaft 68, Figure 6, the rear end of the latter being flexibly coupled through a shaft 69 with the armature shaft of a spring supported motor 70, Figure 1. Shaft 62 is continuously driven from the motor at a predetermined speed throughout the operation of the machine. All drives are conveniently taken from this shaft.

Fixed on shaft 62 outwardly of the worm wheel 66 is a worm 71 which engages a worm wheel 72 fixed on one end of a suitably journaled horizontal shaft 73, the other or forward end of the shaft 73 having fixed thereon a worm 74 which engages a worm wheel 75 running free on the end of a shaft 76 journaled in the brackets 60 and 61 in parallel relation to shaft 62 and in the same horizontal plane as the latter. Between the brackets shaft 76 has a keyway 76'.

Worm wheel 75 has an integral hub 77 provided with a plurality of axially extending notches 78. Fixed on shaft 76 between the hub 77 and bracket 60 is a disc 79 which has eccentrically pivoted thereon a dog 80 on a pin 81, Figure 8, the dog having a nose 82 engageable in any one of the notches 78 so as to cause the disc and therewith shaft 76 to be driven from the worm wheel 75. The dog is pulled to clutching position by a tension spring 83. The tail 84 of the dog has fixed thereon by one end a flat spring 85, the free part of the spring being normally spaced somewhat from the underlying surface of the tail.

Slidable in blocks 86 and 87 fixed to the outside of bracket 60 are plungers 88 and 89 diametrically opposite each other and parallel with shaft 76, the paths of the plungers being just outside the periphery of disc 79. Levers 90 and 91 pivoted on a horizontal pin 92 supported on the inner face of bracket 60 have their upper ends pivoted to the plungers 88 and 89 and their lower ends to the core 93 of a solenoid 94 mounted on the base plate 30. A tension spring 95 tends to swing the arms 90 and 91 in a counter-clockwise direction, Figure 6, whereby to maintain the plungers 88 and 89 in projected position wherein their ends are in the path of the tail of dog 80. In Figure 8 the tail has struck plunger

89 and the dog has been swung to withdraw nose 82. When the tail 84 approaches either one of the plungers the flat spring 85 is first of all pressed against the tail and withdrawal of the nose 82 follows, the withdrawal movement being somewhat augmented as spring 85 returns to its spaced relation. Any possibility of clicking of the clutch when inoperative is thus prevented.

In operation, when solenoid 94 is energized the plungers are retracted, thus releasing the dog so that it can engage in a groove 78 as one comes around. The retraction of the plungers is only momentary and in order to assure release of the dog a plate 96 is pivoted on pin 81 between the dog and the disc and is pulled in the same direction as the dog by a tension spring 97. The plate 96 has a tail portion 98 which springs in front of the plunger upon retraction of the latter and prevents the plunger from getting in front of the tail 84. The leading end of plate 96 abuts hub 77 to limit its swinging movement. Plate 96 is, of course, returned against spring 97 when the tail 84 again approaches a projected plunger. It will be evident that due to the provision of the two plungers at diametrically opposite points a half revolution will be imparted to shaft 76 each time the clutch is engaged.

Fixed on shaft 62 outwardly of worm 71 is a worm wheel 99 which engages a worm 100 on a shaft 101 journaled in a bearing block secured beneath the horizontal frame member 102, the forward end of this shaft having fixed thereon a collar 103, Figure 7, provided with an axially extending peripheral notch 104. A disc 105 free on the forward extremity of shaft 101 has eccentrically pivoted thereon, on a screw 106, a dog 107 in the form of a bell crank lever, of which one arm is provided with a nose 108 adapted to be engaged in notch 104 due to the action of a tension spring 109. The other arm 110 of the bell crank lever normally extends across a peripheral notch 111 of disc 105, the leading edge 112 of the notch 111 being inclined or flared outwardly and rearwardly.

Fixed on the forward side of disc 105 is a bevel pinion 113 which is in constant engagement with bevel pinions 114 and 115 freely rotatable on a shaft 116 parallel to shafts 62 and 76, shaft 116 being journaled in bearings on brackets 60 and 61 and at its left hand end in a pedestal 117 rising from plate 65. Splined on shaft 116 between pinions 114 and 115 is a clutch collar 118 having lugs cooperable with lugs on the two pinions so that by shifting the collar, shaft 116 can be driven in either direction and at the same speed as shaft 101. Collar 118 has a peripheral groove engaged by a forked shipper 119 fixed on a rod 120 which is slidably supported in a bearing at one end of a fixed arm 121 and in notches in the top edges of brackets 60 and 61, Figures 1 and 5.

Journaled in a bearing adjacent the front of bracket 60 is a shaft 122 in parallel relation to shaft 62. Fixed on the outer end of shaft 122 is an arm 123 to whose upper extremity is pivoted a link 124 whose rear portion is laterally guided in a bracket 125 of inverted U-shape on the top of frame member 102. The rear portion of link 124 is down-turned and is pivoted by means of a screw 126, Figure 5, to the rear end of a plunger 127 slidable in parallelism with shaft 101 in a block fixed beneath member 102. The plunger 127 is disposed so that its forward end can ride on the rear margin of disc 105 so as to be struck by the extremity of arm 110 to release dog 107 whereby to withdraw the nose 108 from the notch 104. The link 124, and therewith plunger 127, is pulled forwardly by a tension spring 128, Figure 5. After nose 108 has been disengaged, the forward end of plunger 127, entering notch 111, exerts a cam action on the notch wall 112 so as to rotate disc 105 through a further small angle, the arm 110 being thus further depressed so that nose 108 is slightly further retracted and any possibility of clicking thus prevented. When plunger 127 is retracted and the dog 107 consequently engaged with the constantly rotating collar 103, shaft 116 will be rotated through one complete revolution and will then be arrested by the plunger 127 again engaging arm 110 and entering notch 111, as above described.

To insure against immediate return of the plunger into notch 111 after its retraction, there is provided a bell crank lever 129 pivoted at 130 on a vertical axis on top of frame portion 102. Lever 129 is pulled in a counter-clockwise direction by a tension spring 131. One arm 132 of the lever normally bears against the down-turned portion of link 124, as shown in Figure 5, this arm being provided with a shoulder 133 which swings in front of the said downwardly projecting portion when the link is moved rearwardly, thereby holding the link and the plunger against forward movement. This movement of the bell crank lever brings its tail portion 134 into the path of the head of screw 106 at the rear of disc 105 and when the disc has been driven sufficiently far so that notch 111 is well clear of the forward end of the plunger, the screw head strikes tail 134 and knocks off the latch from link 124 so that the end of the plunger is now borne against the rear margin of the disc by the action of spring 128, ready to strike the arm 110 of pawl 107 with the de-clutching effect heretofore described.

Pivoted to the upper portion of arm 123 through a spacing collar 135 is a drag link 136 whose forward end extends over shaft 62 between bracket 60 and worm wheel 66, Figures 5 and 9, the forward extremity of the link being guided in a vertical slot in a bracket 137. At the forward end of the link its bottom portion is cut away to provide a forwardly faced shoulder 138, Figure 9, which is engageable by an axially extending pin 139, Figure 5, on worm wheel 66. Pivoted on the outside of bracket 60 and inwardly of the drag link 136 is a lever 140, Figures 5, 6, 8 and 8a in generally the form of an inverted Y providing an upstanding arm 141, and angularly related arms 142 and 143 which respectively extend rearwardly and forwardly of the machine. Arm 143 has fixed thereto a flat spring 144 which underlies the drag link 136. The drag link has fixed on its inner side a lug 145 which is adapted to strike arm 141 when the link moves rearwardly. Arm 140 bears frictionally against a flat spring 140' on bracket 60. Disc 79 has a hub portion adjacent bracket 60 in which is fixed a radially extending pin 146, Figure 6, which is adapted to strike portion 142 of lever 140 to return the lever.

The drag link carries a pawl 147 having a nose portion, which in the relation of parts shown in Figure 8, is engaged in a peripheral recess 148 of disc 79. The pawl can swing only in a counter-clockwise direction from its illustrated position.

Mounted on a block of insulation 149, Figures 6 and 9, on the frame portion 102 is a switch 150 which has upper and lower spring arms 151 and 152 normally spaced apart. Underlying the

arm 152 is a further spring arm 153 whose free end 154 is inclined forwardly and downwardly, this end lying in the path of reciprocation of a pin 155 on link 124. When the link moves rearwardly, pin 155 strikes the top of portion 154 so that the latter is moved downwardly. However, when the link moves forwardly the pin 155 engages under portion 154 thereby bending arm 153 upwardly so that arm 152 is engaged with arm 151 to close the switch. This cannot occur, however, until plunger 127 moves into notch 111 to open the clutch. In Figure 30, switch 150 is shown disposed in a conductor 156 which leads to a contact 156a of a switch 277, this contact being in connection with a switch contact 156b when a bridge piece 278 of the switch is in the full line position of Figure 30. Contact 156b is in connection with one end of the winding of solenoid 94, the other end of the winding being in connection with a conductor 157.

With the parts in initial position, both the one revolution clutch and the one-half revolution clutch are open and the nose of pawl 147 is in recess 148 of disc 79. This means that the drag link is in the dotted line position shown in Figure 9, so that the shoulder 138 is in the circle of movement of pin 139 of worm wheel 66. If the motor 70 is now started, worm wheel 66 will be driven in a counter-clockwise direction as seen from the left, Figures 5 and 6, and pin 66 will engage shoulder 138 to pull the drag link rearwardly. As the drag link thus moves, its lug 145 engages arm 141 of lever 140 so that the lever is swung to bring spring 144 into pressure engagement with the underside of the drag link, the lever being retained in this relation by its frictional engagement with the spring 140', this being sufficient to hold the lever against the reaction of spring 144. As pin 139 now leaves shoulder 138, the drag link is swung upwardly, due to the action of spring 144, to bring the shoulder 138 out of the path of pin 139. Also, at the beginning of the rearward movement of the drag link, pawl 147 swings out of notch 148.

Link 124 has, of course, moved with the drag link and pin 155 has passed over portion 154 of arm 153, this being without any effect, as heretofore explained. Plunger 127 is withdrawn from notch 111 and disc 105 and pinion 113 are immediately driven. If clutch collar 118 is in the position shown in Figure 5, the shaft 116 will be driven in a counter-clockwise direction as seen from the left, Figures 5 and 6, through one rotation. If the collar is in engagement with the pinion 115, shaft 116 will be driven through one rotation in a clockwise direction.

As notch 111 of disc 105 comes in front of plunger 127, return of link 124 is permitted, and as pin 155 now passes beneath portion 154 of arm 153, switch 150 is closed, thereby energizing solenoid 94 so that plungers 88 and 89 are retracted. Plunger 89, Figure 8, thus releases dog 80 so that disc 79 is driven a half revolution in a counter-clockwise direction, Figure 8, that is, until the tail of dog 80 strikes plunger 88. The plungers have immediately returned to projected relation as plate 96 and the tail 84 have moved from in front of plunger 89. It will be understood that solenoid 94 is only momentarily energized, and that the plunger return is effected by spring 95.

The playing of each record, as will hereinafter appear, involves a full rotation of disc 79 and shaft 76. Due to re-energization of solenoid 94 during the cycle by means which will be later described, plungers 88 and 89 are again retracted and disc 79 is returned to the position of Figure 8. During this second half-revolution, pin 146 strikes arm 142 of lever 140 so that the latter is swung in a clockwise direction thereby permitting the drag link to drop. However, the nose of pawl 147 rides on a full peripheral portion of disc 79 and the link is maintained in such an elevated position that its shoulder 138 is out of the path of travel of pin 129. When the second half-revolution is completed the nose of the pawl drops into recess 148 and the described cycle can be repeated.

Magazine control

Arms 58 and 59 are provided at their forward extremities with circumferentially grooved rollers 160 and 161, Figures 5 and 6, these rollers being disposed in the planes of cam fingers 162 and 163 fixed on shaft 76. These fingers, as seen by reference to cam finger 162, Figure 9, have straight trailing edges fairly close to the periphery of shaft 76, the leading ends of the fingers being tapered. In the rest position of the machine the fingers extend substantially straight downwardly, as shown in Figure 9 so that the arms 58 and 59 are depressed and the magazine consequently closed. Shortly after drive of shaft 76 starts, the ends of the fingers pass away from the rollers and arms 58 and 59 are snapped upwardly by tension springs as at 164, Figure 9, so that the bell crank levers as at 52 are free to swing away from the ends of the magazine and the latter may now open to expose a selected record. During the latter part of the second revolution of the half revolution clutch which controls the drive of shaft 76, the cam fingers 162 and 163 engage rollers 160 and 161 and arms 58 and 59 are returned to the position of Figure 9, closing the magazine.

Record selecting and playing mechanism

All of the record playing mechanism, as here shown, is mounted on a carriage generally designated by the reference numeral 165, Figures 12, 13 and 14, and except for extended parts, the mechanism is in the housing 33 shown in Figure 1.

The carriage comprises a frame consisting of an upwardly open channel member having parallel side walls 166 and 167 extending vertically upwardly from a bottom wall 168. The side walls are pierced at opposite points and rotatably receive shafts 62, 76 and 116, the latter having threads engaged in a nut 169 fixed on the outside of wall 167. The side walls have secured thereto the depending legs of an inverted U-member having a horizontal top portion 170 and the legs of this member are pierced at opposite points and slidably receive rod 120.

Splined on shaft 76 substantially midway between the side walls is a main cam 171 which has an end surface 172 provided with a slight depression 173, the end surface being followed by a curved side surface 174 falling to a depression 175 from which rises a terminal curved surface 176. The other end and the other side of the cam have the same contour as just described. The starting position of the cam is shown in Figure 14.

As shown in the last mentioned figure, a roller 177 carried at the extremity of an extension 178 is engaged in the depression 173, extension 178 being integral with an arm 179 which is swingable on a sleeve 180 surrounding shaft 116 between side walls 166 and 167, Figure 17. The end of sleeve 180 adjacent wall 166 is fixed in a collar 181 which in turn is screwed to the side wall. A

brace 182 fixed to arm 179 has a bearing on the end of sleeve 180 adjacent wall 167. The arm and brace are held against displacement to the left by stop collars 183 and 184, displacement to the right being prevented by the engagement of the brace with wall 167. At the left hand side of its free end, arm 179, Figure 24, supports a rotary disc or turntable 185 on a horizontal shaft perpendicular to the plane of swing of the arm, the disc having the usual facing of soft material. In fixed connection with the disc shaft on the other side of arm 179, is a grooved pulley 186 connected by a belt 187 with a grooved pulley 188 formed at one end of a barrel which at its other end has a sprocket 189, the barrel being rotatable on sleeve 180.

Pivoted to arm 179 at the left side thereof through top and bottom plates 190 and 190', Figures 18 and 19, is an arm 191 which has a forked end clearing sleeve 180. A compression spring 192 urges the arms apart, the swinging range of arm 191 away from arm 179 being limited by a stop 193 in the end of a plate 194 fixed to the top of arm 191 and resting on top of arm 179 to take the weight of arm 191. At the right hand side of its free end, arm 191, Figures 1 and 24, rotatably supports a disc or turntable 195 which is exactly like disc 185 except that it is equipped with a tapered centering pin 196. The centering pin is spring-projected and is readily depressible, the mounting being, for example, like that shown in the patent to Schwartz, 1,963,214 of June 19, 1934. The discs are designed to clamp a record, centered by pin 196, between them, and when in clamping relation are co-axial.

An extension 197 is fixed to the lower end of arm 191 and is apertured to freely pass sleeve 180. At its extremity the extension has threaded therethrough a screw 198, Figures 13 and 14, whose end is adapted to bear against the left hand face of an upright plate 199 pivoted on the bottom wall 168 on a horizontal axis in a plane perpendicular to the axis of shaft 76. Referring also to Figure 22 plate 199 has threaded therethrough a screw 200 whose end constitutes a follower for the contours of a face cam 201 which is fixed in slightly spaced relation to the cam 171 at the left thereof. The face of cam 201 comprises raised and lowered portions 202 and 203 separated by a rise 204 and a drop 205 which are suitably inclined. The two cams are positioned by spacer sleeves 76a and 76b on shaft 76 between the cams and walls 166 and 167, sleeve 76b being splined on the shaft.

A flanged collar 206 is rotatable on a reduced portion of the hub 207 of a sprocket 208, Figure 15, the hub being rotatable on shaft 62 between fixed planes and having fixed to its extremity the hub of a bevel pinion 209. Secured to the flange of collar 206 is a record positioning finger 210 consisting of laminations of spring strip metal, the finger being held in a constant plane by the shoulder of hub 207 and by pinion 209 and normally projecting upwardly as indicated in Figure 14. The finger 210 comprises two spring strips 211 and 212 which extend in contact with each other and are reinforced at their base portions by members 213 and 214, the split between strips 211 and 212 being in a plane parallel to the face of disc 185 and spaced therefrom a distance equal to half the thickness of a record. The free ends of strips 211 and 212 are outwardly flared as are also the adjacent portions of their longitudinal margins. At an intermediate portion of strips 211 and 212 a V-shaped member 215 of spring strip material is secured to the lower or rear margins thereof and constitutes a wedge having spring wings.

Fixed on the collar of sleeve 206 is a radially projecting finger 216 to the end of which is pivoted one end of a link 217, Figure 14. Rearwardly the top of link 217 is recessed to provide a forwardly faced square shoulder 218 and a reduced tail portion 219. Rearwardly of shoulder 218 a block 220 is swivelled on link 217 and is provided with a bore slidably receiving one end of a link 221 whose other end is pivoted at 222 on a bracket 223 secured on wall 169. At its intermediate portion link 221 has an upwardly and forwardly inclined top edge which terminates in a flat edge 224 beyond which is a recess 225. Links 217 and 221 constitute a toggle tending to be collapsed upwardly by a tension spring 226. In the relation of parts shown in Figure 14, a roller 227 on extension 176 and coaxial with roller 177, is in front of the shoulder 218 and due to its engagement thereby and by the tail 219 prevents telescoping and upward collapse of the toggle. Cam 171 is provided with a pair of axially extending pins 228 and 229 adapted to engage edge portion 224 of link 221 upon rotation of the cam. On the hub of the cam is a further pin 230 which projects radially and is likewise adapted to strike edge 224 of link 221. Pin 228 in the rest relation of the parts is on portion 224 of link 221 just to the rear of the recess 225.

If the half revolution clutch through which shaft 76 is driven is now thrown in, cam 171, Figure 14, will be driven in clockwise direction, there being a slot in the forward portion of the bottom wall 168 to pass the cam. As the cam starts to rotate the depression 173 moves away from roller 177, but while the roller is still on the end edge 172, pin 228 bearing on edge portion 224, flattens the toggle to such an extent that shoulder 218 passes below roller 227 and the links 217 and 221 are abruptly telescoped by spring 226 so that finger 210 is rapidly swung in a clockwise direction bringing the spring wedge 215 between the top portions of a pair of wings 37 relative to which the carriage is properly positioned, the flared forward extremity of the finger being forced apart by the record which is between the wings and gripping the same to an extent depending on the diameter of the record. It will be understood that when the levers as at 52 are now released in the manner hereinbefore described, the magazine will part or open away from the finger in both directions due to the expanding action of the wedge, the record being maintained in vertical position by the finger as indicated in dotted lines in Figure 1. With the toggle in telescoped condition the extremity of tail 219 of link 217 is below shaft 76.

As the cam continues to rotate, portion 174 thereof comes against roller 177, permitting arms 179 and 191 to swing downwardly by gravity from their normally upwardly and rearwardly extending position, Figure 14, into straddling relation with the record. As they lower, the rise 204 of cam 201 will engage follower 200 of plate 199 and the plate will be swung to the left, Figure 13, bearing against screw 198 on extension 197 so that arm 191 is swung toward arm 179 against the action of spring 192. The discs 185 and 195 are sufficiently approached so that the centering pin is depressed and rides along the record surface adjacent the record opening until it comes to the latter and snaps into the same. Cam portion 176 now engages roller 177 and ele-

vates the arm and the record, still in vertical position, to the playing position shown in Figure 1 and cam 171 is at this time exactly reversed from the position shown in Figure 14. As the record comes into playing position, arm 191 engages a roller 191' on a rigid bracket extending rearwardly from carriage portion 170, forcing the arm toward arm 179 so that the record is tightly gripped between discs 185 and 195.

In the case of a twelve inch record the record opening will be an inch above the position of the opening in the case of a ten inch record. The point of the centering pin travels in an arc which intersects the position of either opening and consequently either record size will be engaged. The pin may engage the opening of a twelve inch record on the way down so that the arms will be held against further gravitation, or the pin may possibly slide out of the opening permitting the arms to lower to the ten inch position, the pin effectively entering the opening on the way back.

After the toggle has been released by pin 228, roller 227 holds it flattened due to contact with the top of link 217 to the right of shoulder 218. As extension 178 begins to swing upwardly, pin 229 comes into engagement with edge portion 224 of link 221 so that the toggle is still maintained relatively flattened. This condition is substantially maintained until pin 230 comes against the extremity of tail portion 219 of link 217 and the toggle is still maintained sufficiently flattened so that as roller 227 swings rearwardly during the elevation of the record supporting arms, it will not engage shoulder 218 and consequently the record positioning finger 210 will remain in its lowered position. When the record has been played, shaft 76 undergoes another half revolution during which the record arm is permitted to swing rearwardly to replace the record which will be engaged by the positioning finger and retained in upright position as arm 191 is swung away from arm 179 to release the record due to the action of spring 192 as now permitted by cam 201 whose lowered portion 203 is now in front of follower 200. During this time, the extremity of tail 219 of link 217 has been restrained from extreme upward movement through contact with the hub of cam 171 and as the record arms are now swung upwardly, roller 227 engages shoulder 218 thereby projecting link 217 forwardly so that the positioning finger 210 is returned to its generally upright position and all the parts are again as in Figure 14.

The engagement of roller 177 in the cam recesses as at 173 serves to hold shaft 76 against accidental rotation when the half revolution clutch is disengaged.

It has been above described now, with the carriage properly positioned relative to the magazine and the machine in operation, the magazine will be opened and a record will be elevated, played and returned. Assuming clutch member 118 to be engaged with pinion 114, at the end of the playing cycle the drag link 136 will be again pulled forward so that the one revolution clutch is closed and pinion 114 and member 118 are driven through one revolution. The pitch of the threads of shaft 116 is such that its consequent rotation will drive the carriage 165 one record space and the playing cycle will be repeated, the carriage being automatically driven one step to the right at the completion of each cycle. Fixed on rod 120 adjacent its right hand end is a stop collar 265, Figure 1, and to the left of this collar a spiral spring 266 freely surrounds the rod. As the carriage moves to bring the playing mechanism into proper relation to the last record space at the right of the magazine, spring 266 is abutted by the right hand leg of the inverted U-member, this being permitted by an enlarged opening in the right hand wall of casing 33. As the carriage reaches its extreme right hand playing position the spring convolutions come together and sufficient positive movement to the right is given to rod 120 so that the engagement of clutch member 118 with pinion 114 is loosened and the expanding action of the spring then moves the rod and therewith member 118 so that the latter is brought into operative relation relative to pinion 115, the one revolution clutch opening at the same time. When the playing cycle has now been completed the immediate engagement of the lugs of pinion 115 with those of member 118, as the one revolution clutch is closed, will cause shaft 116 to be reversely driven and the carriage thereby to be moved one space to the left.

The left hand portion of rod 120 is formed with a keyway 120' in which is engaged the end of a screw 267 which is threaded in a block 268 slidable on rod 120. The block has a flat top surface on which is swingable a stop plate 269 pivoted on screw 267. The plate is normally held in the position shown in Figure 5 by a tension spring 270 anchored at its ends to the block and plate respectively and holding the plate against a stop 271 on the block, the plate projecting to the right of the block a distance equal to one step of the carriage 165. A spiral spring 272 surrounds rod 120 between the left hand end of block 268 and a collar 273 which is fixed on the rod. With the spring fully expanded, the lower extremity of screw 267 is against an end wall of the keyway 120'. As the carriage approaches its left hand limit position a finger 274 fixed on the left hand leg of the inverted U-member above rod 120 engages the end of plate 269, spring 272 is compressed and as the left hand limit position of the carriage is reached the spring expands to shift member 118 into engagement with pinion 114. Consequently, when the extreme left hand record has been played drive through the one revolution clutch will cause the carriage to be moved one space to the right.

It will thus be seen that as long as the motor is running the carriage will be stepped back and forth in front of the magazine and the records will be successively played from end to end of the group.

Referring to Figure 30, reference numerals 275 and 276 designate leads from a suitable electrical source, lead 275 running to one side of motor 70 and lead 276 running to a contact 277*a* of switch 277. In the full line position of the bridge piece 278, contact 277*a* is in connection with a contact 277*b* of the switch and this latter contact is in connection through a conductor 279, in which is interposed a normally closed manually operable, switch 280, with the other side of the motor.

The bridge piece 278 in the full line position establishes entirely independent connections between contacts 277*a* and 277*b*, on the one hand, and between contacts 156*a* and 156*b*, on the other hand, as will be understood. When the bridge piece is moved to the dotted line position of Figure 30, the connection between wires 156 and 156*c* is broken and a connection is established between contact 277*a* and a further contact 277*c* of the switch. A conductor 281 in connection with contact 277*c* under these circumstances establishes a connection to the said other

side of the motor 70 through normally closed limit switches 282 and 283, a shunt 284 containing a normally closed manually operable switch 285, being connected around switch 283, and a shunt 317 containing a normally open manually operable switch 316 connected around switch 282. In the normal operating condition of the machine, bridge piece 278 is in the full line position of Figure 30. When it is desired to stop the machine at once, switch 280 is opened for the reason that movement of the bridge piece 278 to the dotted line position completes another circuit to the motor and causes the carriage to return to a starting position at the left hand end of the magazine before the machine is stopped, as will be later described.

A solenoid 286 has one end of its winding in connection with conductor 281 through a wire 287, the other end of the winding being in connection with lead 275 through a conductor 288 and a normally closed switch 289, this switch having a pivoted upwardly extending actuating arm 290, Figure 10. As also shown in this figure the solenoid is mounted in a frame 291 fixed to the base plate 30, this frame having a top cross portion on which switch 289 is secured. The solenoid includes an armature 292 which is connected with an upwardly extending lever 293 pivoted at 294 at the upper end of an upright bracket 295 on base plate 30, the pivot being parallel to rod 120. Lever 293 has a forwardly bent upper portion 296 which is guided in a loop at the end of a bracket 297, Figures 5 and 6, for movement toward and away from a lug 269' on that portion of plate 269 which projects to the right of block 268 in the relation of parts shown in Figure 5, the forward extremity of portion 296 normally lying slightly to the rear of the rear edge of the plate and above the plane of the plate proper. Lever 293 and the armature 292 are yieldingly held in the position shown in Figure 10 by means of a tension spring 298.

Also connected to the armature 292 through a pin and slot connection is the lower end of a lever 299 pivoted at 300 to the bracket 295 on an axis parallel to the pivot 294. The upper end of this lever is connected through a pin and slot connection, the slot being designated at 301', with a link 301 which is also connected through a pin and slot connection with the switch arm 290. A lever 302 is pivoted at 303 at the upper end of bracket 295 on an axis at right angles to the axis of lever 299 and at its lower end has a foot 304 held against the upper portion of lever 299 by means of a tension spring 305. The upper end of lever 302 is bent oppositely from the foot portion 304, i. e., to the right as seen from the front of the machine, and lies in the path of travel of the carriage 265 and near the left hand limit of travel. The upper end of lever 302 is struck by the left hand wall of casing 33 or by a suitably adjustable abutment on the casing so that as the carriage moves into its extreme left hand limit position, the lever will be swung to release lever 299 so that the latter and lever 293 are returned to the normal position of Figure 10 under the action of spring 298. Limit switch 282, Figures 5, 6 and 9, is mounted on a frame member adjacent the left hand side of link 124 and includes an operating finger 282' which is struck by a pin 124' on link 124 as the latter is returned to its forward position by spring 123, switch 282 being thus opened.

A rock shaft 308 journaled at one end in the bracket 306 and at its other end in a similar

bracket 309, Figure 1, has fixed thereto a normally downwardly projecting finger 310 to the lower end of which is pivoted an upwardly extending latch 311 which has a pin and slot connection with link 301. Fixed on the shaft 122 is a finger 312 which projects toward latch 311 in the plane thereof. A tension spring 313 having its ends connected to finger 310 and latch 311 tends to pull the latter toward the extremity of finger 312, this action being normally prevented by the link 301 due to the fact that the pin is in the left hand end of the slot 301' as seen in Figure 10 and due to the fact that spring 298 overcomes spring 313.

Assuming now that the playing of a record has just been completed and that bridge piece 278 is moved to its dotted line position, solenoid 286 will be energized, pulling armature 292 to the right, Figure 10, and thereby swinging levers 293 and 299 in a counter-clockwise direction. As lever 293 is swung its portion 296 strikes the lug 269' and swings plate 269 until spring 270 passes over the pivot 267 and snaps the plate to the position of Figure 29 into abutment with a stop 271' so that the now right hand edge of plate 269 is flush with the right hand face of block 268. At the same time the swinging of lever 299 has permitted the foot 304 of lever 302 to engage behind the upper right hand edge of lever 299 so that return of lever 293 as well as lever 299 is prevented. Arm 290 of the switch 289 is also swung with levers 293 and 299 so that the switch is opened, as shown in Figure 30 and consequently there is no buzzing of the solenoid although its armature is held in retracted relation by lever 302 due to its engagement by lever 299 as above described.

The drag link 136 is now pulled rearwardly by pin 139, as hereinbefore described, thus retracting plunger 127 and permitting operation of the one revolution clutch, this involving the rocking of shaft 122 in a clockwise direction, Figure 10, so that finger 312 is swung downwardly from its illustrated position and is engaged by latch 311 due to the action of spring 313 which is no longer restrained by link 301 since the latter was shifted to the left, Figure 10, upon the swinging of lever 299. Since shaft 122 is held in its rocked position by latch 311 it follows that plunger 127 is held away from disc 105 so that the clutch now remains closed and the screw shaft 116 is continuously driven in a direction depending upon whether clutch member 118 is engaged with pinion 115 or 117. If in engagement with the latter the carriage will be driven to its right hand limit and will reverse and return to the left, whereas if in engagement with the former, the carriage will be immediately returned to the left.

As the carriage approaches its left hand limit of travel as now determined by the plate 269 in its position of Figure 29, a dog 314 pivoted at the extremity of a laterally deflectable spring arm 315 which is secured beside finger 274, Figures 12, 13, 28 and 29, trips underneath the forwardly projecting portion of plate 269 and comes up to the left of the latter as shown in Figure 29. The finger 274 strikes plate 269 and the reversing action occurs as previously desscribed except that the carriage is one step to the left of the position it occupies when the plate 269 is in the position of Figure 28. In that position the dog 314 clears the plate upon movement of the carriage to its left hand position.

Simultaneously with the actuation of the reversing mechanism for the screw shaft, lever 302

is swung to release lever 299 and spring 298 returns levers 293 and 299, link 301, and switch arm 290, to the position shown in Figure 10, link 301 in its movement releasing latch 311 from finger 312 so that rock shaft 122 is returned and plunger 127 acts to open the one revolution clutch. This forward movement of plunger 127 permits link 124 to move likewise and at the end of its movement pin 124' strikes finger 282' of limit switch 282 and the circuit to the motor 70 is broken.

During the clutch opening movement of plunger 127 the over and under switch 150 is closed, but this has no effect on solenoid 94 due to the fact that the switch is dead when the bridge member 278 of main switch 277 is in the dotted line position of Figure 30. Switches 421, 422 and 423, however, are alive so that the machine is enabled to complete the playing cycle in which it is engaged when bridge piece 278 is moved to its dotted line position. When the main switch is again closed the carriage 165 will be driven one step to the right and the first record will be played as hereinbefore described. As the carriage moves to the right the dog 314 will engage plate 269, Figure 29, and return it sufficiently toward the relation of Figure 28 to enable spring 270 to snap the plate against the stop 271, the plate now being set for automatic playing as hereinbefore described. If dog 314 is in front of plate 269 when it is sought to swing the latter to its forwardly projecting position, arm 315 will be flexed so that proper operation will occur. Also the right hand edge of plate 269, Figure 28, is made arcuate substantially on the center of screw 267 so that even if the end of finger 274 is in contact with the plate 269 the latter can be swung from the position of Figure 28 to that of Figure 29.

It will thus be seen that by moving switch 277 to the dotted line position of Figure 30 for the purpose of shutting off the machine, the carriage will always be returned to an extreme left hand starting position. In this position the carriage would obstruct the front loading of the left hand portion of the magazine and consequently it is desirable that provisions be present enabling the carriage to be stopped at the right hand end of the magazine. This can, of course, be done by opening the switch 280, but in the preferred arrangement shown we provide the limit switch 283 previously mentioned, this being shown in Figure 1 as mounted on the right hand bracket 61 so as to be opened as a result of engagement by the right hand wall, or a stop member thereon, of casing 33, as the carriage reaches its right hand limit position. Opening of the switch 283 will be without effect unless switch 285 is manually opened.

With the carriage in its extreme left hand position and switch 277 in the full line position of Figure 30, if the switch 316 in the shunt circuit around the limit switch 282 is opened and switch 285 is opened the carriage will travel to its right hand limit position and stop. After the left hand portion of the magazine has been loaded and switch 316 opened (limit switch 282 being now closed), the closing of switch 285 will cause the carriage to return to starting position.

When a record has been selected and elevated to playing position it is necessary that it be rotated first in one direction and then the other if both sides of the record are to be played as is contemplated in automatic operation. The reversible drive means is as follows:

Referring particularly to Figure 15, the bevel pinion 209 engages a pinion 317 rotatable about a vertical pin 318 which projects downwardly into a reinforcing bar 319 secured to the bottom wall 168 of the carriage. Pinion 317 engages also a bevel pinion 320 of the same size as pinion 209, rotatable on shaft 62 and against wall 166. A clutch member 321 is slidable on shaft 62 between pinions 209 and 320 and mates with the squared portion of the shaft so as to be driven thereby. The clutch member 321 has laterally projecting lugs, visible in Figure 12, these being selectively engageable with lugs on the adjacent faces of pinions 209 and 320. Member 321 has an annular groove with which is engaged the forked end of a shipper 322 which is pivoted on a bracket 323 fixed against the inner face of the side wall 166, Figure 14. The forward extremity of the shipper is upwardly turned and has secured thereto a forwardly projecting pin 324. A rectangularly bent rod 325, Figures 13 and 14, has a horizontal portion slidable in an opening in a wing 235 secured to and projecting forwardly of side wall 166, the end of said rod which extends inwardly of wing 235 being pivoted to shipper 322 on a vertical axis by means of a screw 326. Portion 327 of the rod, which lies outwardly of wing 235, extends vertically upwardly. A lever 328 is pivoted on a horizontal fore and aft axis on a bracket 329 by means of a screw 330, the bracket rising from side wall 166. The lower end of lever 328 lies between the forward portion of shipper 322 and the wing 235. Pivoted to the upper end of the lever on an axis parallel to the screw 330 is one end of a horizontally extending portion of a rectangularly bent bar 331 which has a vertically downwardly extending portion 332 aligned with the portion 327 of rod 325. If rod 325 is pulled to the left clutch member 321 will be engaged with pinion 209 and the latter will be driven in the same direction as shaft 62, similarly driving sprocket 208. If rod 331 is pulled to the left clutch member 321 will be engaged with pinion 320 and sprocket 208 will be reversely driven. Sprocket 208 is connected by means of a chain 333, Figure 12, with sprocket 189, Figures 13 and 17, which is fixed to pulley 188 engaged by the drive belt 187. Pinion 209 is held in engagement with pinion 317 by spacer means interposed between hub 207 of sprocket 208 and side wall 167, these spacer means, as here shown, comprising a sprocket 334 and a collar 335, the sprocket being slidable on shaft 62, but having enforced rotation with the latter.

Secured to side wall 167 is a forwardly projecting wing 236, Figures 12, 13 and 14, similar to wing 235, these wings having upwardly projecting portions in which are supported the ends of a shaft 237. Slidable and rockable on this shaft adjacent wings 235 and 236 respectively are barrels 238 and 239 which rockably support blocks 240 and 241 between end collars or flanges 242 and 243 of barrel 238 and 244 and 245 of barrel 239. Block 240 has a plate 246 secured thereto adjacent collar 242, this plate having a pointed nose 247 at its lower forward portion, Figure 21. Block 241 has fixed thereto adjacent flange 245 a similar plate 248, the plate having a pointed nose 249 as seen in Figure 14. Compression springs 250 and 251 surround shaft 237 and at their outer ends bear against barrels 238 and 239 and at their inner ends against stop collars on shaft 237 so that the barrels are normally urged apart to the limit positions shown. Blocks 240 and 241 have bores through which

are passed tubular arms 252 and 253, the arms being securable in longitudinally adjusted position relative to the blocks by suitable means such as set screws, the arms projecting through slots in casing 33, Figure 1. At its upper end, Figures 1 and 25, arm 252 has secured to its right hand side a rectangular box 254 in which is pivoted on a screw 255 a pick-up device carrying a needle 256, the pick-up device being spring urged in a counter-clockwise direction and its movement limited by a pin 257 secured thereto and projecting through an opening 258 in a wall of box 254. Arm 253 carries at its upper end a box 259 similarly supporting a pick-up device equipped with a needle 260. The points of the needles are opposite each other, needle 256 being inclined for proper engagement with the sound track on the left hand side of a vertically disposed record rotating in a clockwise direction as seen from the left of Figure 1 and needle 260 being inclined for engagement with the right hand side of the record when the latter is reversely rotated.

Split blocks 261 and 262 clamped on the lower portions of arms 252 and 253 have pivoted thereto counterweights 263 and 264 so adjusted that the arms tend to gravitate in a counter-clockwise direction as seen from the left of Figure 12. Wires are led from the pick-up devices downwardly through the tubular arms to any suitable amplifying system.

In automatic playing, it is here contemplated that the left hand side of records successively presented in vertical playing position will first be played and the right hand side immediately thereafter. As to each pick-up device, it is necessary that at the proper time it shall be positioned opposite the starting end of the sound track which it is to follow, then moved toward the record to engage its needle with the sound track, moved away from the record upon the completion of playing, and then returned to idle position. The means for accomplishing these operations will now be described.

Rotatably supported by wings 235 and 236 below shaft 237 is a shaft 336, Figures 13, 14 and 20 on which are fixed cylindrical drums 337 and 338 which have aligned peripheral notches 339 and 340. In the rest position of the machine the noses 247 and 249 are on full peripheral portions of the drums as shown in Figure 14, and as a result the arms 252 and 253 are in an elevated position. Shaft 336 has fixed thereon a sprocket 341 connected by a chain 342 with a sprocket 343 of the same size splined on shaft 76 between the spacing collar 76b and side wall 167. Consequently, shaft 336 is driven in one-to-one ratio by shaft 76 and it rotates in the direction of the arrow, Figure 14.

Blocks 344 and 345 fixed on top of the horizontal portion 170 and projecting forwardly thereof, rockably support a shaft 346 parallel to shaft 237. Outwardly of the blocks shaft 346 has fixed on its extremities fingers 347 and 348 which extend generally upwardly and at their upper ends carry pivoted dogs 349 and 350 which project toward each other and which can yield upwardly but not downwardly, the tip portion of these dogs being in the paths of swing of arms 252 and 253, respectively, when the supporting barrels 238 and 239 for the latter are in their limit positions apart. Fixed on shaft 346 centrally thereof is a lever 351 having a rearwardly extending portion which normally rests on top of the base portion, fixed to the support 170, of a vertical bracket 352. A latch 353 in the form of a lever pivotally mounted on

bracket 352 on an axis parallel to shaft 346, Figure 1, has an upper portion lying in the plane of a record in playing position and a lower hook-shaped end, Figure 14, normally pulled against the top of a reduced extremity of the rearwardly extending portion of lever 351 by means of a tension spring 354, so that the parts are retained in the position of Figure 14 against the pull of spring 355, Figure 13, connected to arm 348. The lower hooked-end of lever 353 provides a rearwardly and upwardly inclined forward surface 353'. Lever 351 has a forwardly extending portion, Figure 14, to which is pivoted the upper end of a link 356 whose lower end is pivoted to a generally horizontally extending finger 357 which is pivoted at its forward end on a bracket 358 extending forwardly from the support 170. The free end of finger 357 lies in the plane of cam 171, although out of the range of the latter when in the position of Figure 14. Shaft 346 has fixed thereon a stop finger 359 cooperable with the lower forward edge of support 170.

Journaled in the wings 235 and 236, somewhat to the rear and below shaft 237, is a shaft 360 which has rotatable and slidable thereon a disc 361 integral with a sprocket 362 which is connected by a chain 363 with the sprocket 334 on shaft 62, the sprockets being of the same size. Consequently, disc 361 is continually driven when the machine is in operation. Shaft 360 is positioned between wings 235 and 236 by collars 364 and 365 fixed thereon and between the latter collar and disc 361 a compression spring 366 surrounds shaft 360. To the left of sprocket 363 a sleeve 367 is fixed on shaft 360 and has clutch teeth as at 368 engageable with similar teeth on a hub portion 369 of disc 361. Fixed on sleeve 367 is an arcuate cam member 370 having an axially presented cam edge 371 succeeded by a drop 372, there being a fixed collar 373 to the left of cam member 370 providing a radial shoulder 374 to the left of the cam member. At the left of collar 373 a disc 375 is fixed on shaft 360 and on its left hand face is provided with an arcuate axially projecting cam having an incline 376 rising from the face of the disc and terminating at an abrupt drop 377, Figure 12. A disc 378 fixed on shaft 360 to the left of disc 375 has on its opposed face a similar rise 379 and drop 380, the drops 377 and 380 being substantially diametrically opposite each other.

To the left of disc 378 a disc 381 has on its right hand face a cam rise 382 and drop 383. Integral with the disc is a sleeve 384 slidable on the shaft and having an axially extending slot in which is engaged a radial pin 385 fixed in shaft 360 and serving to impart rotation of the shaft to disc 381 and to limit movement of the latter to the left. A compression spring 386 surrounds shaft 360 between disc 381 and a fixed sleeve 387 and yieldingly holds the disc in its left hand limit position.

Finally, there is fixed on the left hand extremity of shaft 360, outwardly of wing 235, a disc 388 whose left hand face is provided with an arcuate cam having a rise 389 succeeded by an abrupt drop 390.

While barrels 238 and 239 have been stated to be rockable on shaft 237, they may for the present be assumed to have a fixed angular relation to the shaft, this relation being that shown in the various views. Fixed on the collar 242 of barrel 238 is a finger 391, Figures 12 and 23, whose extremity lies adjacent shaft 360 and to the left of sleeve 384. Fixed on the face of flange 243 of barrel 238 is an axially extending bracket 392

which at its extremity has fixed on its outer surface a radial pin 393 on which is mounted a roller 394 in the path of the cam portion of disc 378. Barrel 239 similarly carries a roller 395 in the path of the cam portion of disc 375.

A two-piece bar 396, which is adjustable as to length by means of the screws and slots as shown in Figures 12 and 13, extends generally lengthwise of shaft 360 above the latter and is supported by an arm 397 pivoted at 398 on a vertical axis on top of support 170. The left hand end of bar 396 is downwardly turned and lies to the left of disc 381 so as to be engageable by the cam portion of the latter, while the right hand down-turned end of the bar is adjacent the left hand face of sprocket 362.

Pivoted at 399 on a vertical axis on top of support 170, Figure 14, is a flat spring 400 which is pulled in clockwise direction by a spring 401, Figure 12. Forwardly of support 170 the spring 400 is downwardly bent to pass beneath shaft 360 and pivotally carries an arcuate shoe 402 which normally rides on the collar 367 in position to be engaged by the cam edge 371. The forward extremity of the spring 400 extends substantially tangentially of drum 338 in position to be engaged by a radial finger 403 on the latter.

Shaft 360 is in the same vertical plane as rod ends 327 and 332, Figures 12 and 13, and the cam portion of disc 388 is adapted to cooperate with these rod ends alternately as shaft 360 is rotated, whereby to shift the clutch element 321 back and forth. The horizontal portion of rod 331 rests freely on top of disc 388 for support.

Fixed on shaft 336 to the left of sprocket 341 is a disc 404 of a diameter to overlap a left hand marginal portion of disc 361, the disc 404 being relieved near an edge of its right hand face to provide a recess 405. Also fixed on shaft 336 through a spacing collar 406 is a pair of thin discs 407 and 408 which define a channel adapted to receive pin 324 on shipper 322. The discs have opposite peripheral notches 409 and 410 and have their following margins outwardly flared to provide wings 411 and 412.

Pivoted on a fore and aft axis on a horizontal portion of a bracket 413 rising from wing 235 is a dog 414 having a nose 415 normally spring pressed against the periphery of collar 242, the dog having a notch 416 outwardly of the nose. A bell crank lever 417 is pivoted to an upright portion of bracket 413 and has a foot portion 418 projecting forwardly beneath dog 414. The lever includes an upwardly extending portion 419 whose upper end 420 is bent to extend across the path of swing of arm 252. Also in the path of swing of arm 252 is a normally open spring switch 421 supported on the forward end of block 344, this switch being shown in Figure 30 as interposed in a circuit containing another normally open spring switch 422. This circuit extends between lead 275 and conductor 156c so that the switches 421 and 422 are both closed an energizing circuit for solenoid 94 is completed. A shunt around switches 421 and 422 includes a further normally open spring switch 423 which, as shown in Figure 12, is fixed on bar 345 in the path of swing of arm 253. Closing of switch 423 will complete an energizing circuit for the solenoid.

A dog 424 exactly like dog 414 is pivoted on a bracket 425 and its nose is normally spring held against the periphery of collar 244. A bell crank lever 426 is pivoted on a bracket 427 and includes a foot portion 428 extending forwardly beneath dog 424 and a horizontally bent portion 429 lying in the path of swing of arm 253.

Operation in automatic playing

With the parts in rest position, pin 324 of shipper 322 is between full portions of the discs 407 and 408, as is evident from Figure 14, and consequently clutch member 321 is in the neutral position shown in Figure 12. As heretofore stated, the nose portions 247 and 249 of plates 246 and 248 are on full peripheral portions of drums 337 and 338, this relation being shown in Figure 14. A full portion of the right hand face of disc 404 is in contact with a portion of the left hand face of disc 361 and this means that the disc is in substantially the position shown in Figure 23 wherein the cooperating clutch elements 368 and 369 are disengaged. Shoe 402 lies on top of the cam 370 in the manner shown in Figure 14 and in this position will not interfere with the engagement of clutch elements 368 and 369 upon movement of disc 361 to the left.

When shaft 76 is now driven through 180°, as heretofore described, the record carrying arms remove a record from the magazine and elevate it to the playing position shown in Figure 1. During this operation shaft 336 is likewise driven through 180° so that the drums 337 and 338 come into the relation shown in Figures 20 and 21 permitting the noses 247 and 249 to fall into the notches 339 and 340 and the arms 252 and 253 to gravitate downwardly to be arrested by dogs 349 and 350. The needles of the pick-up devices are now directly opposite the starting ends of the tracks of a ten inch record. Also at the end of this first half revolution of shaft 336 the recess 405 has come in front of the engaged portion of disc 361 so that the disc is moved to the left, Figure 23, under the force of spring 366, thereby engaging clutch elements 368 and 369. Furthermore, the notches 409 and 410 are now opposite pin 324 so that the latter is free to move out of the channel defined between discs 407 and 408. Shoe 402 has ridden off of cam member 370 onto collar 367, still being held against shoulder 374 due to the action of spring 401.

As shaft 360 is now driven, roller 394 is engaged by the cam rise 379 and the barrel 238, and therewith arm 252, is drawn to the right, so that the needle 256 of the left hand pick-up device is engaged with the adjacent sound track, the collar 242 being now engaged in the notch 416 of dog 414 as shown in Figure 13*a* so that the pick-up device is maintained in playing position as the cam rise 379 passes beyond roller 394. During this operation the cam 389 of disc 388 through engagement with rod portion 332 has pulled rod 331 to the left so that clutch member 321 becomes engaged with pinion 320 and the record is driven in clockwise direction as seen from the left, Figure 1.

As barrel 238 moved to the right, finger 391 engaged sleeve 384 to displace disc 381 to the right against the action of spring 386 and after the pick-up device has been engaged with the record and the record drive initiated, cam rise 382 has sufficiently moved bar 396 to the right so that sprocket 362 is displaced to disengage clutch elements 368 and 369.

The displacement of arm 252 to the right is just sufficient to free it from dog 349 so that as the playing of the record continues the arm can move past the dog without interference. When the playing of the record has been completed arm 252 strikes portion 420 of the bell crank lever 417

and the latter is swung so that its foot portion 418 swings dog 414 upwardly to release nose 415 from lateral engagement with the collar 242 and consequently spring 259 returns barrel 238 to its left hand limit position, the nose 415 coming to rest on the periphery of collar 242 in its initial position. As arm 252 actuates bell crank lever 417, it also closes switch 421, but this does not affect the solenoid 94, since switch 422 is open.

Due to the return of the barrel 238, finger 391 releases sleeve 384 and permits disc 381 to return to the left under the action of spring 386, thus releasing bar 396 so that spring 366 causes the re-engagement of clutch elements 368 and 369. Shaft 360 being again driven, the cam rise 376 of disc 375 engages roller 395 and moves barrel 239 to the left so that the needle 260 of the right hand pick-up device is engaged with the right hand sound track of the record and arm 253 is positioned to clear dog 350. Dog 424 engages collar 244 to retain barrel 239 in its displaced position and as cam rise 376 passes beyond roller 395 shoe 402 has been sufficiently displaced to the right by the cam edge 371 to engage and displace sprocket 362 so that clutch elements 368 and 369 are disengaged. In the meantime, cam rise 389 of disc 388 has engaged portion 327 of rod 325 and moved the latter to the left so that the record drive has been reversed. The change from the left to the right hand side is accomplished substantially instantaneously.

As the playing of the right hand side of the record is completed, arm 253 strikes portion 429 of bell crank lever 426 so that dog 424 is tripped and barrel 239, and therewith the right hand pick-up device, are returned by spring 251. Arm 253 substantially simultaneously engages and closes switch 423 so that solenoid 94 is energized and consequently shaft 336 is again driven through a half revolution as the record arms return the record and again come back to their rest position. During this second half revolution, wing 411 of disc 407 engages pin 324 and cams it back into the channel between the discs so that clutch element 321 is returned to the neutral position of Figure 12 to stop the record drive. Finger 403 on drum 338 strikes the forward end of the spring 400 which carries the shoe 402 so that the latter is moved radially away from the cam edge 371 and then is swung on top of cam member 370 against shoulder 374 by spring 401. However, a full portion of the right hand face of disc 384 is now in front of disc 361 and clutch elements 368 and 369 are maintained disengaged as shaft 336 comes again to its initial position.

During the second half revolution of shaft 336, the walls 339' and 349' of notches 339 and 340 engage the noses 247 and 249 and the arms are returned to rest position above and somewhat beyond dogs 349 and 350 which the arms trip in passing.

With the machine still running, in automatic operation the carriage will move one step in one direction or the other and the playing cycle will be repeated.

Record sizing

In case a twelve inch instead of a ten inch record is selected, its edge will abut the upper portion of lever 353 as the record comes into playing position, thus swinging the lower end of the lever in counter-clockwise direction, Figure 14, away from the extremity of lever 351 and consequently shaft 346 is rocked in a counter-clockwise direction by spring 355 until stop 359 abuts portion 170. The extremity of lever 351, acting on the inclined surface 353', snaps the upper portion of lever 353 clear of the edge of the record so that it will not scrape thereon. Arms 252 and 253, which at this point are supported on dogs 349 and 350, are consequently swung upwardly into exact position to enable their associated pick-up devices to engage the starting points of the record sound tracks when the devices are moved toward the record in the manner which has been described. The playing operation proceeds as before and during the second half rotation of shaft 76 cam 171 will engage finger 357 and will move it upwardly thereby returning shaft 346 to the position shown in Figure 14 wherein the dogs 349 and 350 are positioned with reference to a ten inch record, the lower end of lever 353 being again engaged over the extremity of lever 351 due to the action of spring 354 as enabled by the inclined surface 353'. Thus, the pick-ups will always be positioned for a ten inch record unless a twelve inch record is presented in playing position, and in that case the record itself acts to cause the pick-ups to assume the proper radial starting relation to the record.

Selective operation

The description thus far has contemplated automatic action wherein both sides of successive records are played. In automatic selective action where it is desired to play but one side of a record, it is necessary that the pick-up device on the opposite side be held inactive, although where both sides of the selected record are to be played both pick-ups act as before. Furthermore, it is necessary that the normally one revolution clutch be conditioned to act continuously until the carriage has arrived in proper relation to the selected record in case the selected record is more than one step away. The means for accomplishing this selective operation will now be described.

Fixed in the right hand face of flange 243 of barrel 238 is a pin 430 which is engaged in a vertical slot in the upper rearwardly directed end portion 431 of a lever 432 which is pivoted at 433, Figure 27, on a vertical plate 434 fixed to and projecting forwardly of the bottom wall 163. The lower end of the lever is engaged behind the upper end of a dog or abutment 435 pivoted at 436, for swinging in either direction, on a fore and aft axis on a block 437 fixed to the left hand side of plate 434. A tension spring 438 connected between a frame bracket 439 and a finger 440 projecting radially from collar 242 of barrel 238 tends to rock the barrel in a clockwise direction as seen from the left, Figures 12 and 13, such rocking being normally prevented by the lever 432, as held by dog 435, so that the barrel is maintained in the angular relation heretofore assumed.

A pin 441 projecting from flange 245 of barrel 239 is similarly engaged in the slotted upper end portion of a lever 442 pivoted at 443, Figure 27, with its lower end engaged behind the upper end of a dog or abutment 444 pivoted at 445 on a fore and aft axis on a block 446 secured to plate 434, the barrel being thus maintained in its angular relation heretofore assumed against the action of a tension spring 447. In the relation of parts shown, the lower ends of dogs 435 and 444 are in fore and aft alignment.

A lever 448 is pivoted at 449 on a fore and aft axis to a bracket 450 secured on the right hand side of plate 434 and has a lower portion 451 bent to the left and bearing against the right

hand side of dog 435 below the pivot 436. Pivoted at 452 on the lower portion of lever 448 is a plunger 453 guided in an opening in plate 434 and bearing against dog 435 above the pivot 436. Lever 448 has an upper portion bent to the left with its extremity 454 received in a vertical slot 455 in plate 434, Figures 14 and 27, just in front of the lower portion of lever 442. In the relation of parts shown, the extremity 454 does not protrude to the left of plate 434 sufficiently to interfere with the counter-clockwise swing of lever 442. Also pivoted at 449 on bracket 450 is a lever 456 having a lower portion 457 bent to the left and bearing against dog 444 beneath the pivot 445. Pivoted to lever 456 below the pivot 449 is a plunger 458, like plunger 453, guided in an opening in plate 434 and bearing against dog 444 above the pivot 445. Lever 456 has an upper portion 459 bent to the left with its extremity received in a vertical slot 460 in plate 434 just forward of the lower portion of lever 432 and normally out of the path of swing of the latter. A tension spring 461 is connected between the lower portion of lever 448 and block 437, and a tension spring 462 is connected between the lower end of lever 456 and block 446. The plungers 453 and 458 serve to limit the action of these springs.

Referring to Figure 13, if the dog 435 is swung in a clockwise direction, lever 448, through plunger 453, will be swung in a counter-clockwise direction to project its upper extremity 454 into the path of lever 442. Lever 432 will be swung in a counter-clockwise direction as seen from the left of Figure 13, since, its lower end being released by the dog, spring 438 will rock barrel 238 in a clock-wise direction, as seen from the left of Figure 13, thus swinging roller 394 out of the range of the cam portion of disc 378. Finger 391 is also swung out of the range of sleeve 384, but this latter is merely incidental. It will be understood that since upon rotation of shaft 360 cam disc 380 will now not engage roller 394, barrel 238 will not be displaced to the right, nor will cam disc 381 act through bar 395 to disengage clutch elements 368 and 369. Consequently, the continued rotation of shaft 360 will bring the cam portion of disc 375 into engagement with roller 395 and the needle of the right hand pick-up will be engaged with the right hand side of the record. During the rotation of the shaft 360, cam disc 388 acting on rod 331 will momentarily move clutch member 321 into engagement with pinion 320, but its continued movement will move member 321 into engagement with pinion 209 so that the record will be properly rotated for cooperation of the right hand pick-up.

During the second half rotation of shaft 336, a lug 463 on a collar 464 fixed on the shaft engages a block 465 on the upper portion of lever 432 and will return the same and therewith barrel 238, the dog 435 snapping in front of the lower extremity of the lever to the position shown in Figures 13 and 27. It will be evident that the same results will follow if dog 435 is swung in a counter-clockwise direction. The lower end of dog 435 will be released, as before, and lever 448 will be swung in the same direction as before through its lower portion 451.

If dog 444 is swung in either direction, barrel 239 will be rocked by spring 447 to remove roller 395 from the range of cam disc 375 and consequently rotation of the cam disc will be ineffective to move the right hand pick-up device toward the record.

The switch 422, heretofore mentioned, has an operating portion in the path of swing of lever 442, Figure 13, so that when the latter moves as a result of being freed by dog 444, the switch will be closed. Consequently, when arm 252, at the conclusion of the playing of the left hand side of the record, strikes and closes switch 421, a circuit will be completed to solenoid 94 and the second half rotation of shaft 336 will take place. During this rotation a lug 466 on a collar 467 fixed on shaft 336 will engage a block 468 on lever 442 to return the latter and therewith barrel 239.

If dogs 435 and 444 are simultaneously swung to release levers 432 and 442, the upper portions 454 and 459 of levers 448 and 456 will be projected in front of levers 432 and 442 so that these levers will be maintained in rest position. Consequently, the position of barrels 238 and 239 is not affected and the rollers 394 and 395 remain in cooperative relation to their associated cam discs. The left and right hand sides of the record will accordingly be successively played exactly as in automatic operation.

Beneath the forward portion of the carriage 165, a rod 470 extends between brackets 306 and 309 in parallelism with shaft 308, and pivoted on this rod are bars 471 equal in number to the record spaces of the magazine. The forward portion of each of these bars rests on shoulders at the rearward ends of a pair of levers 472 and 473 pivoted on a rod 474 supported by brackets 475 and 476 (Figures 1, 26 and 27), the levers being spaced apart by washers 477 strung on the shaft and being confined between end blocks as at 478, fixed on the shaft. The rear portions of the levers are normally supported on a rod 479 extending between brackets 475 and 476. Each lever 473 has a bottom extension 480 at its forward end, and each lever 472 has a top extension 481 at its forward end, the extensions 481 being shorter than the extensions 480 for convenience of manipulation.

Each lever 472 has a flattened U-shaped clip 482 straddling and fixed to its forward portion perpendicular to its longitudinal axis, the right-hand leg of the clip extending above the top edge of a forward recess 483 to provide a stop 484, the stops of the several levers 472 being aligned beneath the path of the lower end of dog 444.

Each of the levers 473 is similarly equipped with a similar clip providing an upwardly projecting stop 485, these stops being aligned beneath the path of the lower extremity of dog 435. In the case of the levers 473, the clips are reversed with regard to clips 482 so that the upwardly projecting portion providing the stop 485 is to the left of the lever. Therefore, the stops 484 and 485 of a pair of levers associated with a bar 471 are in fore and aft alignment. Projecting downwardly from the forward portion of each of levers 472 and 473 is a spring 486 having bowed portions 487 and 488 in the former of which is normally engaged a rod 489 extending between brackets 475 and 476.

Each of the bars 471 is provided near its forward end with a square notch 490 which defines a continuous channel when the bars are in their normal horizontal position wherein their forward ends are supported squarely on the rear ends of levers 472 and 473. A bar 471*a*, exactly like bars 471, is fixed on rod 470 alongside the first bar 471 and has a notch 490*a* aligned with the notches 490.

Splined on shaft 308 is a downwardly projecting finger 491 whose extremity is received in the groove defined by the notches 490 and 490a (Figure 27), this finger having enforced travel with the carriage by reason of its position between brackets 492 and 493 (Figure 14) secured to the carriage understructure. A vertical plate 494 secured beneath the bottom wall 168 in a fore and aft plane of the machine is provided with a slot 495 inclined somewhat upwardly and rearwardly from the vertical, this slot slidably receiving the shanks of rivets 496 and 497 secured to a slide 498 whose lower extremity is in the fore and aft plane of finger 491. The lower end of slide 498 is normally held above the normal top plane of the bars 471 by a spring 497' and is disposed forwardly of rod 470.

Extending across the forward portions of levers 470 is a universal bar 499 in the form of an angle mounted on pivots as at 500 in plates 306 and 309, these pivots being at the upper edge of the main flange 501 of the angle and the latter being normally yieldingly held in a downwardly and rearwardly inclined position against a stop 502, Figure 10, by a spring 503. Fixed to the bar 499 is a rearwardly extending arm 503 whose extremity is pierced to receive a pivot screw 504 which is received also in a transverse slot in the forward extremity of link 301.

The width of bars 471 is the same as the stepping distance of carriage 165, so that in any playing position of the carriage the extremity of finger 491 will be centrally positioned in a notch 490. In practice, the pairs of levers 472 and 473 will be numbered in accordance with the spaces of the magazine. For example, the first lever 472 may be marked 1L, signifying that if it is actuated, the left-hand side of the first record will be played. The first lever 473 may be marked 1R, signifying that if it is depressed, the right hand side of the first record will be played, and so on.

It will be recalled that in the starting condition of the machine the carriage 165 is one step to the left of the proper playing position for the first record. This means that the lower ends of dogs 435 and 444 are above the bar 478, i. e., to the left of all the levers 472 and 473. The lower end of finger 491 is in the notch 490a of bar 471a, and is held against the forward wall of the notch under the action of a spring 308' secured between bottom plate 30 and an arm 308'' fixed to shaft 308, Figure 10. If any lever 472 is actuated by depressing its forwardly extending portion 480, it will be swung to the dotted line position of Figure 27 and will be yieldingly retained in its operated position due to the engagement of the bowed portion 488 of spring 486 with rod 489, the lower hooked end of the spring serving to limit the swing of the lever. The stop 484 of the actuated lever will be in the dotted line position shown in Figure 27 wherein it is in the path of travel of the lower end of dog 444. The bar 471 associated with the actuated lever is swung to the dotted line position of Figure 27, thus causing a break to appear in the rear wall of the channel defined by the notches 490. The forward portion of the operated bar 471, engaging the lower edge of the flange 501 of the universal bar 499, rocks the universal bar to the dotted line position of Figure 27 so that link 301, Figure 10, is moved to the left permitting spring 313 to pull the nose of latch 311 against the end of finger 312, the force of spring 313 having been previously over-balanced by the force of spring 503. When switch 277 is now moved to starting position, i. e., the full line position of Figure 30, plunger 127, which controls the one revolution clutch, will be retracted, this involving a rocking of shaft 122 in a clockwise direction, Figure 10, and permitting the latch 311 to engage over the end of finger 312 so that plunger 127 will be retained in retracted position and the one revolution clutch closed. The relatively strong returning force of spring 128, Figure 5, places latch 311 under tension and through the downwardly projecting arm 310 on which the latch is pivoted tends to rock shaft 308, to which the arm is fixed, in a counter-clockwise direction. However, shaft 308 cannot rock due to the engagement, now, of finger 491 with the rear wall of notch 490a.

The carriage will now travel to the right until the lower end of dog 444 engages the stop 484 which has been set in its path, and, consequently, the dog will be tripped to render the right hand playing mechanism inoperative in the manner heretofore described. Simultaneously, the lower end of finger 491, which has been sliding along the rear wall of the channel defined by the notches, comes to the break in its guiding channel caused by the bar 471 which has been operated, and the finger being thus released, shaft 308 will be rocked, permitting finger 312 to disengage itself from latch 311 so that plunger 127 returns and opens its associated clutch. Finger 491 is immediately returned by spring 308' against the forward wall of the notch at the break. The engagement of latch 311 with finger 312 held the actuating pin 155 for switch 150 to the rear of the latter, and upon the return of control plunger 127 the switch is operated to energize solenoid 94. The left hand side of the selected record is, consequently, played and the record then returned. During the second half revolution of shaft 76, a pin 510 on the left hand face of the main cam 171 comes against the top of slide 498 so that the latter is depressed to return the operated bar 471 and therewith its associated lever 472. This permits the return of the universal bar to its normal position by spring 503, provided no other bar 471 has been swung, as will be the case when a plurality of records have been selected. The parts are now all in condition for automatic playing, and unless the machine is turned off the carriage will move into playing position to the next record to the right and so on, and the records will be successively played until the machine is stopped.

If two records have been selected the universal bar 499 will be retained in its dotted line position, Figure 27, after the first record has been played and its associated bar 471 returned. Consequently, when the drag link 136 is again pulled rearwardly, finger 312 will again be engaged by latch 311 so that the one revolution clutch will remain closed, provided, of course, that the carriage has to move more than one space to the selected record.

It will be understood that in case a lever 473 is operated, the sequence will be the same as just described in connection with lever 472, except that a stop 485 will be moved into the path of dog 435 and the latter will be tripped so that only the right hand side of a selected record will be played. In case both of the levers 472 and 473 associated with a bar 471 are operated, dogs 435 and 434 will be simultaneously tripped but without effect, due to the action of the inter-locking mechanism as hereinbefore described, and consequently both sides of the record will be played in sequence.

If while a selected record is being played a lever 472 or 473 to the left of that record is operated, when the playing of the record has been completed, the carriage will travel to its right-hand limit position, and then will return to the second record. Of course, selections may be made at any time during automatic playing, and the selected records will be played after the completion of the cycle in which the machine may be engaged. Under these circumstances, the order in which the selections will be played will depend on which direction the carriage happens to have been moving in automatic operation.

As stated at the outset, the playing mechanism preferably moves relative to the magazine, rather than the reverse, and the principal reason for this is that while the playing mechanism can all be disposed on a relatively compact carriage, the magazine may be made of any length desired and the distance of the carriage travel may be made to correspond merely by lengthening the various shafts on or along which the carriage moves. With an extreme length of travel, it will be desirable to take the weight of the carriage off of the shafts, and this may be done by equipping the carriage with rollers and providing rails for engagement by the rollers.

For commercial use of the machine, any suitable coin-controlled mechanism may, of course, be adopted.

It will be understood that the described apparatus is susceptible of wide variation as to form and arrangement of parts, and, consequently, we do not limit ourselves to the illustrative disclosure herein, except as in the following claims. In referring to the records as being stored in side by side relation in the claims, it is not intended to limit the arrangement necessarily to one in which the records are supported on edge.

We claim:

1. In an automatic phonograph, record storing means and record playing means, one of said means being movable relative to the other for record selection, drive means for the movable means, means controlling said drive means for automatic drive of the movable means by equal steps, variably settable means controlling said drive means for automatic drive of the movable means by said equal or by variable steps, transfer means operable to move a record from the storing means for playing and to return the record, means automatically operated after each step for causing said transfer means to move the selected record from said storage means for the playing thereof, means for appropriately rotating the record while removed from said storing means for the playing of both sides thereof, pickup means, means for engaging said pickup means with either side or successively with both sides of the removed record when the record is appropriately rotated, means operable in dependence upon the setting of said variably settable means to cause the playing of the record on one or the other side only or successively on both sides thereof while the record remains removed from said storing means, and means automatically operated after the playing of either side of the record or only when both sides of the record have been successively played for causing the transfer means to return the record.

2. In an automatic phonograph, record storing means and record playing means, one of said means being movable relative to the other for record selection, drive means including an electric motor for the movable means for reciprocating said movable means between limit positions of which one is a normal starting position, means controlling said drive means for automtaic drive of the movable means by equal steps, variably settable means controlling said drive means for automatic drive of the movable means by variable steps, means for moving a record from the storage means after each step and for playing the same and returning it to the storage means, a main motor circuit including a switch, said driving means normally acting to reciprocate said movable means as long as said switch is closed, an auxiliary motor circuit, a switch in said auxiliary circuit which is opened by the closing of said main circuit switch and is closed by the opening of said main circuit switch, and a normally closed switch in said auxiliary circuit automatically operated when said movable means reaches said normal starting position after said main circuit switch has been opened and said auxiliary circuit switch closed.

3. In an automatic phonograph, means for moving a record between inactive and playing positions comprising a pair of arms extending side by side, means for moving the arms together and apart, means pivotally supporting said arms for swinging in a direction transverse to the direction of movement together and apart of the arms between inactive and playing positions, means for swinging the arms between said positions, opposed rotary members carried by said arms at their free ends, a centering pin disposed centrally of one of said members, and means for driving one of said members; the means for moving the arms together and apart acting to cause the rotary members to grip a record in inactive position, to retain the record while it is moved to playing position and returned toward inactive position, and then to release the record.

4. Apparatus according to claim 3 wherein the centering pin is yieldably projected so as to be readily depressible.

5. Apparatus according to claim 3 wherein the means for moving the arms together and apart includes a plate swingable on an axis parallel to the plane of swing of said arms, an arm portion contactible with one side of said plate during swinging of the arms, a driven cam on the other side of said plate, and a follower portion for said cam on said plate.

6. Apparatus according to claim 3 wherein the means for moving the arms together and apart includes a plate swingable on an axis parallel to the plane of swing of said arms, an arm portion contactible with one side of said plate during swinging of the arms, a driven cam on the other side of said plate, and a follower portion for said cam on said plate; and wherein the swinging means for the arms comprises a cam in coaxially fixed relation with the first-mentioned cam.

7. In an automatic phonograph, a record magazine including a group of spaced-apart plates arranged side by side and pivoted in the manner of the leaves of a book, said plates defining record compartments, means for swinging the plates into parallel relation and maintaining them in such relation, means for releasing the swinging means to permit the plates to spread apart, and expanding means selectively insertable between any pair of said plates for causing the group to open in the manner of a book whereby to expose a record in the compartment defined by the pair of plates between which said expanding means is inserted.

8. In an automatic phonograph, a record magazine including a group of spaced apart plates arranged side by side and pivoted in the manner

of the leaves of a book, said plates defining record compartments, means for swinging the plates into parallel relation and maintaining them in such relation, means for releasing the swinging means to permit the plates to spread apart, expanding means selectively insertable between any pair of said plates for causing the group to open in the manner of a book whereby to expose a record in the compartment defined by the pair of plates between which said expanding means is inserted, and means for engaging the exposed record and maintaining it against tilting.

9. Apparatus according to claim 7 wherein the expanding means is constituted by spring-projected wedge means.

10. Apparatus according to claim 8 wherein the means for engaging the exposed record is constituted by a split spring finger.

11. Apparatus according to claim 8 wherein the means for engaging the exposed record is constituted by a split spring finger, and wherein the expanding means is constituted by wedge means carried by said finger.

12. Apparatus according to claim 7 wherein the expanding means and the means for engaging the exposed record are mounted on a common carriage reciprocable along the magazine.

13. Apparatus according to claim 7 wherein the plates are of generally L-shape and wherein the records are so supported that segments thereof are accessible in the angles of the plates.

14. In an automatic phonograph, a record magazine including a group of spaced-apart plates arranged side by side and pivoted in the manner of the leaves of a book, said plates defining record compartments, means for swinging the plates into parallel relation and maintaining them in such relation, means for releasing the swinging means to permit the plates to spread apart, expanding means selectively insertable between any pair of said plates for causing the group to open in the manner of a book whereby to expose a record in the compartment defined by the pair of plates between which said expanding means is inserted, means for engaging the exposed record and maintaining it against tilting, a carriage reciprocable along said magazine and on which said expanding means and said means for engaging the exposed record are mounted, and record playing mechanism on said carriage, said mechanism including means for gripping the exposed record and moving it out of said magazine and free of the record engaging means to playing position and for then returning the record.

15. In an automatic phonograph, a record magazine including a group of spaced-apart plates arranged side by side and pivoted in the manner of the leaves of a book, said plates defining record compartments, means for swinging the plates into parallel relation and maintaining them in such relation, means for releasing the swinging means to permit the plates to spread apart, expanding means selectively insertable between any pair of said plates for causing the group to open in the manner of a book whereby to expose a record in the compartment defined by the pair of plates between which said expanding means is inserted, means for engaging the exposed record and maintaining it against tilting, a carriage reciprocable along said magazine and on which said expanding means and said means for engaging the exposed record are mounted, record playing mechanism on said carriage, said mechanism including means for gripping the exposed record and moving it out of said magazine and free of the record engaging means to playing position and for then returning the record, and coordinated motor driven means on said carriage for controlling the action of said expanding and record engaging means and of said record gripping and moving means.

16. In an automatic phonograph, a record magazine comprising a group of plates pivoted in the manner of the leaves of a book and defining record compartments, means normally holding the magazine closed, means for releasing said holding means to permit the magazine to open, and means for parting the group between any selected pair of plates to expose a record therebetween after the operation of said releasing means.

17. In an automatic phonograph, a record magazine comprising a group of vertical plates pivoted at their lower edges and defining record compartments wherein records are normally maintained upright by the plates, means for parting the group between any selected pair of plates to expose a record therebetween, and means for maintaining the exposed record upright.

18. In an automatic phonograph, record storing means for normally supporting records in uniformly spaced parallel side by side relation, record playing means, one of said means being movable relative to the other for record selection, drive means for said movable means including a clutch, means automatically operable to open said clutch after said movable means has been driven a distance equal to the record spacing, the last-named means including a rock shaft and a finger fixed on said shaft, a latch swingable into engagement with said finger to engage the latter whereby to render the clutch opening means inoperative, spring means tending to swing said latch into engaging position, a group of members in side by side relation pivoted on a common axis extending in the direction of travel of said movable means, said members being swingable in one and the same direction and corresponding in number to the number of spaces in said record storing means, a universal bar pivoted at its ends and extending along said pivoted members, means whereby said bar normally holds said latch in disengaged position, swinging of any one of said pivoted members rocking said bar to release said latch for engagement with said finger when said clutch has been opened, and means controlled by the pivoted member which has been operated for releasing said latch when said movable means has traveled into a certain relation to the operated member.

19. Apparatus according to claim 18 wherein the last-named means includes a spring acting to swing said finger out of engagement by the latch, a rock shaft along which said movable means travels, a connection between the last-named rock shaft and said latch whereby the latter is supported in operative relation to said finger, and a finger splined on the last-named rock shaft and movable with said movable means during travel of the latter, and wherein said pivoted members are provided with grooves which in the normal position of said members form a continuous channel in which the free end of said splined finger moves and against a side wall of which said finger end is borne by said spring through said connection, the operated member causing a break in said side wall through which said finger end escapes so that the action of said spring rocks the last-named rock shaft and releases said latch.

20. In an automatic phonograph, record storing means for normally supporting records in

parallel side by side relation, record playing means, one of said means being movable relative to the other for record selection, means for driving said movable means; said record playing means including means for moving a selected record from the storing means to a playing position and for reversibly rotating the record while in playing position, a pair of pick-up devices, arms supporting said devices for cooperation with the record faces respectively, and means for moving first one arm and then the other toward the opposite faces of the record while the latter is appropriately rotated so that the faces are successively played; pairs of settable stops arranged along the path of said movable means, there being a pair of stops for each record space of said storing means, a pair of movable abutments on said movable means respectively cooperable with the stops of each pair of stops during drive of said movable means, means controlled as the result of engagement of one of said abutments with a stop for rendering inoperative the moving means for one of said arms, means controlled as the result of the engagement of the other of said abutments with a stop for rendering inoperative the moving means for the other of said arms, and means for interrupting the drive of said movable means immediately after the movement of either of said abutments upon engagement with a stop.

21. Apparatus according to claim 20 wherein interlocking means is provided for rendering ineffective the means for rendering inoperative the moving means for the arms whenever said abutments simultaneously engage the stops of a pair of stops so that successive playing of the record faces results.

22. In an automatic phonograph, means for successively or selectively playing the faces of a record, comprising a pair of pick-up devices, means supporting said devices on opposite sides of the record for movement toward the record and across the same, a shaft having a pair of cams fixed thereon, followers for said cams in connection with the supporting means for said devices whereby upon rotation of said shaft first one and then the other of said devices is engaged with the record by movement axially of the record, and means for moving either one of said followers out of the range of its associated cam so that its associated device will remain away from the record.

23. Apparatus according to claim 22 wherein reversible drive means for the record is provided, wherein a further cam is fixed on said shaft, and wherein shifting mechanism for the drive means is arranged for control by said further cam.

24. In an automatic phonograph, record means for supporting in a certain plane and in laterally exposed condition a record of either of a plurality of sizes, and record playing means, said playing means including a movable arm carrying a turntable and a yieldingly projected centering pin, means for moving said arm to cause the centering pin to travel in a path which intersects the opening of a supported record of any size and which causes depression of the centering pin due to contact with an adjacent face of the record, whereby said centering pin is enabled to enter such opening, and means for holding the centered record against said turntable for playing.

25. Apparatus according to claim 24 wherein the arm is pivotally mounted and the path of the pin is arcuate and deflected toward the adjacent face of the record.

26. In an automatic phonograph, a record magazine comprising a group of separable vertical plates defining record compartments, said plates having cushion means on the faces thereof, means compressing said group whereby said cushion means are caused to engage the faces of records in the compartments at points about the record centers whereby to maintain the records against warping, and means for releasing said compressing means to permit separation of said plates.

27. In an automatic phonograph, a record magazine comprising a group of separable vertical plates defining record compartments, said plates having cushion means on the faces thereof, means compressing said group whereby said cushion means are caused to engage the faces of records in the compartments at points about the record centers whereby to maintain the records against warping, wedge means insertable between any pair of said plates, means for releasing said compressing means to permit separation of the group between the pair of plates engaged by said wedge means, means for withdrawing the wedge means, and means for restoring the compressing means.

28. In an automatic phonograph, a record magazine comprising a group of separable vertical plates defining record compartments, said plates having cushion means on the faces thereof, means compressing said group whereby said cushion means are caused to engage the faces of records in the compartments at points about the record centers whereby to maintain the records against warping, wedge means insertable between any pair of said plates, means for releasing said compression means to permit separation of the group between the pair of plates engaged by said wedge means, means for withdrawing the wedge means, means for restoring the compressing means, and means independent of the plates for maintaining generally upright a record between said pair of plates upon separation of the latter.

29. In an automatic phonograph, a record magazine comprising a group of separable vertical plates defining record compartments, means normally holding the plates in equally spaced relation, wedge means insertable between any pair of said plates, means for releasing said holding means to permit separation of the group between said pair of plates under the action of said wedge means, means for withdrawing the wedge means, and means for returning the holding means.

30. In an automatic phonograph, a record magazine comprising a group of separable vertical plates defining record compartments, means normally holding the plates in equally spaced relation, wedge means insertable between any pair of said plates, means for releasing said holding means to permit separation of the group between said pair of plates under the action of said wedge means, means for withdrawing the wedge means, means for returning the holding means, and means independent of the plates for maintaining generally upright a record between said pair of plates upon separation of the latter.

31. In an automatic phonograph, a record magazine comprising a group of separable vertical plates defining record compartments, means normally holding said plates in equally spaced relation, a carriage reciprocable along said group, wedge means mounted on said carriage, means for moving said wedge means into engagement with a pair of plates defining the compartment

of a record to be played, means for releasing said holding means to permit said wedge means to become effective to separate the group between said pair of plates, pick-up means on said carriage, means for moving a record from between said pair of plates into playing relation with said pick-up means and for returning the record to the magazine after it has been played, means for withdrawing the wedge means, and means for returning the holding means to restore the equally spaced relation of said plates.

32. In an automatic phonograph, a record magazine comprising a group of separable vertical plates defining record compartments, means normally holding said plates in equally spaced relation, a carriage reciprocable along said group, wedge means mounted on said carriage, means for moving said wedge means into engagement with a pair of plates defining the compartment of a record to be played, means for releasing said holding means to permit said wedge means to become effective to separate the group between said pair of plates, pick-up means on said carriage, means for moving a record from between said pair of plates into playing relation with said pick-up means and for returning the record to the magazine after it has been played, means for withdrawing the wedge means, means for returning the holding means to restore the equally spaced relation of said plates, and means independent of the plates for maintaining generally upright a record between said pair of plates upon separation of the latter.

33. In an automatic phonograph, a record magazine comprising a group of separable vertical plates defining record compartments, means normally holding said plates in equally spaced relation, a carriage reciprocable along said group, means for driving the carriage by steps for record selection, wedge means mounted on said carriage, means operated after each stepping movement of the carriage for moving said wedge means between the pair of plates between which the selected record is disposed, means operated after such movement of the wedge means to release said holding means to permit separation of said group between said pair of plates, pick-up means on the carriage, means for moving a record from between said pair of plates into playing relationship with said pick-up means and for returning the record to the magazine after it has been played, means for withdrawing the wedge means, and means for returning the holding means to restore the equally spaced relation of said plates.

34. In an automatic phonograph, a record magazine comprising a group of separable vertical plates defining record compartments, means normally holding said plates in equally spaced relation, a carriage reciprocable along said group, means for driving the carriage by steps for record selection, wedge means mounted on said carriage, means operated after each stepping movement of the carriage for moving said wedge means between the pair of plates between which the selected record is disposed, means operated after such movement of the wedge means to release said holding means to permit separation of said group between said pair of plates, pick-up means on the carriage, means for moving a record from between said pair of plates into playing relationship with said pick-up means and for returning the record to the magazine after it has been played, means for withdrawing the wedge means, means for returning the holding means to restore the equally spaced relation of said plates, and

means independent of the plates for maintaining generally upright a record between said pair of plates upon separation of the latter.

35. In an automatic phonograph, record storing means for normally supporting records in side by side relation, record playing means, one of said means being movable relative to the other for record selection, drive means for stepping said movable means between record selecting positions; said record playing means including transfer means operable to move a selected record from said storing means to a record playing station and to return the record, means automatically operated at the end of a stepping operation to cause said transfer means to move the selected record from the storing means to the playing station, means for reversibly rotating said record while at the playing station, pickup means, means for engaging said pickup means with one side of the appropriately rotated record, means automatically operated after said one side has been played and while the record remains at said station for reversing the direction of record rotation and for engaging the pickup means with the other side of the record, and means automatically operated only when both sides of the record have been successively played to cause said transfer means to return the record.

36. In an automatic phonograph, record storing means for normally supporting records in side by side relation, record playing means, one of said means being movable relative to the other for record selection, drive means for stepping the movable means between record selecting positions, means for automatically reversing said drive means at a limit position of said movable means; said record playing means including transfer means operable to move a selected record from said storing means for playing and to return the record, means automatically operated at the end of a stepping operation to cause said transfer means to move the selected record from the storing means for the playing thereof, means for appropriately rotating said record while removed from said storing means for the playing of both sides thereof, pickup means, means for engaging said pickup means with one side of the appropriately rotated record, means automatically operated after said one side has been played and while the record remains out of said storing means for engaging the pickup means with the other side of the appropriately rotated record, and means automatically operated only when both sides of the record have been successively played to cause said transfer means to return the record, said means for engaging said pickup means being arranged to engage the pickup means first with the same side of a selected record in both directions of travel of said movable means.

37. In an automatic phonograph, record storing means for normally supporting records in side by side relation, record playing means, one of said means being movable relative to the other for record selection, drive means for stepping the movable means between record selecting positions, means for automatically reversing said drive means at a limit position of said movable means; said record playing means including transfer means operable to move a selected record from said storing means for playing and to return the record, means automatically operated at the end of a stepping operation to cause said transfer means to move the selected record from the storing means for the playing thereof, means

for appropriately rotating said record while removed from said storing means for the playing of both sides thereof, pickup means, means for engaging said pickup means with one side of the appropriately rotated record, means automatically operated after said one side has been played and while the record remains out of said storing means for engaging the pickup means with the other side of the appropriately rotated record, means automatically operated only when both sides of the record have successively played to cause said transfer means to return the record, said means for engaging said pickup means being arranged to engage the pickup means first with the same side of a selected record in both directions of travel of said movable means; and means for conditioning the drive means to return the movable means from any point of its travel to a predetermined starting position.

38. In an automatic phonograph, record storing means for normally supporting records in side by side relation, record playing means, drive means for moving one of said means relative to the other by steps for record selection; said record playing means including transfer means operable to move a selected record from said storing means to a playing station and for returning the record, means automatically operated subsequent to a stepping operation to cause said transfer means to move a selected record from the storing means to the playing station, means for reversibly rotating the record while at the playing station, pickup means, means for engaging said pickup means with one side of the appropriately rotated record, means automatically operated as the result of the inward travel of said pickup means on said one side of the record and while the record remains at said station for reversing the direction of record rotation and for engaging the pickup means with the other side of the record, and means automatically operated only when both sides of the record have been successively played to cause said transfer means to return the record.

39. In an automatic phonograph, record storing means and record playing means, one of said means being movable relative to the other for record selection, drive means for the movable means, variably settable means controlling said drive means for automatic drive of the movable means by equal steps or by variable steps, transfer means operable to move a record from the storing means for playing and to return the record, means automatically operated after each step for causing said transfer means to move the selected record from said storage means for the playing thereof, means for appropriately rotating the record while removed from the storing means for the playing of both sides thereof, pickup means, means for engaging said pickup means with either side or successively with both sides of the removed record when the record is appropriately rotated, means operable in dependence upon the setting of said variably settable means to cause the playing of the record on one or the other side only or successively on both sides thereof while the record remains out of said storing means, means automatically operated after the playing of either selected side of the record for causing the transfer means to return the record, and means controlled by the setting of said variably settable means for rendering said automatically operated means inoperative until the second side of the record has been played.

40. In an automatic phonograph, record storing means for normally supporting records in side by side relation, record playing means, one of said means being movable relative to the other for record selection, drive means for stepping the movable means between record selecting positions, means for automatically reversing said drive means at a limit position of said movable means, transfer means operable to move a record from the storing means for playing and to return the record, means automatically operated after each step for causing said transfer means to move the selected record from said storage means for the playing thereof, means for appropriately rotating the record while removed from said storing means for the playing of both sides thereof, pickup means, means for engaging said pickup means with either side or successively with both sides of the record when the removed record is appropriately rotated, means operable in dependence upon the setting of said variably settable means to cause the playing of the record on one or the other side only or successively on both sides thereof while the record remains out of said storing means, means automatically operated after the playing of either selected side of the record for causing the transfer means to return the record, and means controlled by the setting of said variably settable means for rendering said automatically operated means inoperative until the second side of the record has been played, said means for engaging said pickup means being arranged to cause the same succession of playing of the sides of a record in both directions of movement of said movable means.

41. In an automatic phonograph, a record magazine wherein records are normally maintained in side by side relation, a carriage movable along said magazine, means including a motor for driving the carriage by equal steps for record selection; means on the carriage automatically operated after each step for moving a record from the magazine to a playing station, playing the record, and returning it; reversing means for the carriage drive automatically operated during continued drive of the carriage when the carriage comes into playing relation with respect to the first and last record positions in the magazine, said reversing means including abutment means at the ends of the magazine, means operable for conditioning the driving means to move the carriage to a starting position determined by one of said abutment means when operation of the phonograph is to be stopped, means automatically operated when said conditioning means is operated to adjust said one of said abutment means so as to permit the carriage to move one step beyond the end record position which is adjacent said one of said abutment means, means automatically operated to stop said motor when the carriage comes into the position determined by said adjusted abutment means, and means acting automatically to restore said adjusted abutment means when operation of the phonograph is again initiated.

42. In an automatic phonograph, a record magazine wherein records are normally maintained in side by side relation, a carriage movable along said magazine, means including a motor for driving the carriage by equal steps for record selection; means on the carriage automatically operated after each step for moving a record from the magazine to a playing station, playing the record, and returning it; reversing means for the carriage drive automatically operated during

continued drive of the carriage when the carriage comes into playing relation with respect to the first and last record positions in the magazine, said reversing means including abutment means at the ends of the magazine, means operable for conditioning the driving means to move the carriage to a starting position determined by one of said abutment means when operation of the phonograph is to be stopped, means automatically operated when said conditioning means is operated to adjust said one of said abutment means so as to permit the carriage to move one step beyond the end record position which is adjacent said one of said abutment means, means automatically operated to stop said motor when the carriage comes into the position determined by said adjusted abutment means, and means actuated by movement of the carriage away from said adjusted abutment to restore said adjusted abutment when operation of the phonograph is again initiated.

43. In an automatic phonograph, record storing means for normally supporting records in side by side relation, record playing means, one of said means being movable relative to the other for record selection, drive means for stepping said movable means between record selecting positions; said record playing means including transfer means operable to move a selected record from said storing means for playing and to return the record, means automatically operated at the end of a stepping operation to cause said transfer means to move the selected record from the storing means for the playing thereof, pickup means, means automatically controlling the pickup means for successively playing both sides of the record while the record remains out of said storing means, means for appropriately rotating the removed record for the playing of both sides thereof, and means automatically operated only when both sides of the record have been successively played to cause the transfer means to return the record to the storing means.

44. In an automatic phonograph, record storing means for normally supporting records in side by side relation, record playing means, one of said means being movable relative to the other for record selection, drive means for stepping said movable means between record selecting positions; said record playing means including transfer means operable to move a selected record from said storing means and to return the record, means automatically operated at the end of a stepping operation to cause said transfer means to move the selected record from the storing means for the playing thereof, pickup means, means automatically controlling the pickup means for playing either side or successively both sides of the record while the record remains out of said storing means, means for appropriately rotating the removed record for the playing of either or of both sides thereof, means automatically operated to cause the transfer means to return the record to the storing means after the first side of the record has been played, and means for rendering said automatically operated means inoperative until the second side of the record has been played.

45. In an automatic phonograph, a record magazine comprising a group of separable vertical plates defining record compartments between them, cushion means on the opposed faces of said plates, means engaging the end plates of said group for holding said plates against separation and with said cushion means yieldingly engaging both sides of records in said compartments to maintain the records in substantially vertical planes, means for releasing said holding means whereby to release the pressure of said cushion means so as to render a selected record available for removal, means independent of the plates for maintaining the selected record in a substantially vertical plane after said pressure release; means for laterally removing the selected record from the magazine in said plane, for playing it, and then returning it to the magazine in said plane; and means for then restoring said holding means.

46. In an automatic phonograph, a record magazine comprising a group of separable vertical plates pivotally supported at the bottom in the manner of the leaves of a book and defining record compartments between them, cushion means on the opposed faces of said plates, means engaging the end plates of said group for holding said plates against separation and with said cushion means yieldingly engaging both sides of records in said compartments to maintain the records in substantially vertical planes, means for releasing said holding means whereby to release the pressure of said cushion means so as to render a selected record available for removal, means independent of the plates for maintaining the selected record in a substantially vertical plane after said pressure release; means for laterally removing the selected record from the magazine in said plane, for playing it, and then returning it to the magazine in said plane; and means for then restoring said holding means.

47. In an automatic phonograph, record storing means for normally supporting records in parallel side by side relation, record playing means, one of said means being movable relative to the other for record selection, means for driving said movable means; said record playing means including means for moving a selected record from the storing means for playing and for appropriately rotating the removed record for the playing of either record face, pickup means cooperable with the record in playing position, and means normally causing both faces of the selected record to be played in succession; and record face selecting means including pairs of settable stops arranged along the path of said movable means, there being a pair of stops for each record space of said storing means, a pair of movable abutments on said movable means respectively cooperable with the stops of each pair of stops during drive of said movable means, means controlled as the result of engagement of one of said abutments with a stop for selecting one face of the selected record for playing, means controlled as the result of the engagement of the other of said abutments with a stop for selecting the other face of the selected record for playing, interlocking means preventing the selecting action of the record face selecting means whenever said abutments simultaneously engage the stops of a pair of stops so that normal successive playing of the record faces results, and means for interrupting the drive of said movable means immediately after the movement of either one or both of said abutments upon stop engagement.

48. In an automatic phonograph, record storing means for normally supporting records in side by side relation, record playing means, one of said means being movable relative to the other for record selection, drive means for stepping said movable means between record selecting positions, said record playing means including transfer

means operable to move a selected record from said storing means for playing and to return the record, means automatically operated at the end of a stepping operation to cause said transfer means to move the selected record from the storing means for the playing thereof, pickup means, means for engaging the pickup means with one side of a removed record and for disengaging the pickup means to permit the return of the played record to said storing means if only said one side is to be played or for engaging the pickup means with the other side of the record for the successive playing of both record sides while the record remains out of storage and then for disengaging the pickup means to permit the return of the played record, means for appropriately

rotating the removed record for the playing of either side thereof, means settable in advance of a playing operation to control said drive means for drive of the movable means by equal or by variable steps and for determining which side of the selected record shall be played if only one side is to be played or for causing the playing of both sides in succession while the record remains out of storage, and means automatically operated after the playing of either side of the record or only when both sides have been successively played for causing the transfer means to return the record.

JOSEPH A. DARWIN.
ROBERT ROBERTSON.