

Jan. 27, 1942.

E. COMPARE

2,270,995

MAGAZINE PHONOGRAPH

Filed April 22, 1939

8 Sheets-Sheet 1

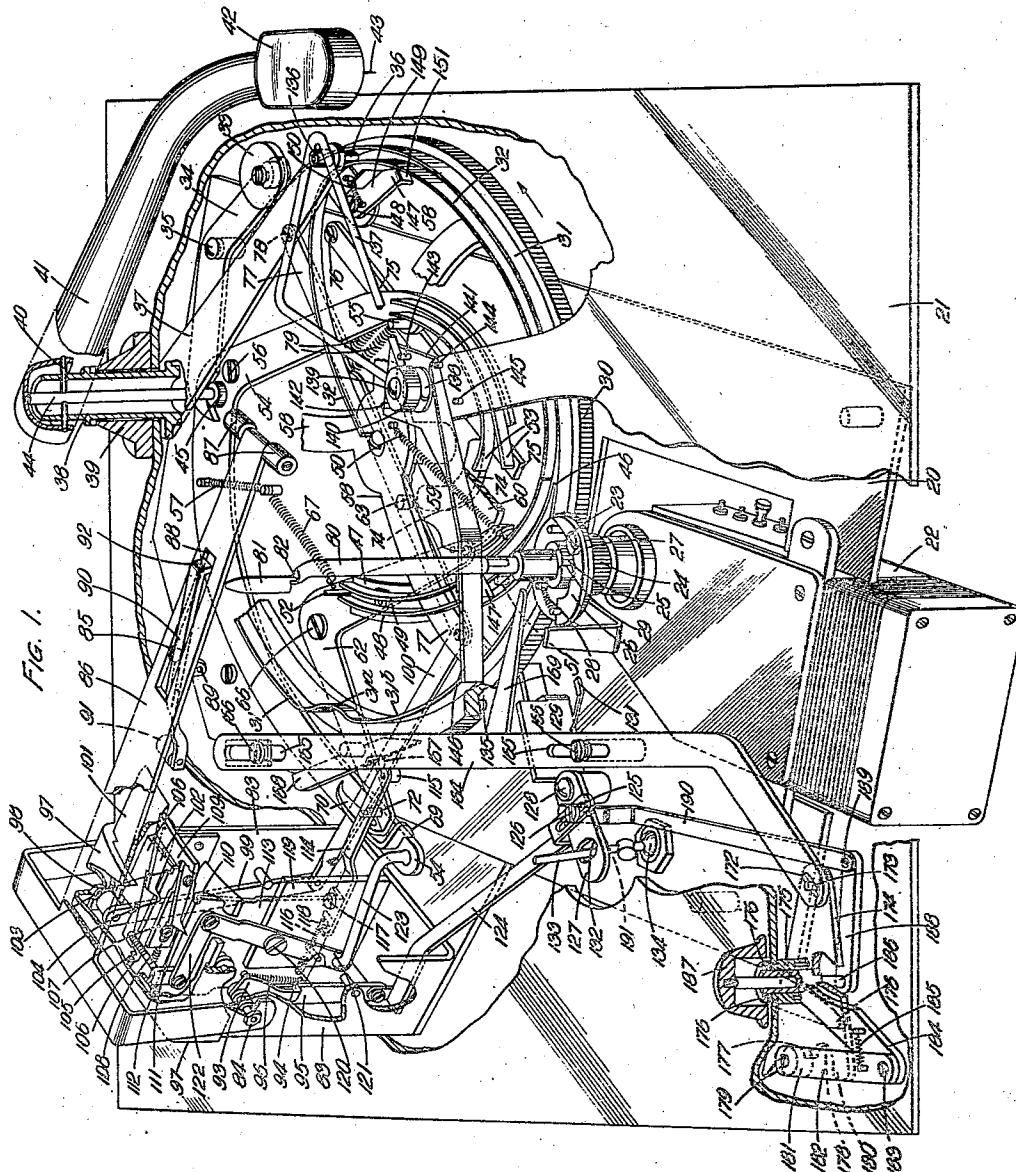


FIG. 1.

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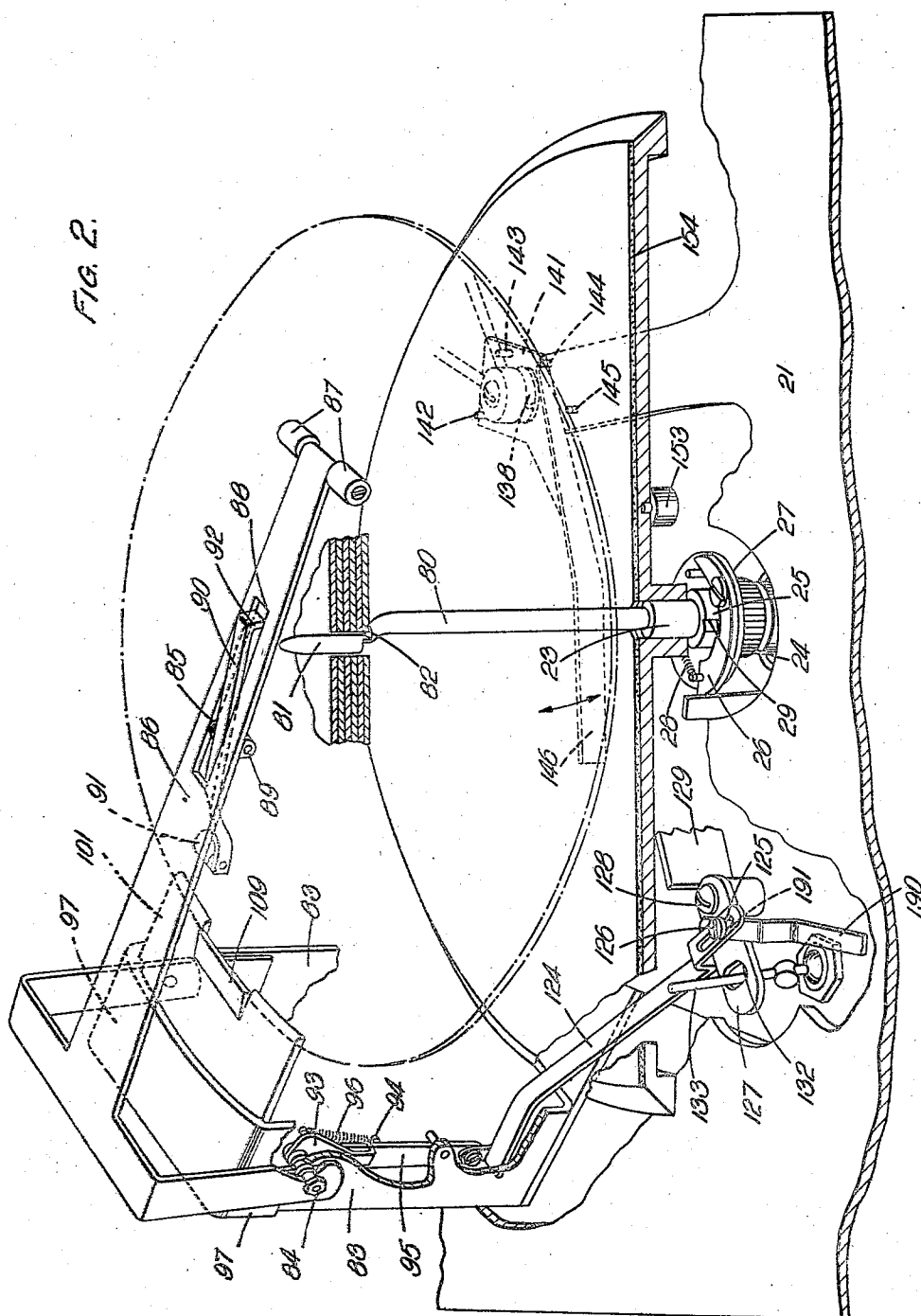
E. COMPARE

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MAGAZINE PHONOGRAPH

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8 Sheets-Sheet 2



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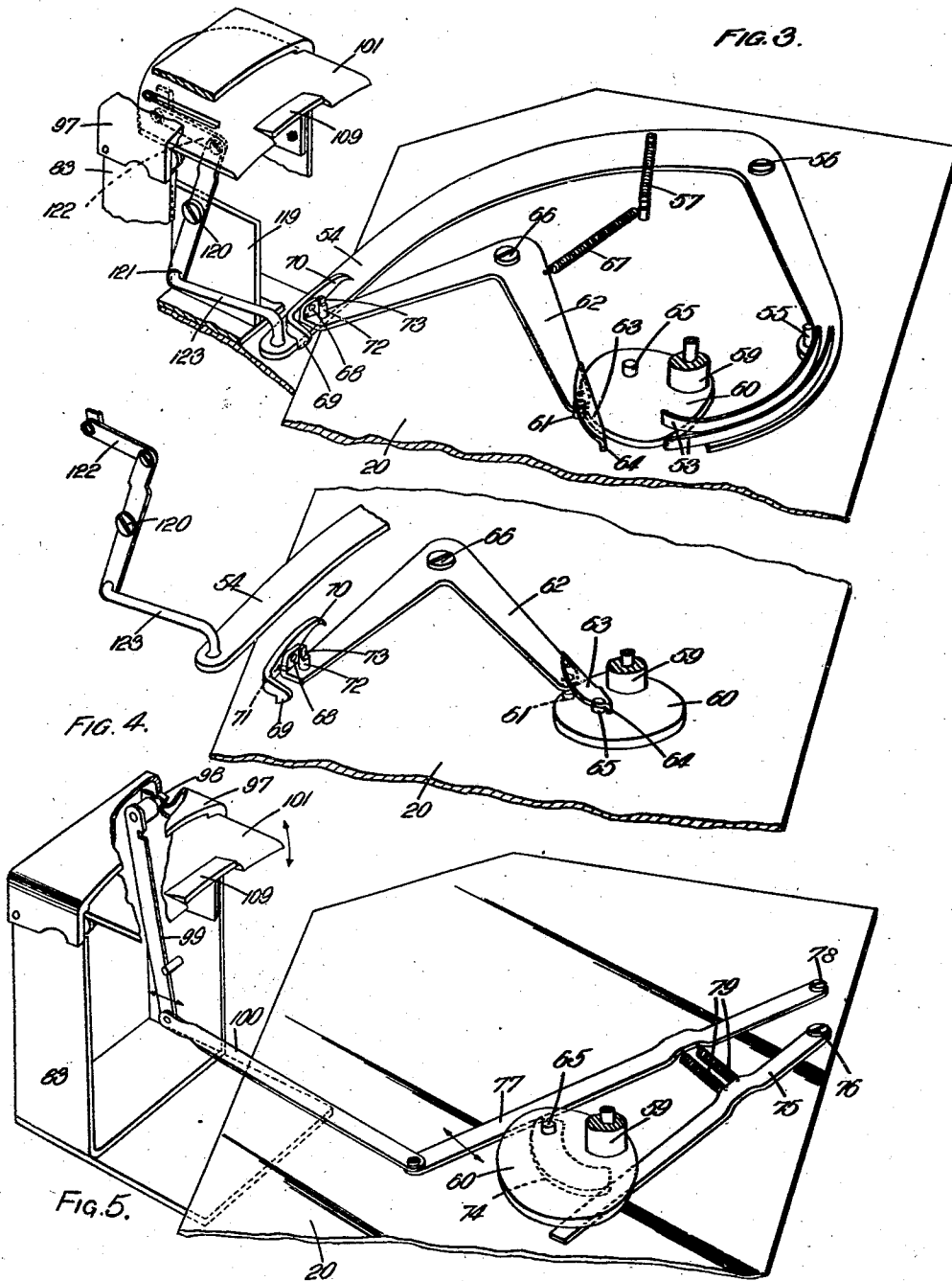
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MAGAZINE PHONOGRAPH

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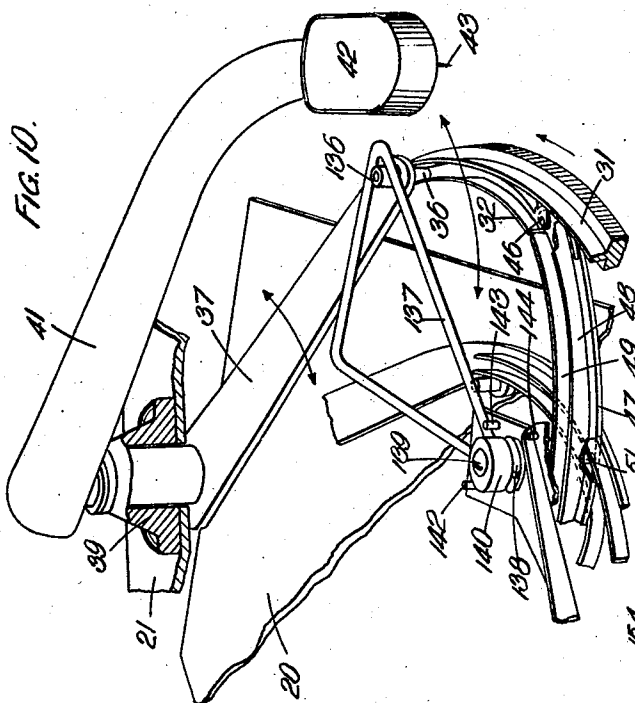
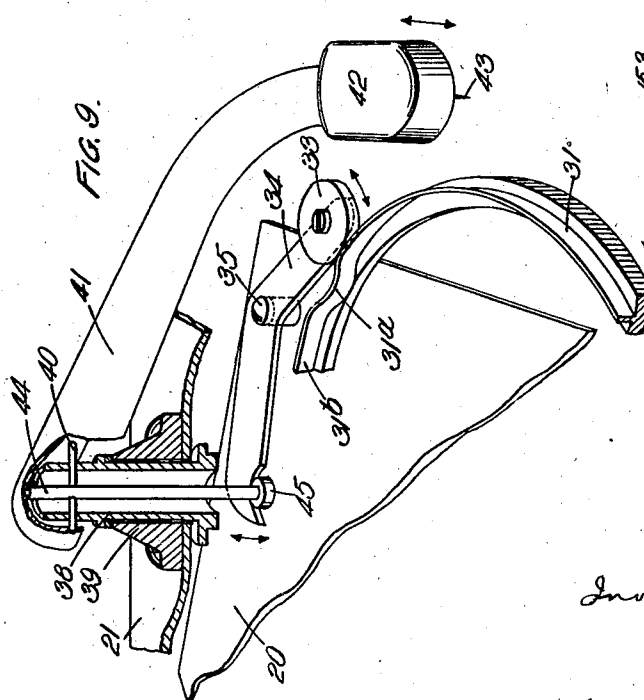
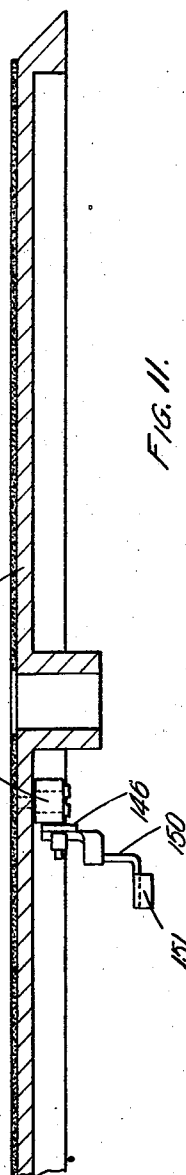
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8 Sheets-Sheet 5



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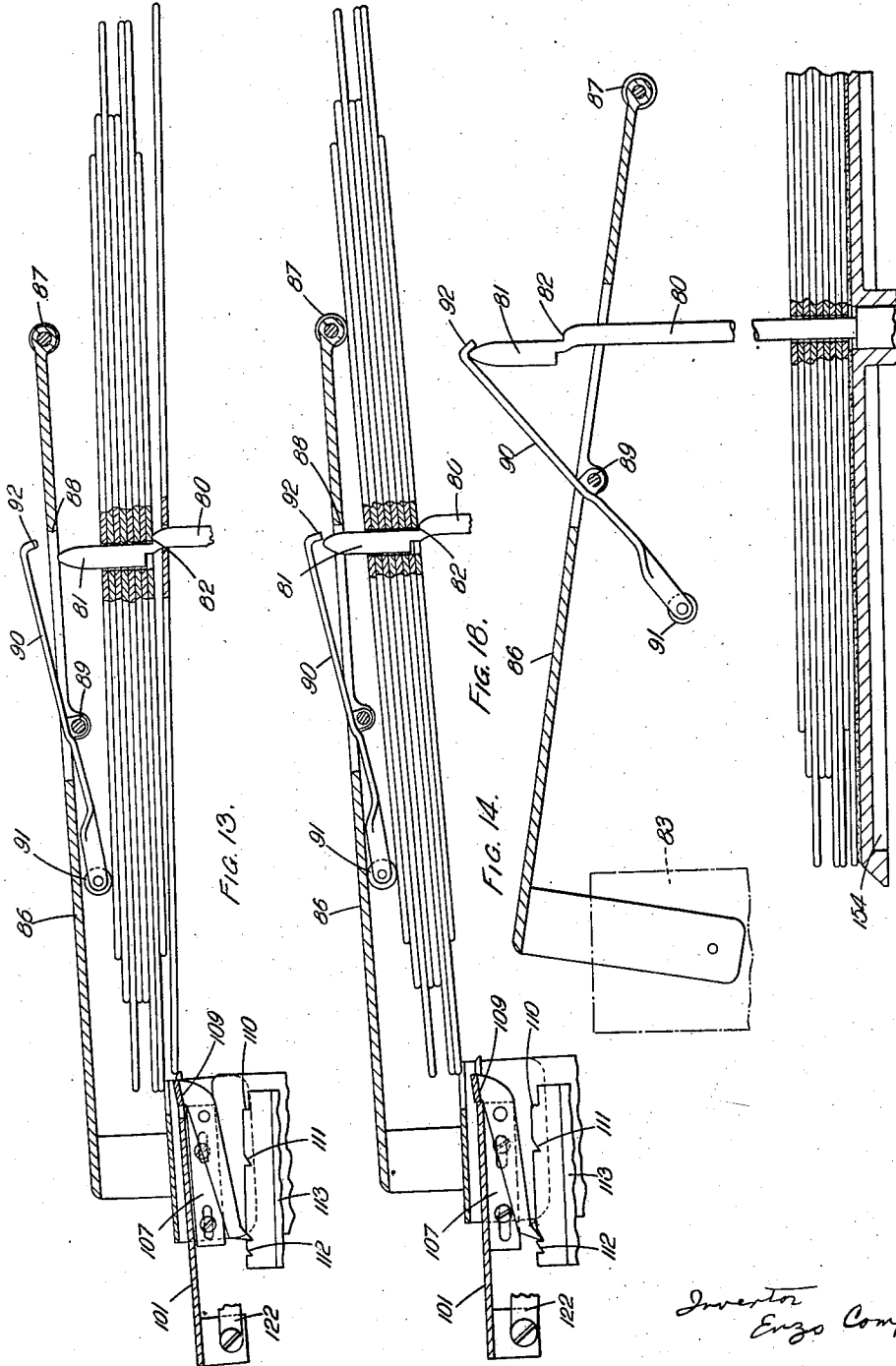
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MAGAZINE PHONOGRAPH

Filed April 22, 1939

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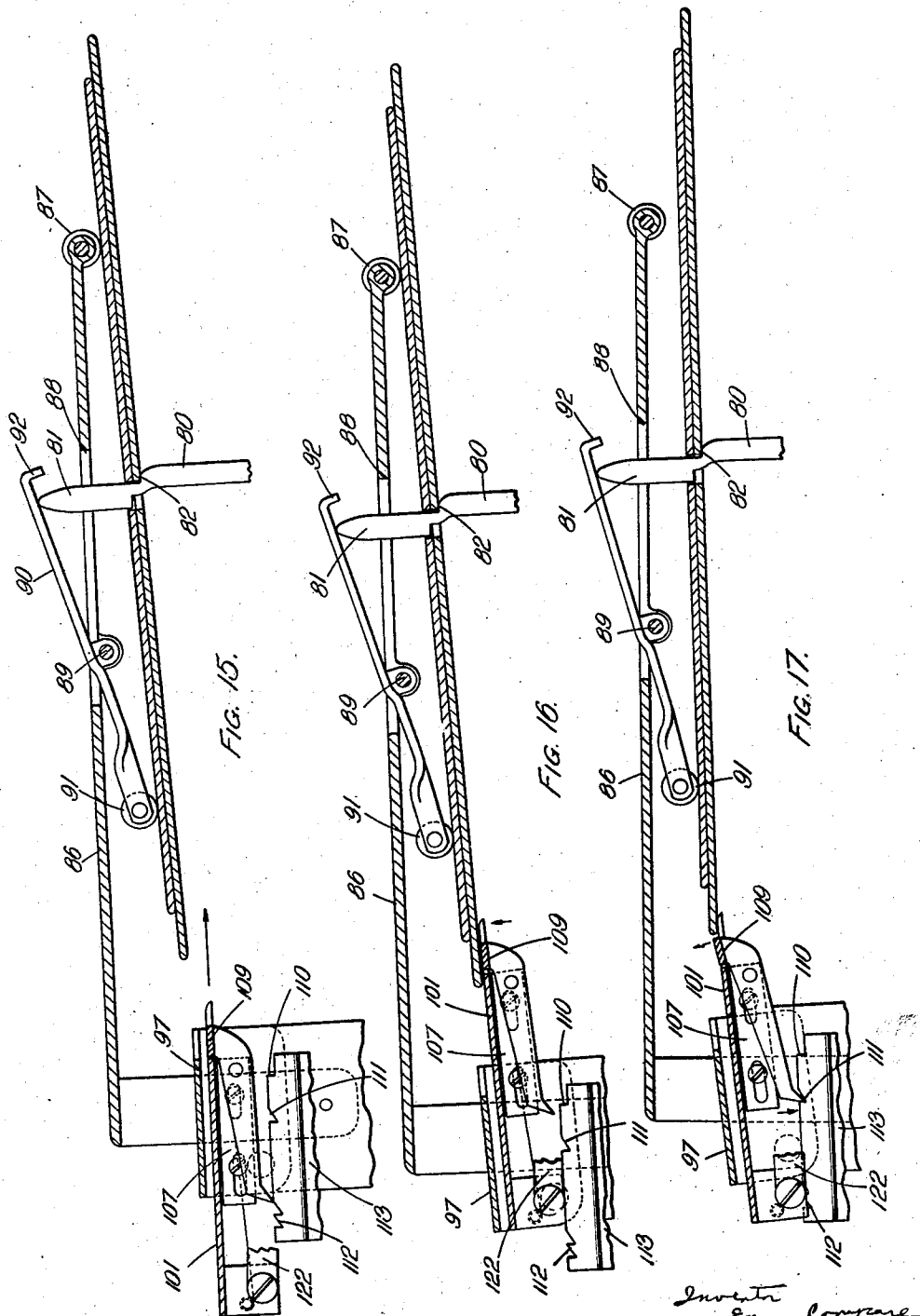
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MAGAZINE PHONOGRAPH
Filed April 22, 1939

2,270,995

8 Sheets-Sheet 7



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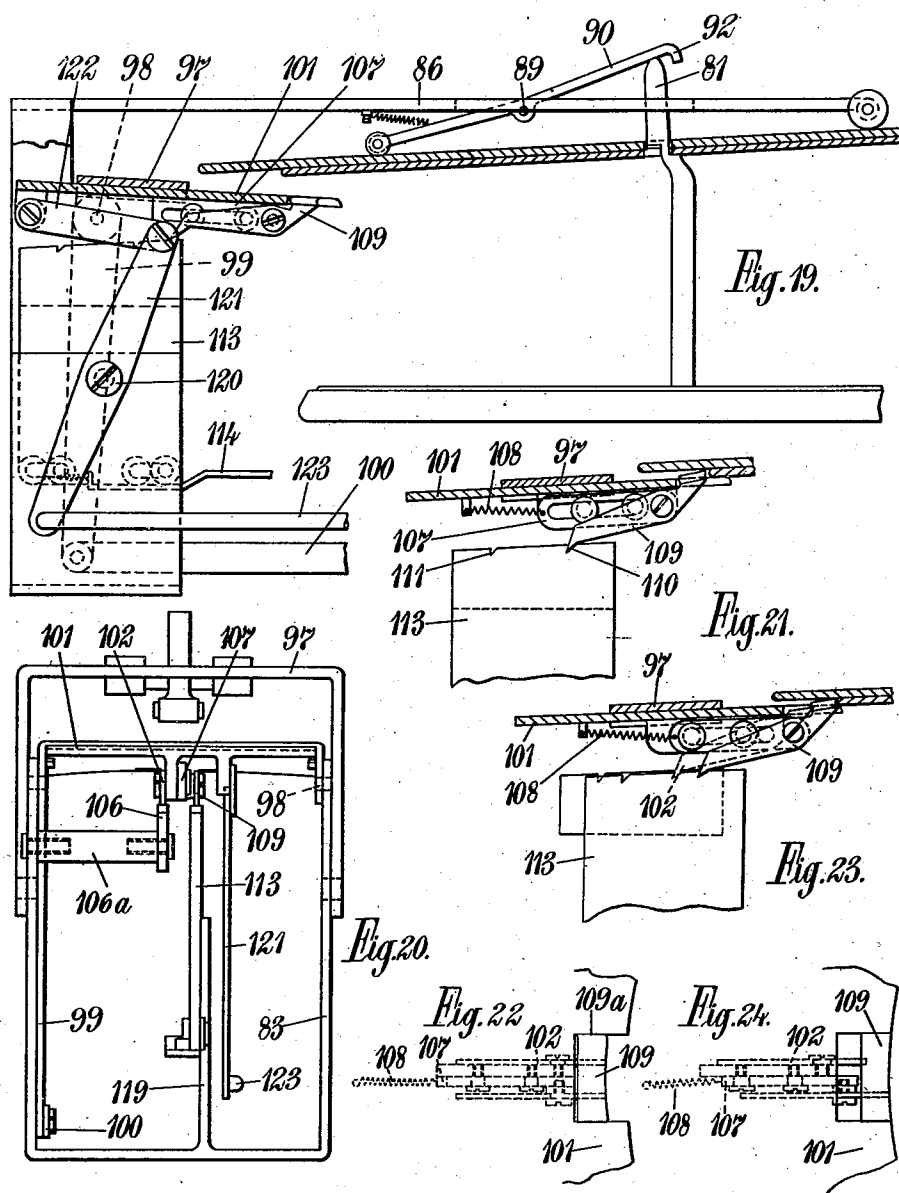
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MAGAZINE PHONOGRAPH

Filed April 22, 1939

8 Sheets-Sheet 8



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UNITED STATES PATENT OFFICE

2,270,995

MAGAZINE PHONOGRAPH

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Application April 22, 1939, Serial No. 269,487
In Great Britain April 28, 1938

18 Claims. (Cl. 274-10)

This invention relates to magazine phonographs or like talking or sound reproducing machines and to record changing mechanism whereby a series of records may be played successively, the changing of the records and ancillary operations being performed automatically. The invention is more particularly concerned with mechanism comprising an offset or shouldered means supporting the records at their centres from which they are released by lateral displacement, a pick-up or tone arm being moved outwardly during the release of the record and subsequently returned and engaged in the first groove of the record for playing purposes.

The invention has for its object to provide improved mechanism of the above character adapted to change and play in succession a series of records of varying diameter without manual adjustment. A further object is to provide improved means for manually starting, repeating and rejecting any record. A further object is to provide improved means for initiating the record changing cycle of operations, and another object is to provide improved means for stopping the mechanism automatically on the termination of the playing of the last record. A further object is to provide a mechanism capable of operating satisfactorily when tilted and thus suitable for use on board ship. Other objects of the invention will be clear to those engaged in the art upon an understanding of the present disclosure.

According to a feature of the invention there is provided a unitary record feeding device comprising a generally horizontal, reciprocable plate engaging under the bottom record disc of the magazine pile and a feed pawl slidable and rockable with respect to said plate and engageable with the edge of said record disc, wherein the movements of the plate and feed pawl are separately controlled for successive operation by cam follower means.

The nature of the present invention and a preferred manner of carrying the same into execution will be more fully understood from the following description having reference to the accompanying drawings of an embodiment of the invention given by way of example.

In the drawings:

Figure 1 is a general view of the machine in perspective with parts cut away to show other parts;

Figure 2 is a view similar to Figure 1 showing certain parts (partly sectioned) not included in Figure 1 and omitting other parts;

Figures 3 to 10 are views in perspective of de-

tails of the mechanism taken from various aspects, Figures 3 to 5 showing especially cam means controlling the record feeding device, Figure 6 showing a control bar, Figures 7 and 8 showing clutch actuating mechanism in engaged and disengaged positions respectively and Figures 9 and 10 showing mechanism controlling and controlled by the movements of the tone arm;

Figures 11 and 12 are detail views partly sectioned in plan and elevation respectively showing means for causing a clutch to engage, when playing of a record finishes, to start the record changing cycle;

Figures 13 to 18 are similar partial views in side elevation, partly in section, showing various stages in the feeding of record discs from the magazine to the turntable;

Figure 19 is a side view showing the detail of the record feeding mechanism;

Figure 20 is an end view of the mechanism shown in Figure 19;

Figure 21 is a sectional elevation of a part of the record feeding mechanism showing the feed pawl on the return movement;

Figure 22 is a plan of a part of the mechanism showing the pawl;

Figure 23 is an elevation of the mechanism shown in Figure 21 with the feed pawl on the forward movement;

Figure 24 is a plan of a part of the mechanism in the position of Figure 23.

In reading the following description Figure 1 may be referred to throughout as showing the majority of the parts, reference to other figures being indicated where necessary.

In the illustrated embodiment of the invention the gramophone mechanism is mounted on a chassis comprising a base plate 20, which supports a driving motor 22, and a cover plate 21. The motor drives a hollow shaft 23, projecting through the cover plate and carrying a turntable, the rotation of shaft 23 being clockwise as seen in Figure 1.

A pinion 24 is loosely mounted on shaft 23 and can be connected thereto by a clutch device comprising a notched pawl 26 pivoted on a plate 27 fast on the pinion and loaded by a spring 28 to engage a notch 29 of a collar 25 fast on shaft 23.

Pinion 24 is in constant mesh with a toothed wheel 30 carrying cam tracks 31 and 32. The outer face of track 31 guides a roller 33 on one end of a bell crank 34 mounted on a fixed pivot 35 and the outer face of track 32 and the inner

face of track 31 guide a pin 38 on an arm 37 fast on a vertical sleeve 38 rotatable in a bearing boss 39 supported on plate 21. A horizontal pin 40 rotatable in the sleeve 38 is fast in a tone arm 41 carrying a sound box or pick-up 42 and stylus 43 and also in a vertical stem 44, whose upper end is fast in the tone arm and whose lower end carries a boss 45 engaging the tail of bell crank 34. The vertical movement of the tone arm is therefore controlled by the cam track 31 and roller 33 which is held against the cam track by the weight of the tone arm and sound box (see Figure 9) and the horizontal movement of the tone arm is controlled by cam track 32 and pin 36, which is prevented from leaving cam track 32, at least for the greater part of its travel, by the inner face of cam track 31.

Pivoted to wheel 30 at 46 is an arm 47 carrying evenly spaced curved cam tracks 48, 49 forming continuations of tracks 31, 32. Arm 47 is biased towards the centre of wheel 30 by a spring 50 and carries on its underside a stud 51 (Figure 10), and is provided with an extension 52 having a slight outward inclination to a line tangent to the curvature of tracks 48, 49. Stud 51 is positioned to engage between a pair of curved cam tracks 53 mounted on a bell crank 54 which also carries a pin 55; the latter engages extension 52 when stud 51 escapes from between tracks 53 at the ends thereof adjacent pin 55. These means serve to guide the arm 47 and determine its displacement about the pivot 46 in accordance with the position of bell crank 54, which is pivoted to the base plate 20 at 56 and controlled by the record disc-feed mechanism as hereinafter described, being given a counter-clockwise bias (as viewed from above) by a spring 57.

The rim of wheel 30 is connected by spokes 58 to a hub 59 the lower end of which carries a cam 60 (see Figures 3 and 4) engaging a stud 61 on a bell crank 62 having a joggled or downturned end 63 terminating in a lip 64 engageable with a stud 65 mounted on the upper face of cam 60. Bell crank 62 is mounted on a fixed pivot 66 and loaded by a spring 67 to hold stud 61 against cam 60 except when stud 65 engages the lip 64. On the outer arm of bell crank 62 is pivoted at 68 a pawl having a hooked nose 69 and a curved tail 70, the nose 69 being engageable with the end of the longer arm of bell crank 54, and the nose end of the pawl being heavier so that it tends to drop and rest on a pin 71 projecting from the bell crank 62. The latter also carries a vertical pin 72 having a flat 73 formed thereon.

On the underside of cam 60 is a cam boss 74 engaging a pair of bars 75, 77 respectively pivoted to the base plate 20 at 76, 78 and lying on opposite sides of the axis of the cam wheel, being interconnected by springs 79 (see Figure 5).

The magazine pile of records is supported on a cranked spigot 80 whose tip 81 is joined to the lower part thereof by the cranked portion, the latter presenting a shoulder 82 which serves to support the record discs; the lower part of the spigot is inserted into the hollow shaft 23 and is detachably engaged with a stationary pin (not shown) inside the hollow shaft, so as to be incapable of turning, e. g. by providing co-operating flats (not shown) on the ends of the spigot 80 and the stationary pin.

The pile of record discs is steadied by means of an arm 86 pivoted for vertical swinging on a frame 83 secured to the base plate 20. The frame 83 is located at one side of the magazine pile and the arm 86 extends beyond the spigot 80, 81,

being slotted at 88 to allow the spigot to pass through it. The extremity of the arm 86 is provided with rollers 87 adapted to rest on the top-most record disc of the magazine pile. Pivoted at 89 to the arm 86, within the slot 88 is an auxiliary arm 90, of which one end is provided with a roller 91 adapted to rest on the top record disc of the pile and the other end 92 is hooked to engage the tip 81 of the spigot 80. The arm 90 is further loaded by a light spring 85 which tends to raise the roller 91 and depress the hooked end 92 of the arm (see Figures 13 to 18).

The lengths of the arms 86 and 90 and the position of the pivot 89 are so selected having regard to the relative heights of the shoulder 82 of the spigot 80 and of the pivotal mounting of the arm 86 that when the pile of record discs is supported solely on the shoulder 82 of the spigot 80, the rollers 87 and 91 both make contact with the top record disc of the pile and maintain the pile at a slight inclination to the horizontal such that the edge of the pile of discs remote from the pivot of the arm 86 is slightly higher than the opposite edge and this inclination is maintained substantially constant regardless of the number of record discs in the magazine pile. As the record discs are withdrawn from the bottom of the pile by the feed mechanism the arm 86 descends and the engagement of the hooked end 92 of the arm 90 with the tip 81 of the cranked spigot maintains the relative position of the rollers 87 and 91 so that the inclination of the discs is kept substantially the same (see especially Figures 13 to 18).

The base of the arm 86 is formed as a yoke, of which the two ends are pivoted on the frame 83, one end being fast on a pivot pin 84 which passes through a bearing in one of the side plates of the frame 83; the inner end of the pivot pin 84 carries a short lever 93 having a hooked end 94 engageable with a longer lever 95 which is loose on the pivot pin 84 and is connected to the short lever 93 by means of a toggle spring 96 (see Figure 2). In the normal position the toggle spring tends to pull down the arm 86 on to the top of the pile of record discs and thereby supplements the weight of the arm in applying pressure to the top disc of the pile. When the arm 86 is raised into a substantially vertical position for charging the magazine, the toggle spring passes over the dead centre and is therefore operative to hold the arm in the vertical position, stop means (not shown) being provided to prevent the arm from swinging back too far. In addition to its action on the arm 86, the toggle spring 96 is also effective to swing the lever 95 clockwise or counter-clockwise (as seen in Figure 1) according as the arm 86 is raised or lowered, for a purpose hereinafter described.

The frame 83 also carries the mechanism for feeding the record discs from the magazine pile to the turntable. This mechanism comprises a bridge-piece or bracket 97 pivotally mounted on the frame 83 for rocking in a vertical plane, one of the pivot pins 98 being fast in the bridge-piece 97 and passing through a bearing in a side plate of the frame 83 for connection to a lever 99, which is in turn connected by a link 100 to the bar 77, already mentioned (see Figure 5). The action of the cam 74 on the spring-interconnected bars 75, 77 is thus transmitted to the lever 99 for rocking the bridge-piece 97.

Slidably mounted on the bridge-piece 97 is a horizontally disposed plate 101 carrying a pawl 102, the tail of which is selectively engageable

with one or other of notches 103, 104, 105 in bracket member 106 secured to the side plate of the frame 83 by a bracket 106^a. A small plate 107 is slidably mounted on the horizontal plate 101, being loaded by a spring 108 which draws the member 107 into its rearmost position (to the left in Figure 1) with respect to the plate 101. Pivoted on the plate 107 is a feed pawl 109 whose nose is shaped to lie in a slot 109^a in the forward edge of the plate 101, being slightly recessed therein in the normal position. The underside of the nose of the feed pawl 109 engages the nose of pawl 102. The tail of feed pawl 109 is selectively engageable with one or other of notches 110, 111, 112 formed in a vertical plate 113 pivotally connected at 117 to a bar 114 terminating in stud 115 having a flattened face for engagement with flat 73 of the pin 72 mounted on the bell crank 62. The plate 113 is slidably mounted on a fixed central plate 119 of the frame 83 and is urged in a direction away from the spigot 80 by a spring 116 anchored in the plate 119 and attached to the tail of the bar 114, which is provided with a projection 118 engageable with the plate 113 and serving as a stop to limit counter-clockwise rotation of the bar 114 on its pivot 117 under the influence of spring 116.

Pivoted to the plate 119 at 120 is a lever 121 connected by means of a link 122 with the horizontal plate 101 and by means of a link 123 with the longer arm (engageable by the pawl nose 71) of the bell crank 64 (see Figures 3 and 4).

The lower end of lever 95 is pivotally connected to a bar 124 slotted at 125 to receive a stud 126 secured in a lever 127 pivoted at 128 on the base plate 20 for horizontal rocking, and having pivoted thereon at 130 (Figure 6) for vertical rocking a stop plate 129 loaded by a spring 131 (see Fig. 6). The lever 127 is slotted at 132 to receive the arm 133 of a switch 134 for starting and stopping the motor 22. The stop plate 129 is engageable with a pin 135 (Figure 6) projecting downwards from the rim of the wheel 30 when the lever 127 is partially swung clockwise on its pivot (as seen in Figure 1); when pin 135 strikes the stop plate 129, the lever 127 is swung further in a clockwise direction and throws over the arm 133 of the switch 134 to switch the motor off. The spring 131 serves both to raise the stop plate 129 into the path of pin 135, and also by friction of its tail on the base plate 20 prevents idle swinging back of the lever 127 on its pivot after switching on the mechanism, which would cause the stop plate 129 to foul the pin 135 on the wheel 30 and thus stop the mechanism, as will hereinafter appear more clearly in the description of the operation of the mechanism.

The arm 37 controlling the horizontal movement of the tone arm carries on its upper face a roller 136 engaging within a triangular frame 137 terminating in an eye 138 threaded on a pivot pin 139, which is mounted on the cover plate 21 and also serves as the pivot of a rockable plate 141 with which the eye 138 is maintained in frictional relationship by means of a collar 140 (see Figure 10). Movement of the triangle 137 relative to the plate 141 is limited by stop pins 142, 143 and movement of the plate 141 about its pivot 139 is limited by stop pins 144, 145 mounted on the cover plate. One edge of the plate 141 is bent up to form an extended vertical flange 146 to which is pivoted a pawl 147

engageable with a vertically upstanding flange 150 of a catch 149 pivoted on the wheel 30 at 148 and having a downwardly projecting end 151; a spring 152 urges the catch 149 towards the rim of wheel 30 (see Figures 7, 8, 11 and 12). The flange 146 is engageable by a small roller 153 eccentrically mounted on the underside of the turntable 154 (see Figures 2, 11 and 12), for a purpose hereinafter described, and the end 151 of catch 149 is engageable with a detent 155 associated with a clutch striker 156, both these parts 155 and 156 being pivoted at 157 on the base plate 20 (see Figures 7 and 8). Detent 155 carries a pin 158 connected by a spring 159 to a pin 160 on the clutch striker 156 and by a spring 161 to a pin 162 mounted on the base plate; pin 160 also acts as a stop pin for the detent 155 being engageable with its edge. The clutch striker 156 is engageable with the end of pawl 26 of the clutch mechanism and is adapted to enter a slot 163 formed in the plate 27 to arrest and lock the pinion 24 after unclutching it from the motor shaft 23.

The mechanism is controlled by a sliding bar 164 slotted at 165 to receive studs 166 which are secured in the base plate 20 and guide the bar 164 to move in a longitudinal direction (see Figure 6). The bar 164 is further provided on its underside with a stud 167 (see Figure 1) engageable with the stud 115 and is also provided with a finger 168 engageable with the tail 70 of the pawl 69, 70 mounted on the bell crank 62. Bar 164 also carries a second finger 169 (Figure 8) engageable with flange 150 of the catch 149 for the purpose of clutching the driving pinion 24 to the motor shaft 23, as hereinafter shown. The underside of the bar 164 is further furnished with a spur 170 (Figure 6) which is shaped to form a ramp 171 engageable with the upper edge of the stop plate 129. The extremity of the bar 164 is slotted at 172 to engage a pin 173 mounted on a plate 174 which is fixed on a sleeve 175 rotatable in the cover-plate 21 and carrying a key 176 for hand operation. The outer edge of the plate 174 is formed to present a pair of notches 177, 178 of which notch 177 terminates in an extended ramp 179 and notch 178 terminates in a stop face 180. The notches 177, 178 and ramp 179 are engageable by a roller 181 mounted on an arm 182 pivoted at 183 to a fixed bracket 184 and loaded by a spring 185 to press the roller 181 against the edge of the plate 174.

Movement of the key 176 rotates the plate 174 to impart longitudinal movement to the bar 164. The bar 164 has two alternative positions of rest according as the roller 181 is engaged in the notch 177 or in the notch 178. These positions correspond respectively to "normal working" and "repeat," as hereinafter shown. Movement of the plate 174 and bar 164 by means of the key 176 beyond the normal working position is effective for starting the mechanism or for rejecting a record in the course of playing, as will hereinafter be shown. Bar 164 cannot, however, remain in the "starting" or "reject" position because the pressure of the roller 181 on the ramp 179, owing to the tension of the spring 185, causes plate 174 to return to the "normal" position in which the roller 181 lodges in the notch 177.

A control for stopping the mechanism at any time is also provided, having a shaft 186 concentrically rotatable within sleeve 175 and carrying a control knob 187. The lower end of the shaft 186 carries a lever 188 pivoted at 189 to a bar 190 which is slotted at 191 to receive the

stud 126 secured in the lever 127; the slotted connection allows the lever 127 to have sufficient play to execute rocking movements in response to displacements of the bars 124 and 164, but rotation of the knob 187 in a counter-clockwise direction (as seen in Figure 1) will cause the bar 190 to take up the clearance in the slot 191, and swing the lever 127 clockwise, so as to throw over the switch 133, 134 into the "off" position and interpose the stop plate 129 into the path of the pin 135 of the wheel 30.

The operative record-changing cycle occupies one complete revolution of wheel 30, the gear ratio of which to pinion 24 is 11 to 1, so that eleven complete revolutions of the motor shaft suffice for completing the cycle. The operations in question comprise:

- (1) Raising and lowering the tone arm;
- (2) Horizontal swinging of the tone arm;
- (3) Engaging the bottom record disc of the magazine pile and feeding it to the turntable;
- (4) Unclutching the mechanism from the motor shaft and arresting the mechanism.

Operation (1) is effected by means of the outer face of cam track 31, roller 33, bell crank 34 and stem 44 (see Figure 9). At the outset roller 33 is lodged in shallow recess 31^a of track 31, and the weight of the tone arm is supported by the turntable and stylus, the heel of bell crank 34 being clear of boss 45 of stem 44. As soon as the wheel 30 starts to move the roller 33 leaves the recess 31^a and the heel of bell crank 34 engages the boss 45 of stem 44 and lifts the tone arm to raise the stylus from the turntable or record disc thereon. Thereafter the roller 33 rides on the cam track 31, which is of constant radius and therefore maintains the tone arm raised, until near the end of the cycle when the roller traverses a part 31^b of the track 31, which is of gradually decreasing radius and allows the tone arm to be gently lowered until the stylus rests on the record disc; finally the roller 33 re-enters the recess 31^a.

Operation (2) is effected by means of arm 37 and pin 36 engaging cam track 32 (and the inner face of track 31) and with extension tracks 48, 49 mounted on arm 47 which is controlled by spring 50 and stud 51 engaging tracks 53 and by the engagement of extension 52 with pin 55 (see Figure 1). Soon after the beginning of the cycle, and after the tone arm has been raised by cam track 31, pin 36 is picked up by the incurved end of track 32 and the arm 37 is thereby swung outwards, the pin thereafter being held stationary by the constant radius parts of tracks 31 and 32 until it enters the channel between tracks 48, 49 by which it is guided to swing arm 37 inwards again. At the same time arm 47, carrying the tracks 48, 49, is guided by engagement of stud 51 with tracks 53 to locate the stylus above the edge of the record disc on the turntable and after the tone arm and stylus have been lowered the action of spring 50, controlled by the engagement of pin 55 with the slightly oblique extension 52 of arm 47, swings the latter slightly inwards; this motion is transmitted by track 48 to pin 36 and arm 37 to engage the stylus with the beginning of the record groove.

Operation (3) is effected by cams 60 and 74 and followers 62, 75 and 77 with the assistance of springs 67 and 79 (see Figures 3, 4 and 5). The cam boss 74 first engages bar 77 and swings it clockwise (Figure 5); this movement is transmitted by link 100 and lever 99 to the bridge 97, which is thereby rocked to depress the free edge

of plate 101. Concurrently with this movement, but starting slightly later, cam 60 engaging stud 61 rotates bell crank 62 clockwise (Figure 3), causing the nose 69 of pawl 69, 70 to engage the longer arm of bell crank 54 and swing it clockwise (Figure 3), the motion being transmitted by link 123, lever 121 and link 122 to plate 101, causing the latter to advance underneath the bottom record disc of the magazine pile. During this movement, pin 72 slips past stud 115, the round faces of pin 72 and stud 115 allowing mutual slipping and the spring 116 yielding slightly to allow bar 114 to swing clockwise (Figure 1) enough for this purpose. When plate 101 is depressed engagement of the tail of the feed pawl 109 by plate 113 rocks the feed pawl to bring its nose into alignment with the face of plate 101 so that the feed pawl does not foul the record disc when the plate 101 advances.

After plate 101 has been fully advanced, cam boss 74 engages bar 75 and swings it counter-clockwise (Figure 5), and springs 79 cause bar 77 to follow the retreat of cam boss 74 and move members 100, 99, 97 to raise the edge of plate 101, which thereupon engages the bottom disc of the pile and slightly lifts the pile on the side engaged thereby, slightly raising the roller 91 of arm 90 and causing the latter to lever up the main arm 86 (the tip 81 of spigot 80 providing the fulcrum against which the hooked end 92 of arm 90 acts), and the rollers 87 are raised clear of the top disc of the pile, which is now supported at its edge by plate 101 as well as at the centre by shoulder 82 of spigot 80.

Continued movement of wheel 30 causes cam 60 to retreat and spring 67 causes bell crank 62 to follow it and swing counterclockwise (Figure 4), while spring 57 causes bell crank 54 to follow the retreat of pawl nose 69 and withdraw plate 101. As long as the nose of the feed pawl 109 is underneath the record disc it is held down and the tail of the feed pawl raised; the tail of the pawl 102 is also kept raised, its head being held down by the feed pawl. The raising of the plate 101, already mentioned, therefore raises the tails of pawls 102 and 109 clear of bracket member 106 and plate 113 so as not to foul the notches 103 to 105 and 110 to 112 when the plate 101 carrying the feed pawl 109 retreats. It must be explained that the notches 103—105 and 110—112 and the tails of the pawls 102, 109 are so formed that the pawl tails will ride over the notches in the advancing movement and can only catch in the notches in the retreating movement. When, therefore, the retreating of plate 101 has proceeded far enough for the feed pawl to escape from under the bottom record disc of the pile the tail of the feed pawl will drop, raising the nose to register with the edge of the record disc. The notches 103—105 and 110—112 being positioned to correspond with standard diameters of record disc the tail of the feed pawl 109 will find one of the notches 110 to 112 beneath it and will engage with the appropriate notch; also the rising of the nose of the feed pawl will allow the tail of pawl 102 to drop also and it too will enter the appropriate notch 103 or 104 or 105 preventing further retreat of plate 101 and locating the plate 101 and train of members 122, 121, 123 and the bell crank 54 for the remainder of the cycle and thereafter till the pawl nose 71 engages bell crank 54 in the next succeeding cycle. In this way the tracks 53 are located for the remainder of the cycle and the relevant parts are so proportioned that when the pin 36 reaches

the end of the tracks 53 the stylus is correctly positioned to enter the record groove, it being understood that by the time this occurs the record disc, whose diameter determined the selection of the appropriate notch engaged by pawl 102, will have been delivered to the turntable.

In the example illustrated notches 103, 110 are appropriately located for engagement and feeding of a nine-inch record disc, notches 104, 111 for a ten-inch record disc and notches 105, 112 for a twelve-inch record disc. As twelve-inch discs sometimes vary somewhat widely from the standard diameter, the notches 105, 112 are duplicated by providing an extra pair of notches appropriately located for engagement and feeding of oversize record discs of twelve-inch nominal diameter as shown in Figures 13 to 17.

Bell crank 62 follows cam 60 until stud 65 has passed under the joggled end 63 of bell crank 62 and engages the terminal lip 64 (Figure 4); this holds stud 61 off the cam 60 for a while and when stud 65 escapes from the lip 64 spring 67 brings the bell crank back sharply on to the cam 60. This causes the flat 73 of pin 72 on the bell crank 62 which has already engaged the flat face of stud 115 to impart a sharp pull to bar 114 to advance plate 113 and the engagement of the tail of the feed pawl 109 with one of the notches 110—112 causes the feed pawl to be sharply advanced also to push forward the record disc engaged thereby till the edge of its central hole slips off the shoulder 82 of spigot 80, thus allowing it to fall on to the turntable. Further retreat of bell crank 62 following cam 60 causes the pin 72 and stud 115 to slide out of engagement whereupon the plate 113 and feed pawl 109 are returned to their normal positions by springs 116 and 108 respectively.

Figures 13 to 17 illustrate stages in the feeding of record discs from the magazine pile to the turntable.

In Figure 13 the magazine is loaded to its full capacity of nine discs and the feed pawl 109 is in the act of delivering the bottom disc, whose central hole has just slipped off the shoulder 82 of the central spigot 80. The bottom disc is of twelve-inch diameter, slightly undersize, and the tail of the feed pawl is therefore lodged in that one of the pair of notches 112 which is nearer the leading edge of the plate 113, the plate 101 being withdrawn to a corresponding extent. It will be noticed that as the leading edge of the plate 101 is still in contact with the bottom record disc, the left hand side of the pile of discs is thereby slightly raised so that the arm 86 is also raised so as to lift the roller 87 out of contact with the top disc of the pile.

In Figure 14 the twelve-inch disc at the bottom of the pile in Figure 13 has been delivered (and is no longer shown) and the parts are in the position occupied during the playing of the said disc. The bottom disc now remaining in the magazine is of smaller (nine-inch) diameter and as the tail of pawl 102 (not shown) is engaged in notch 105 of bracket 106 (also not shown) the plate 101 is retained in the withdrawn position, so that there is a gap between the leading edge of plate 101 and the edge of the bottom disc of the magazine pile, which is therefore entirely supported on the shoulder 32 of the spigot 80, being steadied by the rollers 87 and 91 carried by the arms 86 and 90; both these rollers are now in contact with the top disc of the magazine pile which is slightly inclined towards the feed mechanism as previously described.

Figure 15 shows the position when all the record discs of the magazine pile have been delivered to the turntable except two. The bridge-piece 97 has been rocked to depress slightly the leading edge of the plate 101 and the latter has begun to move forward in the direction of the arrow so that the tail of the feed pawl 109 is riding on the top of the plate 113, thereby depressing the nose of the feed pawl into alignment with the face of the plate 101. The previous record disc delivered having been of twelve-inch diameter (see Figure 14), the leading edge of the plate 101 has not yet reached the edge of the bottom disc remaining in the magazine pile, which is therefore still supported only on the shoulder 82 of spigot 80 and both rollers 87, 91 are in contact with the top disc of the pile, and it will be noticed that the inclination of the pile of discs is substantially the same in this figure and in the preceding figure, notwithstanding the difference in the number of discs in the magazine. As already explained this results from the proportioning of the lengths of the arms 86 and 90 and the position of the pivot 89 relative to the tip 81 of the spigot 80 and the pivot on which the arm 86 rocks.

Figure 16 shows the position of the parts when the plate 101 has been moved forward underneath the bottom disc of the pile and the bridge-piece 97 rocked counterclockwise to raise the plate 101. It will be seen that the tail of the feed pawl 109 is now clear of the plate 113 which would allow the nose of the feed pawl to rise were it not engaged underneath the bottom disc of the pile.

In Figure 17 the plate 101 has retreated until the nose of the feed pawl 109 has cleared the edge of the bottom disc of the pile allowing the nose of the feed pawl to rise and the tail thereof to drop and engage notch 111 corresponding to the diameter (ten inches) of the record disc. At the same time the tail of pawl 102 (not shown) has engaged in the corresponding notch 104 of the bracket 106 (also not shown) thus limiting the retreat of plate 101 whose leading edge is seen to support the edge of the bottom disc of the pile so that the roller 87 is raised from contact with the top disc. The parts are now in position for delivery of the bottom record disc by a forward movement of the plate 113 and feed pawl 109, as shown in Figure 13.

Operation (4) (see Figure 7) is effected on completion of the cycle by the catch 149 whose flanged end engages detent 155 and swings it on its pivot, tensioning springs 159, 161; spring 159 swings the clutch striker 156 against the edge of plate 27 where it engages the end of pawl 26 and causes it to disengage from notch 29 of collar 25 thus unclutching pinion 24 from shaft 23. At the same time striker 156 enters slot 163 of plate 27 and arrests the pinion 24 and wheel 30.

The turntable continues to rotate and the record disc thereon is then played.

As the tone arm is drawn inwards by the stylus engaging in the record groove roller 136 engages the inner limb of triangle 137 and swings it counterclockwise; this movement is frictionally transmitted by eye 138 to plate 141 until the tip of pawl 147 rests on flange 150 of catch 149, in which position of the parts roller 153 carried by the turntable 154 impinges lightly on flange 146 of plate 141 at every revolution of the turntable, the successive impacts being sufficient to overcome the friction between plate 141 and eye 138 so that the inward motion of the triangle 137

continues while plate 141 is maintained sensibly stationary (see Figures 11 and 12). When, however, the stylus runs off the last convolution of the record groove it moves inwards sharply and the consequent movement of the roller 136 is transmitted to the triangle 137 and thence by means of the frictional engagement of eye 138 with plate 141 to the latter and suffices to carry the tip of pawl 147 over flange 150 of catch 149 to engage behind it before the next impact is delivered by the roller 153 on flange 146, so that when this occurs the catch 149 in pushed back against the pull of spring 152 causing the end 151 of catch 149 to release detent 155 and allow spring 161 to return it to its former position (see Figure 8). The edge of detent 155 therefore engages with pin 160 and swings the clutch striker 156 out of engagement with pawl 26 and slot 163, allowing pawl 26 to be engaged with notch 29 of collar 25 by spring 28 to clutch the pinion 24 to shaft 23 and releasing plate 27 to allow the pinion to rotate, thus initiating the next record changing cycle.

When the magazine is exhausted the arm 86 drops until it is suspended on the tip 81 of spigot 80 by the hooked end 92 of auxiliary arm 90 (Figure 18). The consequent rotation of lever 93 causes its end 94 to rock lever 95 clockwise (Figure 1), engagement between parts 94, 95 being maintained by the toggle spring 96. The bar 124 is therefore pulled sufficiently to cause the end of its slot 125 to engage stud 126 and swing the lever 127 clockwise (Figure 1) far enough to cause stop plate 129 to be engaged by pin 135 when the latter is brought round to that point by the rotation of wheel 30. When this occurs pin 135 causes further rotation of plate 129 and lever 127 on pivot 128, whereby the switch 133, 134 is thrown into the "off" position to stop the motor; at the same time any overrunning of wheel 30 is prevented by the stop plate 129 engaging pin 135.

Raising the arm 86 to the erect position for changing the magazine causes the toggle spring 96 to pass over dead centre and pull lever 95 in a clockwise direction and as before this movement of lever 95 sets the parts 127, 129 in position for engagement by pin 135 so as to stop the machine. Similarly on lowering arm 86 on to the magazine pile the toggle spring 96 on passing dead centre in the other direction swings lever 95 counterclockwise, but owing to the slotted connections 125, 132, the plate 129 is not brought clear of the path of pin 135 nor is the switch 133, 134 thrown into "on" position.

The latter operation is performed by moving the bar 164 to the end of its travel beyond the "normal working" position (in which roller 181 is lodged in notch 177) by manipulating key 176. This causes the ramp 171 of spur 170 (Figure 6) to press down the stop plate 129 to clear pin 135 and the tail of spur 170 then rocks stop plate 129 and lever 127 on their pivot 128 to bring the stop plate out of the path of pin 135 and to throw the switch 133, 134 into the "on" position. This movement of bar 164 also causes finger 169 to engage flange 150 of catch 149 (Figures 7 and 8) and move the latter to release detent 155, thereby causing the clutch 28, 29 to engage. As explained, the pressure of roller 181 on ramp 179 brings back bar 164 to "normal working" position, the parts 127, 129 being left behind and prevented from swinging back by the friction of spring 131 on the base plate; the switch is therefore left "on."

If in playing a record it is desired to reject it and go on to the next in the magazine, the bar 164 is again moved beyond the normal position to the "start" position and released.

No effect is produced on the switch which is already "on" but the finger 169 effects immediate re-engagement of the clutch 28, 29 as explained above and thereby immediately starts the record changing cycle again.

Movement of bar 164 to the "repeat" position by manipulation of key 176, so that roller 181 lodges in notch 178, causes stud 167 to engage stud 115 and rock bar 114 slightly on its pivot, with yielding of spring 116, so that stud 115 cannot engage pin 72, and causes finger 168 to depress the tail 70 of pawl 69, 70 so that the head 69 of the pawl cannot engage bell crank 54 (see Figure 6). This throws the feed mechanism out of action so that the rotation of wheel 30 merely operates the tone arm to repeat playing of the record disc on the turntable.

I claim:

1. A magazine phonograph including in combination a turntable, a member extending upwardly from the center of the turntable and providing a shoulder for supporting at their centers a pile of records of different diameters, means for engaging and laterally displacing records from said pile to cause their release from said support member onto said turntable, an out of balance arm hingedly mounted and extending beyond the support member above the record pile, the extremity of said arm being adapted to rest on the topmost record of the pile, and an auxiliary arm having one end resting on the topmost record at a point diametrically opposite to the extremity of the main arm, and the other end of which engages the extremity of the support member, the auxiliary arm being hingedly mounted intermediate its ends to the main arm.

2. A magazine phonograph including in combination a turntable, a member extending upwardly from the center of said turntable and providing a shoulder for supporting at their centers a pile of records of different diameters, means for laterally displacing in succession the lowermost records of the pile from the member onto the turntable, a normally downwardly urged arm hingedly mounted for extending beyond said member and having an aperture through which the free end of said member may pass, the free extremity of said arm being adapted to rest on the topmost record of the pile and an auxiliary arm pivotally mounted on said first arm and having an extremity resting on the topmost record at a point diametrically opposite to the extremity of the main arm, and means for biasing the auxiliary arm in alignment with the main arm.

3. A record changing mechanism for phonographs comprising a magazine carrying a pile of records of different diameters one above the other, a tone arm, adjustable means operatively connected with said tone arm and movable for laterally displacing said tone arm, a member movable from a position distant from the periphery of the records of the pile to a position in engagement with the lowermost record of the pile for measuring the diameter thereof, means operatively connected with respectively said member and the tone arm moving means and movable by the member in an amount corresponding to its movement in measuring the diameter of the lowermost record for correspondingly adjusting the tone arm moving means,

means for moving the member and thereby the means for adjusting the tone arm moving means, and means for thereafter moving the adjusted tone arm moving means for laterally displacing the tone arm in position for playing the measured lowermost record of the pile.

4. In a record changing magazine for phonographs, comprising a magazine carrying a pile of records of different diameters disposed one above the other, a tone arm, angularly adjustable and axially rotatable means connected with said tone arm for laterally displacing the same, a reciprocable member movable from an outer position distant from the periphery of the records of the pile to a position in engagement with the edge of the lowermost record of the pile for measuring the diameter thereof, means operatively connected with respectively the reciprocable member and the tone arm moving means and movable by the reciprocable member in an amount corresponding to its movement in measuring the diameter of the lowermost record for correspondingly angularly adjusting the tone arm moving means, means for moving the reciprocable member and thereby the means for angularly adjusting the tone arm moving means, and means for thereafter axially rotating said tone arm moving means for laterally displacing the tone arm in position for playing the measured lowermost record of the pile.

5. In a record changing magazine for phonographs, comprising a magazine carrying a pile of records of different diameters disposed one above the other, a tone arm, angularly adjustable and axially rotatable means in which upon rotation said tone arm rides for lateral displacement, a reciprocable member movable from an outer position distant from the periphery of the records of the pile to a position in engagement with the edge of the lowermost record of the pile for measuring the diameter thereof, means operatively connected with respectively the reciprocable member and the tone arm moving means and movable by the reciprocable member in an amount corresponding to its movement in measuring the diameter of the lowermost record, for correspondingly angularly adjusting the tone arm moving means, means for moving the reciprocable member and thereby the means for angularly adjusting the tone arm moving means, and means for thereafter axially rotating said tone arm moving means for laterally disposing the tone arm in position for playing the measured lowermost record of the pile.

6. A record changing mechanism for phonographs, comprising a magazine carrying a pile of records of different diameters disposed one above the other, a member mounted for lateral movement between an outer position distant from the edges of the records of the pile and an inner position beneath the lowermost record of the pile, said member being normally urged for upward movement, means for moving said member from its outer position to its inner position, means for restraining said member from normal upward movement during its inward movement, said member at its inner position being contacted and restrained from its normal upward movement by the undersurface of the lowermost record of the pile, and means for moving said member laterally from its inner position towards its outer position, whereby said member as it passes the periphery of the lowermost record of the pile is urged to its full normal upward movement for

laterally contacting the edge of said lowermost record.

7. A record changing mechanism for phonographs, comprising a magazine carrying a pile of records of different diameters disposed one above the other, a member mounted for lateral movement between an outer position distant from the edges of the records of the pile and an inner position beneath the lowermost record of the pile, said member being normally urged for upward movement, means for moving said member from its outer position to its inner position, means for restraining said member from normal upward movement during its inward movement, said member at its inner position being contacted and restrained from its normal upward movement by the undersurface of the lowermost record of the pile, and means for moving said member laterally from its inner position towards its outer position, whereby said member as it passes the periphery of the lowermost record of the pile is urged in its normal upward movement for laterally contacting the edge of said lowermost record, and means for further moving said member in lateral contact with the edge of the lowermost record inwardly towards its inner position to displace said lowermost record from the pile of records.

8. A record changing mechanism for phonographs, comprising a shouldered element supporting at their centers and one above the other, a pile of records of different diameters disposed one above the other, a member mounted for lateral movement between an outer position distant from the edges of the records of the pile and an inner position beneath the lowermost record of the pile, said member being normally urged for upward movement, means for moving said member from its outer position to its inner position, means for restraining said member from normal upward movement during its inward movement, said member at its inner position being contacted and restrained from full normal upward movement by the undersurface of the lowermost record of the pile, and means for moving said member laterally from its inner position towards its outer position, whereby said member as it passes the periphery of the lowermost record of the pile is urged in its normal upward movement for laterally contacting the edge of said lowermost record, and means for further moving said member in lateral contact with the edge of the lowermost record inwardly towards its inner position to displace such lowermost record from the shoulder of the element supporting the same.

9. A record changing mechanism for phonographs, comprising a magazine carrying a pile of records of different diameters disposed one above the other, a member mounted for lateral movement between an outer position distant from the edges of the records of the pile and an inner position beneath the lowermost record of the pile and in contact with the undersurface of said lowermost record, said member being normally urged for upward movement, means for moving said member from its outer position to its inner position, means for restraining said member from normal upward movement during its inward movement, said member at its inner position being contacted and restrained from its normal upward movement by the undersurface of the lowermost record of the pile, and means for moving said member laterally from its inner position towards its outer position, whereby said member as it passes the periphery of the lowermost record

of the pile is urged in its normal upward movement for laterally contacting the edge of said lowermost record.

10. A record changing mechanism for phonographs, comprising a magazine carrying a pile of records of different diameters disposed one above the other, a member mounted for lateral movement between an outer position distant from the edges of the records of the pile and an inner position beneath the lowermost record of the pile and in contact with the undersurface of said lowermost record, said member being normally urged for upward movement, means for moving said member from its outer position to its inner position, means for restraining said member from normal upward movement during its inward movement, said member at its inner position being contacted and restrained from upward movement by the undersurface of the lowermost record of the pile, and means for moving said member laterally from its inner position towards its outer position, whereby said member as it passes the periphery of the lowermost record of the pile is urged in its normal upward movement for laterally contacting the edge of said lowermost record, and means for further moving said member in lateral contact with the edge of the lowermost record inwardly towards its inner position to displace said lowermost record from the pile of records.

11. A record changing mechanism for phonographs, comprising a magazine carrying a pile of records of different diameters disposed one above the other, a member mounted for lateral movement between an outer position distant from the edges of the records of the pile and an inner position in contact with the undersurface of said lowermost record of the pile, movable means on said member normally urged upwardly for projection thereabove, means for moving said member from its outer position to its inner position, means for restraining said movable means from normal upward projection during the inward movement of said member, said movable means at the inner position of the member being contacted and restrained from normal upward movement by the undersurface of the lowermost record of the pile, and means for moving said member laterally from its inner position towards its outer position, whereby as the movable means passes the periphery of the lowermost record of the pile, said movable means is normally urged upwardly for projection above the member and into lateral contact with the edge of the lowermost record of the pile.

12. A record changing mechanism for phonographs, comprising a magazine carrying a pile of records of different diameters disposed one above the other, a member mounted for lateral movement between an outer position distant from the edges of the records of the pile and an inner position in contact with the undersurface of said lowermost record of the pile, means mounted on said member for lateral movement with and relative to said member and normally urged upwardly for projection thereabove, means for moving said member from its outer position to its inner position, means for restraining said movable means from normal upward projection during the inward movement of said member, said movable means at the inner position of the member being contacted and restrained from normal upward movement by the undersurface of the lowermost record of the pile, and means for moving said member laterally from its inner

position towards its outer position, whereby as the movable means passes the periphery of the lowermost record of the pile, said movable means is normally urged upwardly for projection above the member and into lateral contact with the edge of the lowermost record of the pile, and means for laterally moving the movable means towards the center of the record pile and relative to the member mounting the same, to laterally displace the lowermost record contacted thereby from the pile.

13. A record changing mechanism for phonographs, comprising a magazine carrying a pile of records of different diameters disposed one above the other, a member mounted for tilting about a horizontal axis and for lateral movement between an outer position distant from the edges of the records of the pile and an inner position beneath the lowermost record of the pile, means movably mounted on said member and normally urged upward for projection thereabove, means for moving said member from its outer to its inner position, means for upwardly tilting said member at its inner position towards the undersurface of the lowermost record of the pile, whereby the movable means on said member is contacted by and restrained from its normal upward projection by the undersurface of said lowermost record, and means for moving said member laterally from its inner position towards its outer position, whereby as the movable means passes the periphery of the lowermost record of the pile, said movable means is normally urged upwardly for projection above the member and into lateral contact with the edge of the lowermost record of the pile.

14. A record changing mechanism for phonographs, comprising a magazine carrying a pile of records of different diameters disposed one above the other, a member mounted for rocking about a horizontal axis and for lateral movement between an outer position distant from the edges of the records of the pile and an inner position beneath the lowermost record of the pile, means mounted on said member for lateral movement with and relative to said member and normally urged upwardly for projection thereabove, means for moving said member from its outer to its inner position, means for upwardly tilting said member at its inner position towards the undersurface of the lowermost record of the pile, whereby the movable means on said member is contacted by and restrained from its normal upward movement by the undersurface of said lowermost record, and means for moving said member laterally from its inner position towards its outer position, whereby as the movable means passes the periphery of the lowermost record of the pile, said movable means is normally urged upwardly for projection above the member and into lateral contact with the edge of the lowermost record of the pile, and means for laterally moving the movable means towards the center of the record pile and relative to the member mounting the same, for laterally displacing the lowermost record from the pile.

15. A record changing mechanism for phonographs comprising a magazine carrying a pile of records of different diameters disposed one above the other, a member mounted for tilting about a horizontal axis and for lateral movement between an outer position distant from the edges of the records of the pile and an inner position beneath the lowermost record of the pile, means mounted on said member for movement with and

relative to said member and normally urged upwardly for projection thereabove, means for downwardly tilting said member at its outer position, means actuatable as said member is downwardly tilted for restraining said movable means from normal upward projection, means for moving said downwardly tilted member from its outer to its inner position, means for upwardly tilting said member at its inner position towards the undersurface of the lowermost record of the pile, whereby the movable means on said member is contacted by and restrained from its normal upward projection by the undersurface of said lowermost record, and means for moving said member laterally from its inner position towards its outer position, whereby as the movable means passes the periphery of the lowermost record of the pile, said movable means is normally urged upwardly for projection above the member and into lateral contact with the edge of the lowermost record of the pile, means operatively connected between said movable means and said member for arresting the movement of said member from its inner position towards its outer position as the movable means projects into lateral contact with the edge of the lowermost record, and means for laterally moving the movable means towards the center of the pile and relative to the arrested member mounting the same for laterally displacing the lowermost record from the pile.

16. A record changing mechanism for phonographs comprising a magazine carrying a pile of records of different diameters disposed one above the other, a member mounted for rocking about a horizontal axis and for lateral movement between an outer position distant from the edges of the records of the pile and an inner position beneath the lowermost record of the pile, a pawl pivotally mounted on said member and normally urged upward for projection thereabove, means for moving said member from its outer to its inner position, means for upwardly rocking said member towards the undersurface of the lowermost record of the pile, whereby the pawl is contacted by and restrained from its normal upward movement by the undersurface of said lowermost record, and means for moving said member laterally from its inner position towards its outer position, whereby as the pawl passes the periphery of the lowermost record of the pile, said pawl is urged upwardly to project above the member and into lateral contact with the edge of the lowermost record of the pile.

17. A record changing mechanism for phonographs comprising a magazine carrying a pile of records of different diameters disposed one above the other, a member mounted for rocking about a horizontal axis and for lateral movement between an outer position distant from the edges of the records of the pile and an inner position

beneath the lowermost record of the pile, a pawl pivotally mounted on said member for lateral movement with and relative to said member, and normally urged upwardly for projection thereabove, means for moving said member from its outer to its inner position, means for upwardly rocking said member at its inner position towards the undersurface of the lowermost record of the pile, whereby the pawl is contacted by and restrained from its normal upward movement by the undersurface of said lowermost record, and means for moving said member laterally from its inner position towards its outer position, whereby as the pawl passes the periphery of the lowermost record of the pile, said pawl is urged upwardly to project above the member and into lateral contact with the edge of the lowermost record of the pile, and means for laterally moving the pawl towards the center of the record pile and relative to the member mounting the same, for laterally displacing the lowermost record from the pile.

18. A record changing mechanism for phonographs comprising a magazine carrying a pile of records of different diameters disposed one above the other, a member mounted for tilting about a horizontal axis and for lateral movement between an outer position distant from the edges of the records of the pile and an inner position beneath the lowermost record of the pile, a pawl pivotally mounted on said member for movement with and relative to said member and normally urged upwardly for projection thereabove, means for downwardly tilting said member at its outer position, means actuatable as said member is downwardly tilted for restraining said pawl from normal upward projection, means for moving said downwardly tilted member from its outer to its inner position, means for upwardly tilting said member at its inner position towards the undersurface of the lowermost record of the pile, whereby the pawl is contacted by and restrained from its normal upward projection by the undersurface of said lowermost record, and means for moving said member laterally from its inner position towards its outer position, whereby as the pawl passes the periphery of the lowermost record of the pile, said pawl is normally urged upwardly for projection above the member and into lateral contact with the edge of the lowermost record of the pile, means operatively connected between said pawl and said member for arresting the movement of said member from its inner position towards its outer position as the pawl projects into lateral contact with the edge of the lowermost record, and means for laterally moving the pawl towards the center of the pile and relative to the arrested member mounting the same for laterally displacing the lowermost record from the pile.

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