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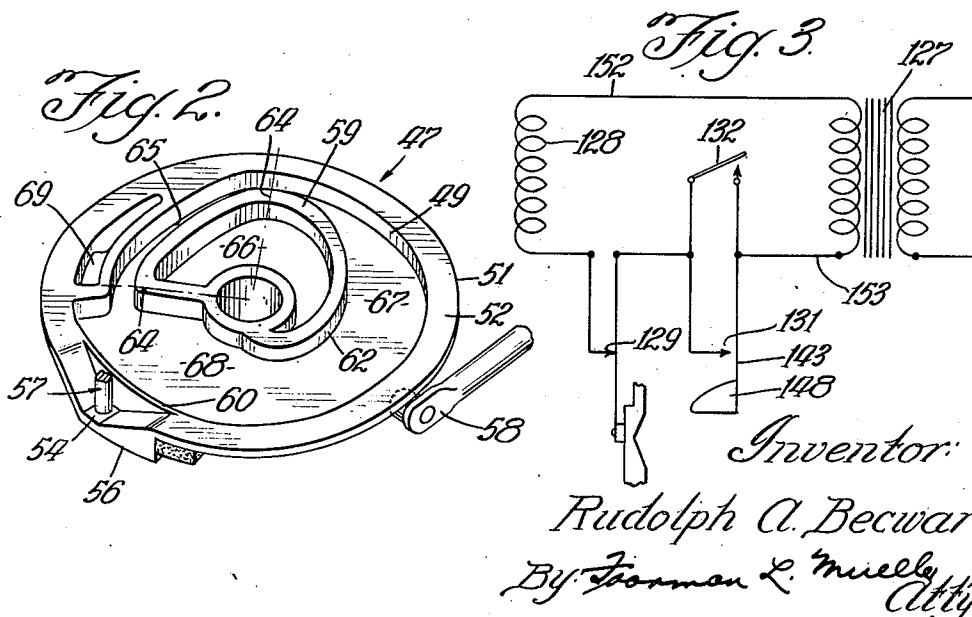
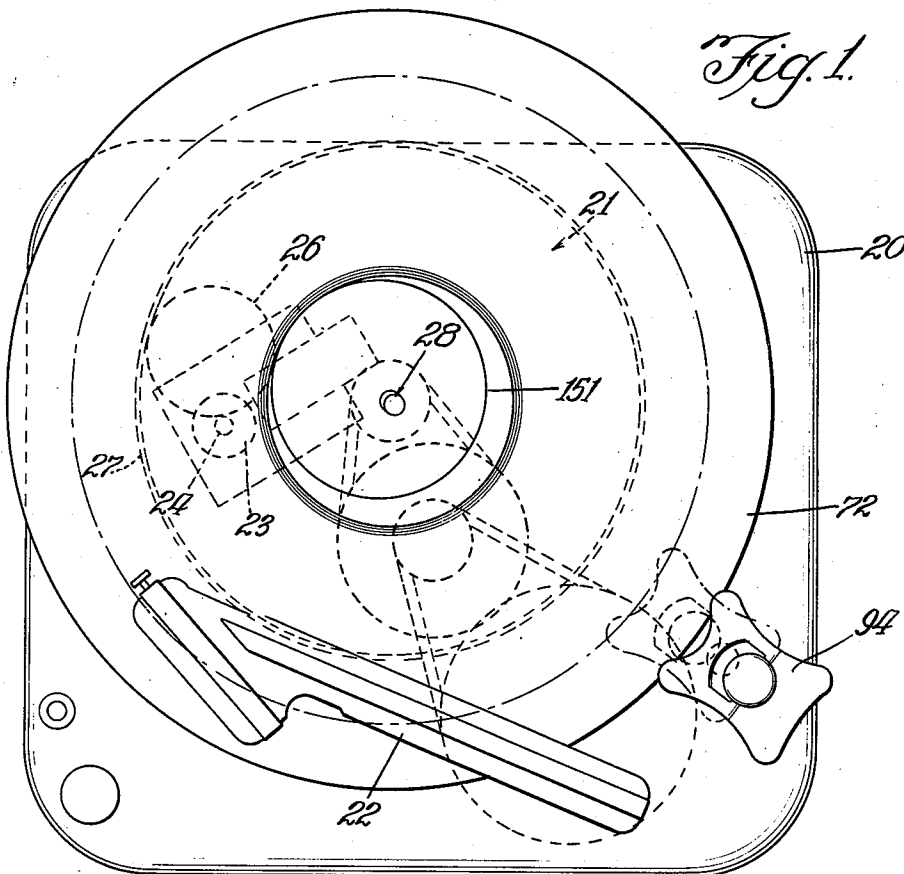
R. A. BECWAR

2,293,703

RECORD CHANGER

Filed May 10, 1940

3 Sheets-Sheet 1



Aug. 25, 1942.

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RECORD CHANGER

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3 Sheets-Sheet 2

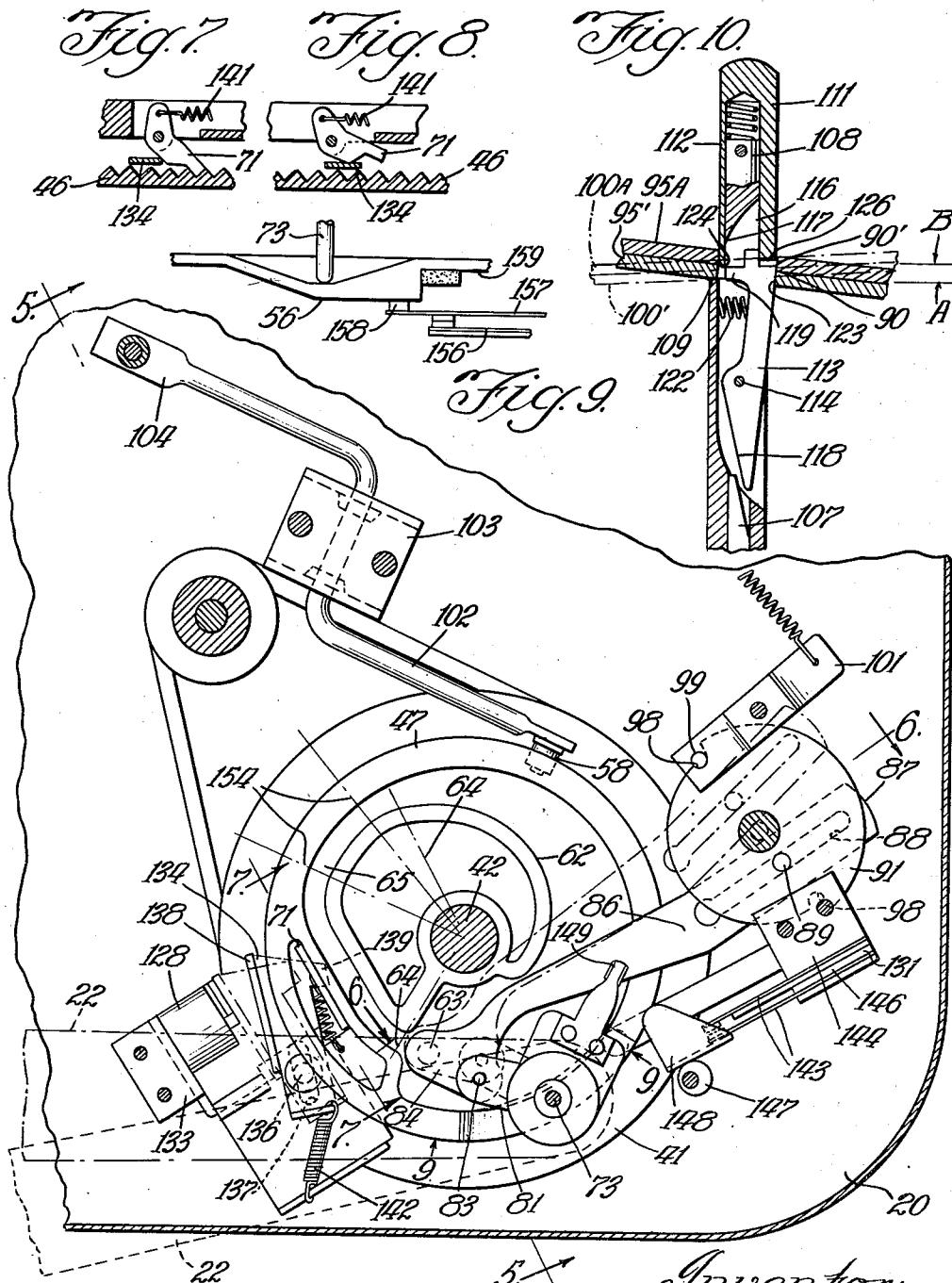


Fig. 4

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Aug. 25, 1942.

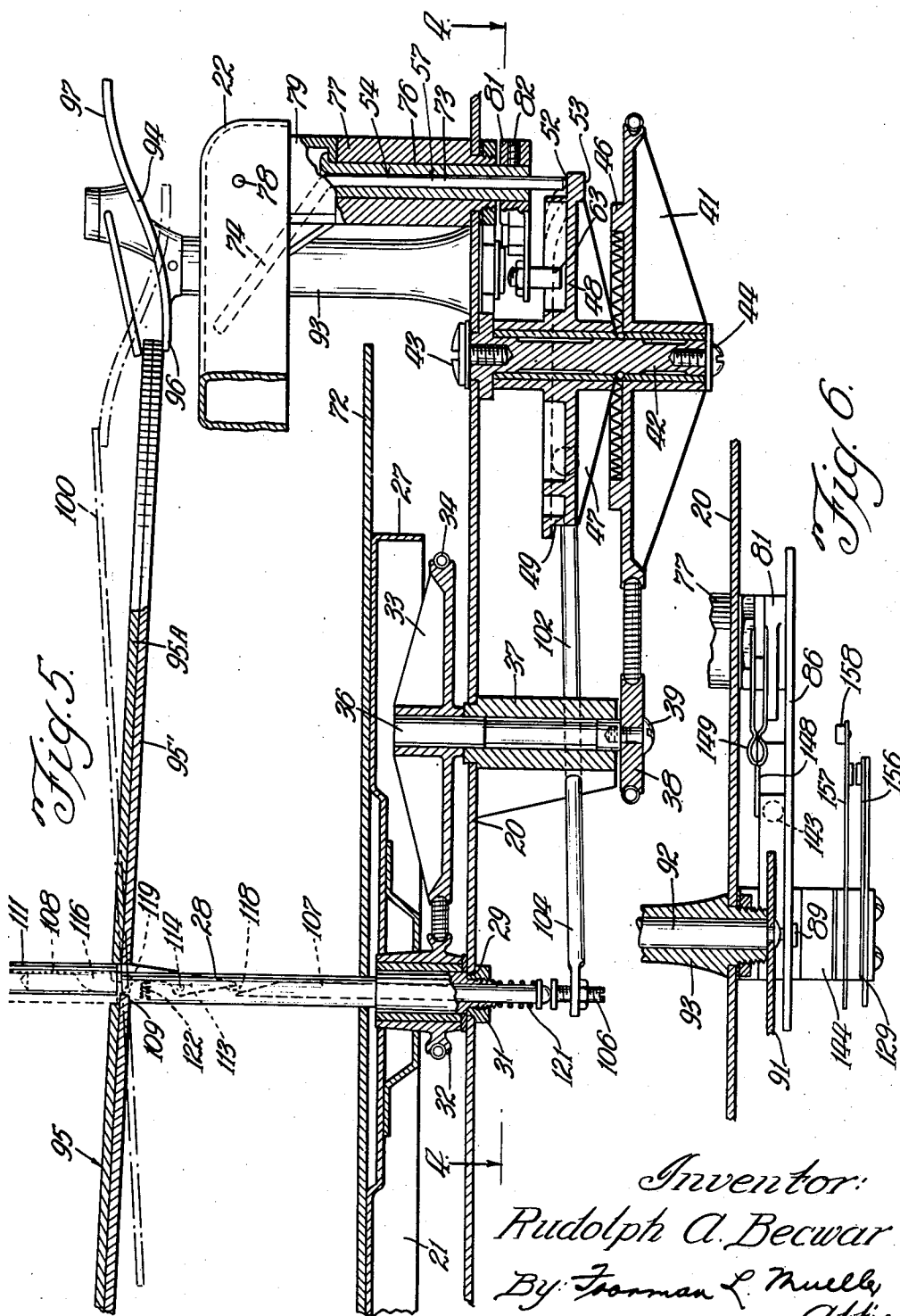
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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,293,703

RECORD CHANGER

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Application May 10, 1940, Serial No. 334,414

7 Claims. (Cl. 274—10)

This invention relates generally to record-changing means for a sound reproducing machine, and in particular to a record-changer adapted to automatically change a plurality of records in succession, the invention being particularly applicable for the changing of records of disc type having off-center or eccentric grooves, which are continuous with and formed at the end of the musical grooves.

An object of this invention is to provide an improved automatic record changer for a sound-reproducing machine.

It is another object of this invention to provide an automatic record changer for a sound-reproducing machine, which is positively controlled in its operation by electrical means in response to a predetermined operating position of the tone arm on the record being played.

A still further object of this invention is to provide a record changer adapted for use with either ten inch or twelve inch records, in which a support for supporting the edge of a plurality of records stacked above the turntable is adapted to position the stack, in correspondence with the diameter of the records therein, relative to the means for releasing successive records into a playing position on the turntable, to provide for a positive operation of the releasing means for records of widely varying thicknesses.

Another object of this invention is to provide an automatic record changer in which an electrical control circuit for starting the operation of the record-changing mechanism is adapted to be closed after the playing of a record, by an initial outward movement of the tone arm as effected by the oscillating movement of the tone arm in the eccentric grooves, formed on the record at the end of the musical grooves.

Yet another object of this invention is to provide an automatic record changer which is simple, compact and rugged in construction, positive and efficient in operation, and comprised of a minimum of parts requiring adjustment.

A feature of this invention is found in the provision of a record changer, in which the operating cam for the record changer mechanism is provided with a normally retracted pawl member which is adapted to be released by electrical control means for engagement with continuously rotating means for driving the cam.

A further feature of this invention is found in the provision of a record changer having an operating cam, in which the clutch means for connecting the operating cam with a continuously rotating driving pulley is actuated by

a solenoid, the circuit of the solenoid including a pair of switch contact arms one of which is adapted for frictional engagement with a pair of spaced fingers movable with the tone arm, the initial outward movement of the tone arm, after the playing of a record, moving the fingers in a direction to close the contact arms whereby to provide for an energization of the solenoid circuit and a consequent actuation of the clutch means.

Another feature of this invention is the provision of a record changer in which an operating cam for actuating the record-changing mechanism, is formed with a cam groove in one side and a radially extending rim at the periphery thereof, the rim being provided with a cam face on each one of its sides, and the cam faces and cam groove being relatively arranged about the operating cam to provide for a predetermined sequential operation of the record-changing mechanism during one revolution of the cam.

Further objects, features, and advantages of this invention will become apparent from the following description when taken in connection with the accompanying drawings in which:

Fig. 1 is a plan view of the invention showing the arrangement of the driving system for the automatic record changer;

Fig. 2 is a view in perspective of the operating cam for the record changing mechanism;

Fig. 3 is an electrical diagram showing the control circuit for the record-changing mechanism;

Fig. 4 is a view partly in section as seen on line 4—4 in Fig. 5;

Fig. 5 is a sectional view taken approximately along the line 5—5 in Fig. 4;

Fig. 6 is a fragmentary sectional view taken on line 6—6 in Fig. 4;

Fig. 7 is a fragmentary sectional view taken on line 7—7 in Fig. 4;

Fig. 8 is a view illustrated similarly to Fig. 7 showing the parts thereof in a changed position;

Fig. 9 is a developed view of the cam portion enclosed between the lines 9—9 in Fig. 4; and

Fig. 10 is an enlarged fragmentary sectional view of the turntable spindle showing the record releasing means.

In the practice of this invention the unplayed records are stacked above the turntable of the phonograph or like machine and successively released for dropping into a playing position

on the turntable. The record-releasing means is operated by a cam mechanism, including a multiple operating cam which is located below the turntable and adapted to provide for a raising of the tone arm from the record in playing position and for a moving of the arm beyond the circumference of such record prior to the actuation of the record releasing means. The invention contemplates further the driving of the cam mechanism by the motor for the turntable through a continuously rotating pulley system, a driving engagement between the pulley system and the operating cam being accomplished through solenoid actuated clutch means, with the circuit of the solenoid including a pair of contact arms which are angularly movable with the tone arm and arranged to be closed after the playing of a record, by the initial movement of the tone arm outwardly toward the circumference of the record, this movement being effected by the travel of the tone arm in the usual spiral grooves which are formed at the central portion of the record. This closing of the contact arms provides for an energization of the solenoid circuit and a consequent actuation of the clutch means, to provide for a driven engagement of the operating cam with the pulley system. After engagement has been accomplished the solenoid circuit is opened and the clutch means conditioned to disengage the operating cam from the pulley system on the return of the cam to its neutral position, whereby to provide for a cyclic operation of the record-changing mechanism during substantially one complete revolution of the operating cam.

There is illustrated in Figs. 1 and 5 the usual frame structure 20, turntable 21, and tone arm 22 for a phonograph or like machine, the turntable 21 being shown with a record 12 supported thereon. The turntable is driven by a low voltage induction motor 23 which is floatingly supported in a suitable manner from the structure 20, the motor shaft being provided with a pulley 24 which is in frictional engagement with the turntable driving pulley 26, which in turn is in frictional engagement with the table rim 27. A shaft or spindle 28 secured to the frame or wall 20 in an obvious manner by the clamping action of the shoulder 29 and nut 31, rotatably supports the turntable, the hub portion of which includes a pulley 32 which is in driving connection with an idler pulley 33 through a flexible spring drive 34. The pulley 33 is mounted at the upper end of a counter shaft 36 which is rotatably supported in a bushing member 37, the member 37 being suitably secured in the wall 20 as by welding or like means. An idler pulley 38 is fastened to the lower end of the counter shaft 36 by screw means such as 39, the pulley 38 being in driving connection with a pulley 41 which is rotatably mounted at the lower end of a stub shaft 42; the shaft 42 being mounted in the wall 20 by screw means 43 and the pulley 41 being maintained on the shaft 42 by screw means 44. Pulleys 33 and 38 act as reduction pulleys between the pulleys 32 and 41, with the entire pulley system being in operation concurrently with an operation of the motor 23. A serrated flange 46 formed on the upper side of the pulley 41 provides for a driving engagement of the pulley 41 with an operating cam 47 in a manner to be later fully described.

The cam 47 (Figs. 2, 4 and 5) is of substantially dish form, having a bottom 48 and an outer wall 49, and may be suitably formed as by die casting

or like means. The wall 49 is provided with an outwardly projecting annular flange or peripheral rim 51, which has cam faces or working surfaces 52 and 53 formed on opposite sides thereof, the low portion or spot 54 of the upper cam 52 being substantially opposite the high spot 56 of the lower cam 53 (Figs. 2 and 9). Cam followers 57 and 58, in operative association with the cam surfaces 52 and 53, respectively, are angularly spaced relative to each other so that the operative effects provided by the low and high spots, 54 and 56, respectively, in the operation of the record-changing mechanism occur in sequence rather than concurrently as will be later fully described. An inner wall 59 projects upwardly from the cam bottom 48 and includes a portion of the cam hub 61, the wall 59 being continuous in extent and substantially equal in height to the outer wall 49, with the vertical surface 62 thereof acting as a cam face or working surface for a corresponding cam follower 63. The portion of the cam surface 62, which is included between the lines 64, is of corresponding contour with the oppositely disposed inner side of the wall 49 to form a guiding slot 65 for the follower 63. It is thus seen that a closed recess 66 is formed within the inner wall 59 and a groove 67 of varying width between the walls 49 and 59. The groove 67 is of uniform width and guiding to the follower 63 only between the lines 64 at the slot 65 and is of varying width over its remaining length, its greatest width being in the zone designated as 68 which occurs at the end of the slot 65 and between the hub 61 and a confining wall 69 adjacent the low spot 54 of cam surface 52, for a purpose to be later fully explained. The outer wall 49 near the end of the slot 65 is increased in section to accommodate an aperture or opening 69 of a size to receive therein a pivotal lever or pawl 71 which is adapted for engagement with the serrated flange 46 of the pulley 41, in a manner to be hereinafter described.

Actuation of the cam follower 54 on movement of the cam 52 is adapted to provide for a lifting or a lowering of the tone arm 22 from the turntable 21, and specifically from a record 12 which is supported in a playing position on the turntable (Fig. 5). The follower 57 is of angular shape and includes a straight portion 73 and a bent portion 74, the portion 74 being inclined upwardly into the hollow tone arm 22. The straight portion 73 is slidably and rotatably supported in a sleeve member 76, which in turn is rotatably supported in a bearing block or bushing 77, which is suitably mounted on the frame 20. The bent portion 74 is adapted to engage the upper side of the tone arm 22 which is pivoted at 78 to a supporting leg member 79 which in turn is rotatably supported on the bushing 77. The upper end of the sleeve 76 is secured to the member 79, by welding or like means, so that the sleeve 76 is angularly or rotatably movable with the tone arm 22 through the leg member 79. It is thus seen that the operating position of the cam follower 54 relative to the tone arm 22 remains unchanged during any swinging movement of the arm across the record 12.

The lower end of the sleeve 76 projects outwardly from the bushing 77 to provide for a mounting at such end of a rocker arm 81, the arm and sleeve being held together in frictional engagement by means of a holding screw 82 or like means. The free end of the arm 81 (Fig. 4) is pivotally connected at 83 to the end portion 84

of a selector link or lever arm 86, the end portion 84 being of sufficient width to also provide for the rotatable mounting therein of the cam follower 63 at a distance from the pivotal connection 83. Angular movement of the rocker arm 81 and hence of the sleeve 76 and tone arm 22 in one direction is thus obtained on actuation of the cam follower 63 by the cam 62. The end 87 of the lever arm 86 is provided with a slot 88 to slidably receive therein a pin member 89 which is mounted in a flat plate or selector disc 91.

The disc 91 is mounted at the lower end of a shaft 92 (Figs. 5 and 6) as by welding or like means, the shaft 92 being rotatably supported in a bushing or sleeve 93, which is suitably secured to the cabinet wall 20. The upper end of the shaft is pin-connected to a platform or shelf 94 of curved contour which is adapted to provide an edge support for a stack of records 95 located vertically above the turntable 21, the shelf 94 being rotatably supported on the upper end of the sleeve or stand 93. As shown in Fig. 1, the projected surface area of the shelf is of substantially rectangular form, the shelf being positioned on the stand 93 in a manner to provide for unequal shelf lengths 96 and 97 on opposite sides of the stand. A rotation of the shelf of 180 degrees thus provides for a supporting shelf of a different length for records of different diameter, the short length 96 being adapted to support the stack of twelve inch records 95 and the long length 97 being adapted to support a stack of ten inch records 100, in a manner to be hereinafter fully described.

The 180 degree rotation of the shaft 92 moves the end 87 of the selector arm 86 from one side of the shaft 92 to the other side thereof through the sliding action of the pin 89 in the slot 88 (Fig. 4), the limits of rotation being defined by the engagement of the notches 98 in the selector disc 91 with the pin 89 in the spring-tensioned pivotal indexing lever 101. When the record edge support 94 is positioned to support ten inch records the arm 86 is in the position indicated by the dot-dash lines. On rotating the support 94 to accommodate twelve inch records the arm 86 is moved to the position indicated by the full lines, this movement of the arm 86 providing for a movement of the rocker arm 81 and specifically the pivotal connection 83 thereof relative to the cam follower 63, the position of which is practically unchanged on movement of arm 86 by rotation of the support. Since the angular movement of the rocker arm 81 controls directly the angular movement or swing of the tone arm 22, the movement of the rocker arm downwardly to the left as seen in Fig. 4 provides for an initial starting position of the tone arm 22 on the record 72 to be played, at an increased distance from the circumference of the turntable 21, the dotted lines representing the starting position of the tone arm 22 when the platform 94 is positioned to accommodate twelve inch records and the dot-dash lines indicating the starting position of the tone arm 22 when ten inch records are to be played. It is thus seen that after a positioning of the platform 94 in correspondence with the diameter of the records to be played, the operation of the roller 63 by the cam 62 and the roller 54 by the cam 52 controls the swing of the tone arm 22 and the lift of the arm 22, respectively, relative to the record being played.

The cam follower 58, which is operatively associated with the cam face 52 of the multiple cam

47, is rotatably mounted at one end of a crank arm 102 which is pivotally supported in a bearing member 103 suspended from the cabinet wall 20 (Figs. 4 and 5). The opposite end 104 of the crank arm 102 is provided with an adjusting screw 106 which is adapted to abuttingly engage the lower end of an operating member 107 which is slidably supported axially of the spindle or shaft 28 (Fig. 5). The spindle 28 is formed with an off-set upper portion 108 to form a shoulder 109, the shoulder 109 acting as a center support for the stack of unplayed records which are located above the turntable 21.

An eccentric cap or sleeve member 111 substantially equal in diameter to the body portion of the spindle 28 is rotatably mounted about the offset portion. In the positioning of a stack of records above the turntable 21 the sleeve 111 is rotated until substantially its thinnest wall section 112 is positioned at the shoulder 109 to provide for an alignment of the records on the shoulder (Fig. 10).

A trigger or trip lever 113 is pivotally connected at 114 to the shaft 28 and is completely retractable in an axially extending groove 116 formed therein, an opening 117 being provided in the bottom of the groove above the shoulder 109. An inclined side portion 118 at the lower end of the lever is adapted for slidable engagement with the upper end of the operating member 107, to provide for an outward movement of a nose or projecting finger 119, formed at the upper end of the lever 113, through the opening 117 immediately above the shoulder 109 for a purpose to be later described. On retraction of the member 107 from its engagement with the side portion 118, as by the spring-retained means 121, (Fig. 5), the finger 119 is removed from the opening 117 by a spring 122 arranged in compression in the spindle 28 between the lever 113 and the bottom of the groove 116. The pivotal movement of the trip lever 113 by the operating member 107 provides for an engagement of the finger 119 with the lowermost or bottom record 95' at the aperture 123 formed at the center of the record. Since the finger 119 is of a length to extend completely over the shoulder 109, the record 95' is pushed clear of the shoulder and into centering engagement about the lower portion of the spindle 28, the spindle being of a diameter somewhat less than the diameter of the record aperture 123. Since the lever 113 is completely retractable within the spindle 28 the record 95' is thus entirely released and free to fall into a playing position on the turntable 21.

As is best illustrated in Fig. 5, the shoulder or center support 109 is of a depth commensurate with the extent or length of the support given the edges of the records 95 by the supporting platform 94. The movement of the lowermost record 95' from the shoulder 109 is thus sufficient to effect a complete separation of the record 95' from the platform 94, so that the record is entirely unsupported in its drop to the turntable 21, except for its centering engagement about the spindle 28. The trigger or record releasing means 113 is thus operable to provide for a separation or release of a record 95' from a stack of unplayed records 95, by engaging the record at its immediate central portion at the aperture 123.

In the arrangement of the records 100 and 95 in a stacked formation it is readily apparent that considerable friction may occur between the lowermost record 100' and 95' and the next adjacent

record 100A and 95A, respectively. Since this frictional factor similarly affects the ten inch and twelve inch records the following description will refer to the twelve inch records. Particularly when the stack 95 is rather high this friction will tend to provide for a movement of the record 95A with the record 95' during the record-releasing operation. Also, it is well-known that records of the same diameter differ widely in thickness and that twelve inch records are generally of a greater thickness than ten inch records. The supporting shelf 94, therefore, is adapted to position the records 95 on the shoulder 109 to provide for a positive engagement of the finger 119 with the lowermost record 95', and of the eccentric sleeve member 112 with the record 95A, irrespective of the relative thicknesses of such records, to prevent any moving of the record 95A with the record 95' when it is being pushed from the shoulder 109.

With reference to Figs. 5 and 10 the lower end of the eccentric cap member 112 is illustrated as being located above the shoulder 109 a distance indicated by the lines A—B, the finger 119 being adapted for projection through the opening 124 formed between the shoulder and such lower end. In the horizontal positioning of the records 95, that is at right angles to the spindle 28, it is readily understood that the distance A—B, should correspond to the thickness of an unusually thick twelve inch record to assure the release of all twelve inch records on actuation of the lever 113. However, in some cases, it might happen that this provision for a very thick twelve inch record would result in the space A—B being sufficiently great to exceed in extent the combined thicknesses of two ten inch records, which are thinner than the usual ten inch records. In the event two such records were positioned adjacent each other it is apparent that both records might be released at one time by the releasing lever 113. To provide for a positive operation of the releasing means to release only one record, irrespective of the relative thicknesses of the records in the stacks 95 and 100, the ends 96 and 97 of the supporting shelf 94 are vertically offset from each other, so that the end portion 96 which is adapted for the support of twelve inch records is below horizontal alignment with the projected space A—B and the ten inch record supporting portion is above horizontal alignment with such projected space. The twelve inch records, which are illustrated in Fig. 10 in full lines, are thus tilted or inclined upwardly from the shoulder 109 so that the portion 90 of the lowermost record 95' is dropped below the wall portion 126 to a point lower than it would occupy if the record was in a horizontal position. The record 95' is thus entirely clear of the wall portion 126 to provide for its dropping into a playing position on the turntable 21 on operation of the trip lever 113. In the playing of ten inch records, which are illustrated in Figs. 5 and 10 in dotted lines, the shelf portion 97 provides for a tilting of the record 100' in a direction downwardly from the shoulder 109 so as to raise the record portion 90' of record 100A into positive engagement with the wall portion 126. The record 100', therefore, is alone moved from the shoulder 109 on actuation of the trip lever 113. A reversed tilting of the records 95' and 100' on the shoulder 109, therefore, serves to reduce the distance A—B over that normally required to accommodate an extra thick twelve inch record when horizontally positioned and to provide for a positive successive releasing of all

ten and twelve inch records, irrespective of the thickness of such records. It is to be understood that the nose or projecting finger 119 is of a size commensurate with the thickness of the thinnest records which might be played, so that engagement of the nose with only one record will be made regardless of the thickness of such record. When all of the records such as 95 or 100 have been played and it is desired to remove the records from the turntable 21, the member 111 is rotated to the position illustrated in dotted lines in Fig. 5, to form a shaft or spindle 28 which is in peripheral alignment over its entire length. Since the pivotal lever 119 is completely retractable within the spindle 128, the spindle is thus unobstructed over its entire length so that the records successively positioned on the turntable 21 may all be removed at one time and in a stack from the spindle 28. It is understood, of course, that prior to the lifting of the records from the spindle the shelf 94 is rotated out of its engaging position with the records 95 or 100 and into a position with a longitudinal side facing the spindle 28, so as to be clear of the records being lifted from the turntable 21.

The operation of the above described record-changing apparatus is controlled through an electric control circuit which is closed in response to a predetermined operating position of the tone arm 22 on the record 72, supported in playing position on the turntable 21. The circuit (Fig. 3) is illustrated as adapted for energization from a suitable electrical source through a transformer 127 and includes a solenoid 128, a lock out switch 129, a control switch 131 and a reject button 132; the switch 131 and reject button 132 being arranged in parallel to provide for separate closing of the circuit.

The solenoid 128 (Fig. 4) is supported in a frame member 133 depending from the wall 20, the solenoid being arranged in a position above the pulley 41 and near the circumference of the cam 47. An armature 134 electrically associated with the solenoid is pivotally connected to the frame member 133, the connecting pin 136 in the member 133 being also slidable in the elongated slot 137 formed in the armature, for a purpose to be later described. The armature 134 is of substantially angular cross-section, one leg 138 thereof being adapted for electrical connection with the solenoid 128 and the other leg 139 acting as a supporting shelf for the dog or pawl member 71 which is pivotally connected to the cam 47 and arranged within the opening 69. The dog 71 is adapted for engagement with one of the serrations in the serrated flange 46 to provide for a driving of the cam 47 by the continuously rotating pulley 41; the spring 141 serving to bias the dog into an engaging position with a serration (Fig. 7). When the solenoid 128 is not energized the armature 134 is urged into a supporting or holding position with the dog 71 by a spring 142, which is connected at one end to the member 133 and at its opposite end to the armature 134 (Fig. 8). The armature 134 and dog 71 thus act as a clutch, which is operable to provide for a driving of the cam 47 by the pulley 41, which in turn is driven by the turntable motor 23. Control switch 131 is comprised of a pair of contact arms 143 which are mounted on a frame 144 depending from the wall 20, the arms being suitably insulated from the frame 144 and from each other by insulating member 146. The gap between the arms 143 is adjusted by an eccentric adjusting screw

147 which is held in the frame plate 20, the screw being in sliding engagement with the outer one of the contact arms 143. Adjustment is thus readily made by turning the screw 147, which moves the outer contact arm 143 relative to the inner contact arm, to provide for a variation in the gap between the arms. The free end of the outer contact arm is provided with a flat extension or plate 148 which is adapted for frictional engagement with a pair of spaced fingers 149 (Figs. 4 and 6), the fingers 149 being mounted on the rocker arm 81 and hence movable with the rocker arm so as to move with the tone arm 22 in its travel across the record 72 being played.

The operation of the invention is best understood from Fig. 4 in which the multiple or operating cam 47 and its associated cam followers are illustrated in the positions which they assume when the tone arm 22 is in a starting position on the record to be played, the record 72 being indicated from the full line position of the rocker arm 81, as a twelve inch record although it is to be understood that the operation is the same for either a ten or a twelve inch record. This operating condition represents a neutral position of the cam 47, the cam being out of engagement with the pulley 41 and the spaced fingers 149 being out of engagement with the projecting plate 148 of the outer contact arm 143. As the tone arm 22 moves inwardly across the record 72 toward the spindle 28 the rocker arm 81 is moved inwardly toward the shaft 42, the follower 63 being out of contact with the cam surface 62 and moving freely in the widened portion 68 of the groove 67 during the entire playing of the record, with the follower 57 being at the low spot 54 of the cam 52 and the follower 58 being in engagement with the low portion of the cam 53 (Figs. 2 and 9); the confining wall 60 serving to maintain the follower 63 within the zone 68 and out of any possible engagement or interference with the follower 57. When the tone arm 22 is in partial traversal of the record 72 the fingers 143 frictionally engage the plate 148, but since the pressure exerted by the fingers on the plate is in a direction to maintain open the contact arms 143, that is in a direction urging the outer contact arm against the adjusting screw, the control or solenoid circuit is maintained open. However, on the record being completed the tone arm is carried to the eccentric groove 151 (Fig. 1) which is formed at the center of the record, to provide for an oscillating movement of the tone arm on the record. When the tone arm is first moved outward in a direction away from the spindle 28, by its oscillating movement in the groove 151, the fingers on rocker arm 81 are moved in a direction towards the shaft 42, which movement provides for a pulling inwardly of the outer contact arm 143 of the eccentric adjusting screw and into contact with the inner contact arm whereby to close the control circuit for the record changing apparatus, the circuit being comprised of conductor 152, solenoid 128, the closed switch 129, control switch 131 and conductor 153.

Closing of the control circuit by the contact arms 143 energizes the solenoid 128 to provide for an actuation of the armature 134 to release the dog 71 for engagement with the pulley 41, rotation of the cam 47 being obtained immediately upon the engagement of the dog 71 because of the continuous rotation of the pulley 41. In the rotation of the cam 47 in a clockwise direction, as seen in Fig. 4, the cam face 52 acts first to oper-

ate the cam follower 57 to raise the tone arm 22 from the record 72 prior to any outward swinging or angular movement of the arm towards the circumference of the record. After the arm 22 has been raised to clear the record, the cam follower 63 is engaged by the cam 62 to effect a movement of the tone arm 22 outward from the spindle 28 towards the circumference of the record, the cam follower 57 continuing to ride on the high portion of the cam 52 to hold the arm 22 in a lifted position and the follower 58 being in engagement with the low portion of the cam 53. When the tone arm 22 has been moved to its outermost position and completely off the face of the record 72, which position is indicated on the cam 62 by the portion between the lines 154, the cam follower 58 is engaged by the high spot 56 of the cam 53 to provide for an actuation of the operating member 107 (Fig. 5) by the crank arm 102, the operating member 107 moving the pivotal lever 107 to release the bottom record 95' of the stack of records 95 from its supported position on the center support 109 and edge support 96, in the manner previously fully described. The record 95' is thus dropped into a playing position on the turntable 21 only after the tone arm 22 is completely removed from the face of the record 72 which has been played. After release of the record 95' into a playing position on the turntable 22, the cam follower 63 continues its travel in the groove 65 to provide for a movement of the tone arm inwardly toward the circumference of the turntable 21, the cam 52 and cam follower 57 operating concurrently to provide for a lowering of the tone arm in operative engagement on the newly positioned record.

During the rotation of the cam 47 the fingers 149 are disengaged from the outer contact arm 143 on movement of the rocker arm 81 outwardly from the shaft 42 by the operation of the cam 62 and its associated follower 63 whereby the solenoid circuit is opened to provide for a release of the armature 134, which is immediately pulled back into an engaging position with the dog 71 by the spring 142. On a continued rotation of the cam 47, the dog 71 is returned to its starting position where it is engaged by the armature 134 and lifted out of its engagement with the serrated flange portion 46 of the pulley 41, to immediately stop any further rotation of the cam 47. The armature 134 does not operate to abruptly disengage the dog 71 from the pulley 41, but serves to gradually lift the dog 71 away from the engaged serration by the sliding action of the armature 134 as permitted by the elongated slot 137 formed therein. This manner of disengaging the dog 71 effects a smoothness of operation of the record-changing mechanism by the reduction of any sudden shocks to the rotating system. The record-changing mechanism is thus returned to its original neutral position and conditioned for the playing of a new record, during substantially one complete revolution of the cam 47.

The moving of the contact arms 143 into a closed position by the fingers 149, as explained above, provides for an energization of the solenoid 128 and an immediate release of the dog 71 by the armature 134 for engagement with the serrated flange 46 of pulley 41, the fingers being initially moved toward the shaft 42 by the oscillating motion of the tone arm 22 in the eccentric groove 151. Since the oscillating motion of the arm 22 in the groove 151 also effects a movement of the fingers 149 in an outward direction from the shaft 42 alternately with the movement

toward the shaft, a condition might occur where the arms 143 are successively opened and closed before the tone arm 22 is lifted completely out of engagement with the record, such as 72, which is being played, whereby to provide for a repeat operation of the solenoid or relay 128. This repeat operation, however, does not effect any further control of the record-changing mechanism, since the dog 71 on initial actuation of the solenoid 128 is immediately engaged by the pulley 41 and rotated out of an engaging position with the armature 134. The repeat operation, therefore, acts only to move the armature 134, which movement is accompanied by the usual "clicking" noise. To prevent a repeat operation of the solenoid 128 and the resulting "clicking" noise, the control circuit (Fig. 3) is provided with a lock out or cam switch 129, which, as illustrated in Figs. 4 and 6, is comprised of spring contact arms 156 and 157 which are suitably supported on the mounting member 144. The contact arm 157 is provided at its free end with an insulating contact or button 158 which is adapted for engagement with the high portion or spot 56 of cam 53. As is best shown in Fig. 9 this engagement maintains the contact arms 156 and 157 in a closed position when the record-changing mechanism is in its neutral position, the arms 156 and 157 being adapted to open on about the first 5 degrees of rotation of the cam 47, which rotation is sufficient to move the cam portion 56 out of engagement with the button 158. Immediately after the start of rotation of the cam 47, therefore, the button 158 is free of the cam and does not contact the low portion 159 of the cam face 53. It is thus seen that on the initial closing of the contact arms 143 and resulting rotation of the multiple cam 47, the control circuit is opened by the opening of the contact arms 156 and 157 so that a second or repeat closing of the arm 143 is rendered ineffective in energizing the solenoid 128 to actuate the armature 134, the contact arms 156 and 157 remaining in an opened position until the operating cam 47 returns to its neutral position.

In the event it is desired to change the record 72, after it has been only partly played, the reject button 132 (Fig. 3) is operable to effect an immediate energization of the solenoid 128 independently of the relative positions of the contact arms 143, the solenoid circuit being complete through conductor 152, solenoid 128, closed cam switch 129, reject button or switch 132 and conductor 153, the energization of the solenoid acting to release the armature 134 to effect an engagement of the dog 71 with the pulley 41 in the manner above noted. On rotation of the cam 47 the operation of the record-changing mechanism is similar to that just described.

The invention is thus seen to provide for a record-changing mechanism which is of simple construction, cheap in cost and which is positively controlled during its operation by electrical means in response to a predetermined operating position of the tone arm on the record being played. A start of operation of the mechanism substantially immediately upon the completion of the playing of a record and the provision of means for stopping the record-changing mechanism immediately after its cycle of operation reduces to a minimum the time required for the changing of a record. The invention further provides an edge support 94 for a plurality of either ten inch or twelve inch records positioned above the turntable 21, which is adapted to position the records in a manner to provide for a

positive release, by the record-releasing means, of only the lowermost record of the stack of records, regardless of the relative thicknesses of the records in such stack. The record-changing mechanism is thus adapted for an efficient operation with either ten inch or twelve inch records and its operation is equally efficient for all records irrespective of their thickness.

It is to be understood that although the invention has been described with particular reference to ten and twelve inch records, it is not to be so limited. It is to be understood also that only a preferred embodiment of the invention has been illustrated and described herein and that modifications and alterations thereof can be made which are within the full intended scope of the invention as defined by the appended claims.

I claim:

1. In a sound reproducing machine for playing disc records having an eccentric groove formed in the central portion thereof connected with the recording grooves, including a tone arm and having record changing mechanism with rotary cam means and driving means therefor, the means for initiating the operation of said record changing mechanism on the completion of the playing of a record including clutch means selectively operatively connecting said cam and driving means, a solenoid for actuating said clutch means, a circuit for said solenoid including a pair of normally open switch contacts, one of said contacts being provided with a flat laterally extending portion, a pair of spaced members operatively connected to said tone arm and movable therewith into frictional engagement with opposite sides of said flat extending portion, said spaced members on movement of said tone arm inwardly across the record in playing position acting to hold said switch contacts open, and on initial movement of said tone arm outwardly of said record closing said switch contacts to energize said solenoid, said initial outward movement of the tone arm being obtained by the oscillating movement thereof in said eccentric groove.

2. In a phonograph having record changing mechanism, the means for operating said record changing mechanism including a rotary cam, a rotary member for driving said cam, means supporting said cam and driving member in a concentrically spaced relation, said driving member having a circular serrated track on the face thereof opposite said cam, clutch means movably supported in the face of said cam with a portion thereof extending laterally of said face into an engaging position with said track, means for actuating said clutch means including a solenoid, an armature for said solenoid, means yieldably retaining said armature between said operating cam and driving member and in a position for engaging said clutch portion to normally hold the same out of engagement with said circular track, with the energization of said solenoid attracting said armature out of said holding position to provide for the driven engagement of said cam and driving member.

3. In a phonograph having a tone arm and including record changing mechanism, the means for operating said record changing mechanism including an operating cam, a rotary member for driving said cam, means supporting said cam and driving member in coaxial alignment but in a spaced relation, said driving member having a circular serrated track thereon opposite said cam,

a pawl element movably supported in the face of said cam and having an end portion thereof extending into an engaging position with said track, means for actuating said pawl including a solenoid and an armature therefor, means for mounting said armature in the space between said cam and driving member, with said armature being movable into an engaging position with the end portion of said pawl to normally hold the same away from said circular track, said solenoid on being energized attracting said armature out of its holding position with said pawl, a circuit for said solenoid including a normally open control switch, and means movable with said tone arm for closing said control switch on the completion of the playing of a record and for opening said control switch when the tone arm is being moved outwardly from said record, with said armature on opening of said control switch moving into the path of travel of said pawl to engage and hold the end portion thereof to stop the rotation of said cam after substantially one complete revolution.

4. In a phonograph for playing a plurality of records in succession and including record changing mechanism having an operating cam, the means for operating said record changing mechanism including a rotating member for driving said cam, means supporting said cam and cam-driving member in a concentrically spaced relation, with said cam being positioned above said driving member, projections on said cam driving member arranged in a circle on the face thereof opposite said cam, a pawl member pivotally supported in the face of said cam and depending downwardly therefrom for engagement with said projections to operatively connect said cam and driving member, means movable between said cam and cam driving member and into the path of movement of said pawl, means yieldably retaining said movable means in the path of said pawl to normally support the same out of engagement with said projections, and means moving said movable means out of the path of said pawl on completion of the playing of a record to provide for the dropping of said pawl into engagement with one of said projections, with said latter means releasing said movable means after said engagement so that said pawl is lifted by said movable means away from said projections after substantially one revolution of said cam.

5. In a phonograph having a tone arm and record changing mechanism including a rotary operating member, the combination of means for intermittently rotating said operating member from a continuously rotating driving member including means rotatably supporting said two members in coaxial alignment and in a spaced relation but permitting relative rotation therebetween, a pivoted clutch element on said operating member extending into the space between said two members, projecting portions arranged in a circle on said driving member defining the path of travel taken by said clutch element on rotation of said operating member, means pivot-

ally supporting said clutch element for pivotal movement into engagement with a projecting portion to operatively connect said two members, and means operatively associated with said tone arm and movable into and out of the path of travel of said clutch element to actuate the same in response to predetermined operating positions of said tone arm.

6. In a phonograph having a tone arm and record changing mechanism including a rotary operating member, the combination of means for intermittently rotating said operating member including a continuously rotating driving member, means rotatably supporting said two members in spaced coaxial alignment, with said operating member being in a superposed relation with said driving member, engaging portions circularly arranged on said driving member and projecting toward said operating member, a pivoted clutch member on said operating member, with the circular path of travel taken by said clutch member on rotation of said operating member being defined by said engaging portions, means pivotally supporting said clutch element for movement into engagement with one of said engaging portions to operatively connect said driving and operating members, means movable into the path of travel of said clutch element to support the same out of engagement with an engaging portion to stop the rotation of said operating member, with said clutch element on movement of said supporting means out of said supporting position pivotally dropping into engagement with an engaging portion to initiate rotation of said operating member, and actuating means for said supporting means operatively associated with said tone arm for controlling the movement of said supporting means in response to predetermined tone arm operating positions.

7. In a phonograph having a tone arm and record changing mechanism including a rotary operating member, the combination of means for intermittently rotating said operating member including a continuously rotating driving member in spaced coaxial alignment with said operating member, a ring of projecting portions on said driving member facing said operating member, a pivoted clutch element movable with said operating member and extending into the space between said two members, means pivotally supporting said clutch element from said operating member to permit its dropping into engagement with one of said projections to operatively connect said two members and initiate rotation of said operating member, means movable between said two members and engageable with said clutch element to lift the same from engagement with a projection to stop the rotation of said operating member, means operatively associated with said tone arm for actuating said movable means out of said clutch element lifting position when said tone arm is in a predetermined operating position, and spring means for returning said movable means to said clutch element lifting position after the operation of said actuating means.

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