

Sept. 5, 1944.

F. KAHL

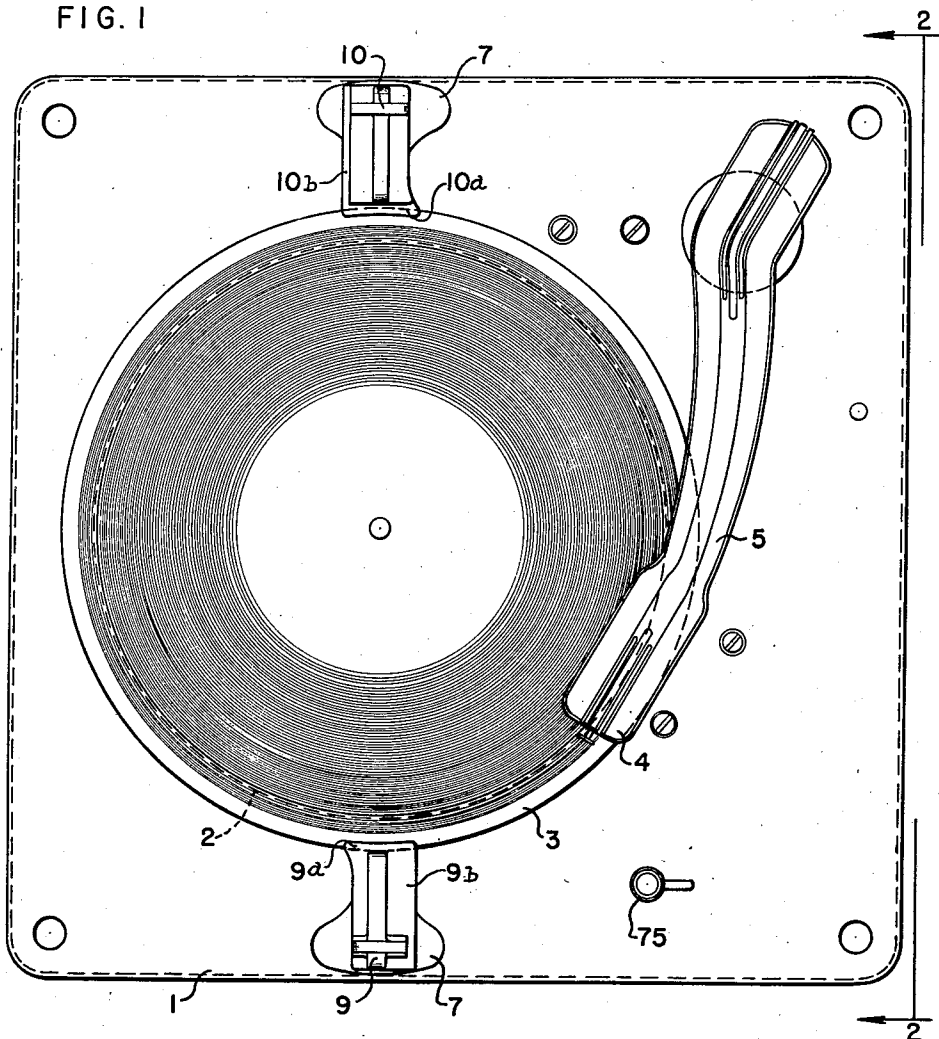
2,357,520

AUTOMATIC RECORD CHANGING MECHANISM

Filed Feb. 23, 1940

4 Sheets-Sheet 1

FIG. 1



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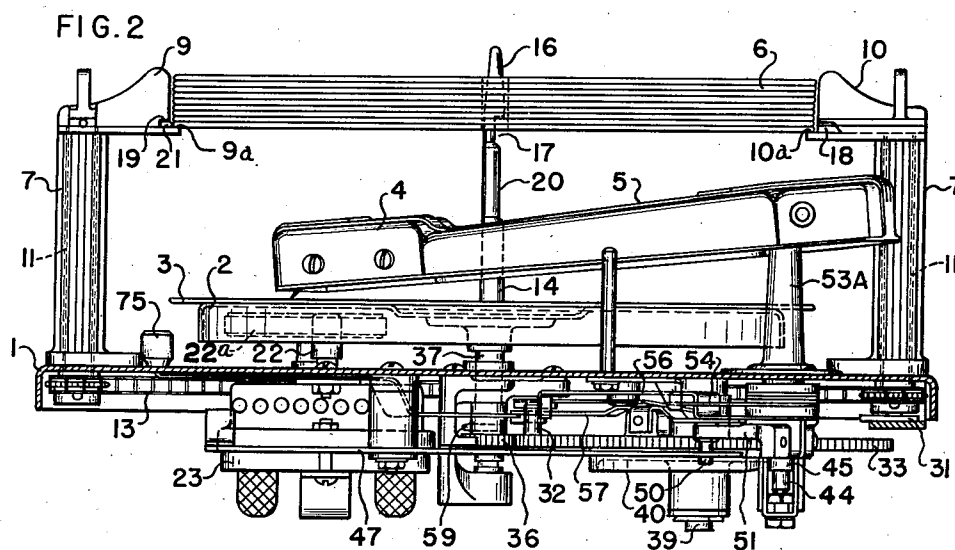
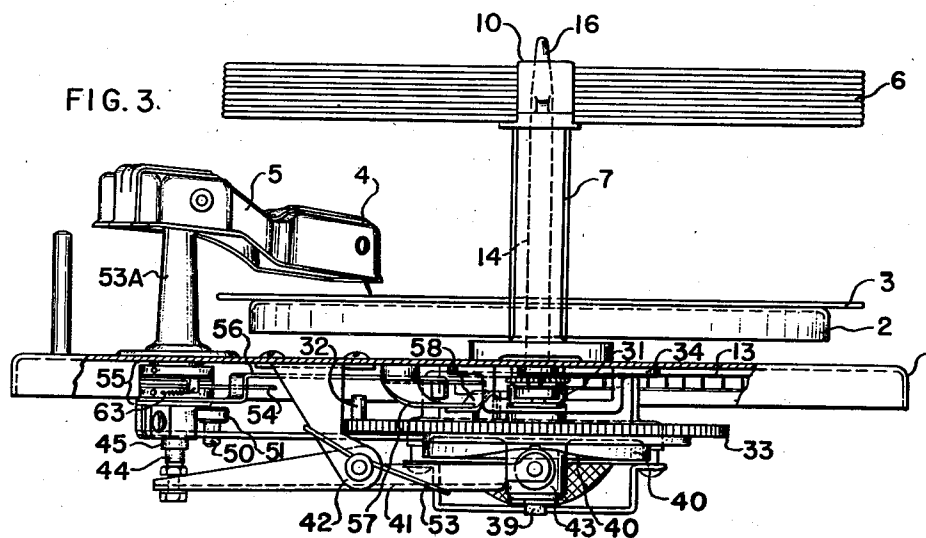
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AUTOMATIC RECORD CHANGING MECHANISM

Filed Feb. 23, 1940

4 Sheets-Sheet 2



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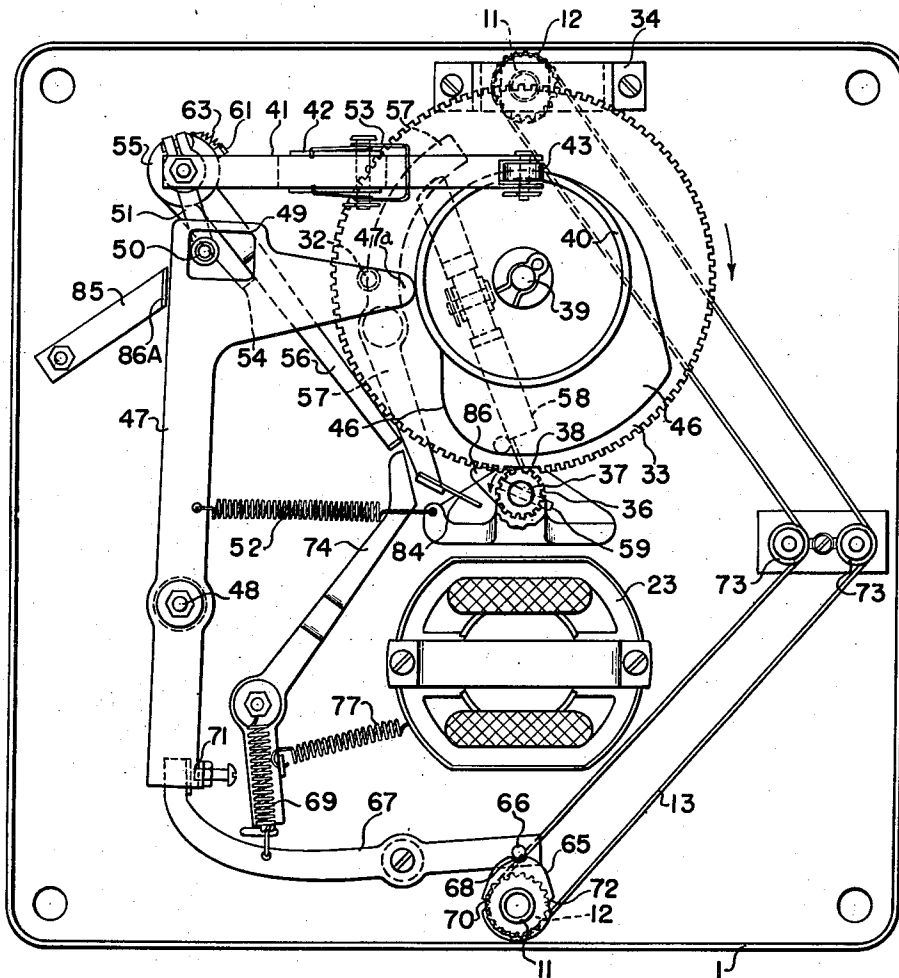
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AUTOMATIC RECORD CHANGING MECHANISM

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4 Sheets-Sheet 3

FIG. 4



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AUTOMATIC RECORD CHANGING MECHANISM

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4 Sheets-Sheet 4

FIG. 5

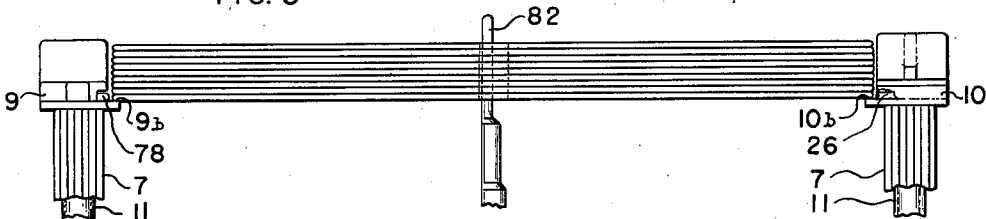


FIG. 6

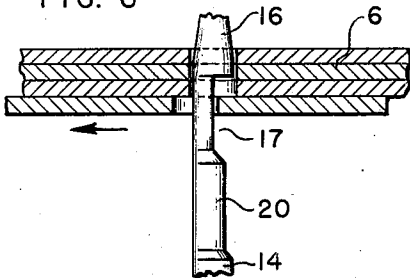


FIG. 7

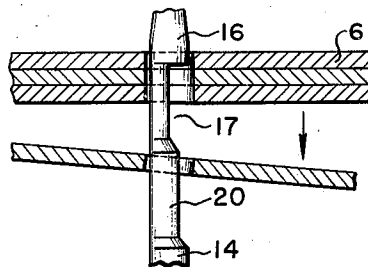


FIG. 8

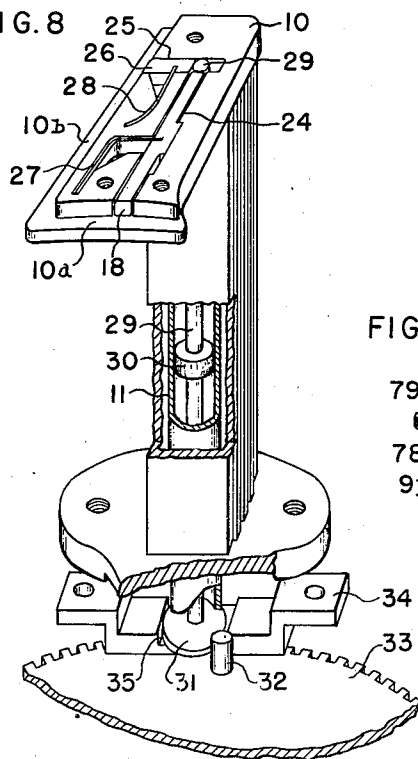


FIG. 10

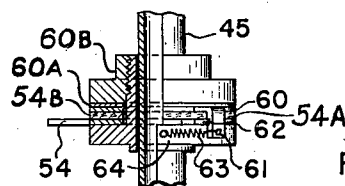


FIG. 9

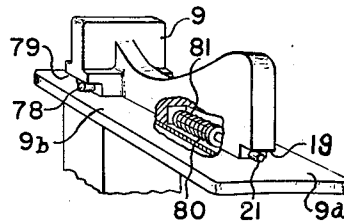
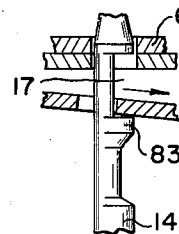


FIG. 11



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2,357,520

AUTOMATIC RECORD CHANGING
MECHANISM

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Application February 23, 1940, Serial No. 320,278

13 Claims. (Cl. 274—10)

This invention relates to phonograph mechanisms and more particularly to an improved automatic phonograph record changer mechanism of the type wherein a stack of records is supported above a phonograph turntable and the lowermost record of the stack may be released to drop by gravity upon the turntable into playing position for reproduction.

When a vocal or symphonic arrangement is sufficiently long that it must be recorded on several records, it is desirable that these records may be played successively without the necessity of manual changing of the records. Likewise, the maximum enjoyment of a program comprising a plurality of numbers requires that the several records to be played be moved automatically and successively into playing position upon the phonograph turntable.

Heretofore, mechanical arrangements have been provided automatically to place a new record from a magazine of records in playing position upon a phonograph turntable upon the completion of the playing of a record previously on the turntable. In one form of these prior automatic record changing mechanisms, the records have been stacked above the turntable and the lowermost record of the stack has been released from the stack to drop by gravity upon the turntable by a releasing mechanism in the nature of a knife which cuts between the lowermost two records of the stack. Other mechanisms of this general type have effected the release of the lowermost record of the stack by a moving member which engages the central aperture of the record, thereupon to move the record off of the fixed record-supporting members. Record changing mechanisms of the former type have the disadvantage that the knife-releasing members tend to chip the edges of the record or may even dig into the edges of the record and jam the mechanism. Record changing mechanisms, of the type which engage by a moving member the central aperture of the record, have the disadvantage that the moving member in time lacerates the edges of the record adjacent the aperture to such an extent that the record aperture becomes enlarged and the record can no longer be properly centered upon the phonograph turntable. Additionally, these and other similar forms of record changing mechanisms have the disadvantage that a record may be removed from the stack of unplayed records only so long as the record is preferably flat, but cannot be removed in the event that the record has taken a more or less permanent warp. A number of the prior record chang-

ing mechanisms of the type having records supported in a stack above the turntable have a characteristically noisy operation during the process of changing records, caused in large part by the impact of the new record in falling with a relatively high velocity upon a record previously placed on the turntable.

An object of the present invention is to provide a record changing mechanism of improved and simplified construction.

A further object of the invention is to provide an improved record changing mechanism of reduced size, requiring a minimum of space in a phonograph cabinet and having no tendency to chip the edges of the record or to enlarge the central aperture of the record and render the record incapable of being accurately centered on the phonograph turntable.

A further object of the invention is to provide a phonograph which operates with a minimum amount of noise during the process of changing records and one whose operation greatly reduces the tendency of changing records to dent the playing surface of records previously placed on the turntable, such as may be caused by the edge-wise impact of a changing record on one already on the turntable.

In accordance with the present invention, a stack of records is supported above the turntable upon supports which engage only peripheral edge portions of the lowermost record of the stack. A centering spindle is arranged to rotate with the turntable and extends into the center hole of at least the lowermost record of the stack. One side of the centering spindle is reduced for the purpose of permitting the lowermost record to be moved laterally to disengage one of said edge portions. Suitable means are provided which operate in timed relation with the movement of the spindle and effect said disengaging movement. When this occurs, the record drops by gravity and in falling disengages itself from the other supports.

The record may, in one embodiment of the invention, drop by gravity onto a shoulder provided at the lower end of the reduced portion of the spindle and be supported there temporarily to break its fall. The record is released from the shoulder a moment later by the spindle in its continued rotary movement and thus drops with greatly decreased velocity, being guided by the spindle into playing position upon the turntable. The decreased velocity minimizes the noise of impact of the falling record with other records previously placed upon the turntable. In accordance

with a further feature of the invention, all of the supports are so arranged and connected that they may be adjusted from ten-inch to twelve-inch record-supporting position or vice versa, as well as moved out of the path of the played records during their removal from the mechanism, by manually moving only one of the supports to the desired position.

In accordance with another feature of the invention, a notch is so provided in one of the peripheral record edge supports as to insure that only the lowermost record may move laterally on the supports into releasing position.

For a better understanding of the invention, together with other and further objects thereof, reference is had to the following description, taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

In the accompanying drawings,

Fig. 1 is a top plan view of the record changer with the unplayed records removed;

Fig. 2 is a side elevation of the record changer of Fig. 1 showing a group of records supported over the turntable and one record on the turntable in playing position, as viewed from the line 2-2 of Fig. 1;

Fig. 3 is a rear elevation of the record changer, showing the cam arrangement for raising and lowering the tone arm;

Fig. 4 is a bottom plan view of the underside of the record changing mechanism;

Fig. 5 is a partial side elevation, showing the record supports moved to twelve-inch record-supporting position, with a modified form of centering pin;

Figs. 6 and 7 are fragmentary views showing various positions of records in relation to the centering pin at closely-spaced intervals of time after the lowermost record has been moved to release it from the supports;

Fig. 8 is a perspective of one record support, with the cover removed, and with the pedestal partially in section;

Fig. 9 is a perspective of another record support showing certain details of its construction;

Fig. 10 is a view of a friction clutch assembly used in the mechanism; and

Fig. 11 shows a modification of the centering spindle.

Referring now more particularly to Fig. 1 of the drawings, the invention is here illustrated as embodied in a record changing and reproducing mechanism having a base plate 1 supporting a horizontally rotatable turntable 2 upon which is shown a record 3 in position for reproduction. A pick-up device or reproducer 4 is supported at the end of a tone arm 5, which is pivoted at its opposite end about a vertical axis to permit the reproducer to move across the face of the record as the needle of the reproducer follows the groove of the record.

Fig. 2, which is a side elevation of the record changing mechanism, shows in greater detail the manner in which a number of unplayed records 6 is supported above the turntable in a stack by means of diametrically opposite record supports 7-7, which are secured to and extend upwardly from the base plate 1. The record supports 7-7 are provided at their upper ends with supporting brackets 9, 10. These brackets engage opposite peripheral edges of the lowermost record of the stack in the manner shown in the drawings, flanged portions 9a, 10a, respectively, being used to support ten-inch records while flanged por-

tions 9b, 10b, respectively, are used to support twelve-inch records when the brackets 9, 10 are rotated 90 degrees in a manner presently to be described.

Each of the brackets 9, 10 is mounted upon the upper end of a tubular shaft 11 which is rotatable about a vertical axis within the supports 7-7. Secured to the lower end of each shaft 11 is a sprocket wheel 12, as clearly shown in Fig. 4. The sprocket wheels are mechanically connected to move in unison by a link chain 13. This insures that the supporting brackets 9, 10 are always rotated together to either the ten-inch or twelve-inch record-supporting position, where they are there locked in a manner hereinafter to be described in greater detail. It is evident that the manual manipulation of either one of the brackets 9, 10 from the ten-inch to the twelve-inch supporting position or vice versa causes a simultaneous movement of the other support to the corresponding supporting position. In similar fashion, both brackets 9, 10 further may be rotated together out of the way when unloading played records from the phonograph turntable.

The turntable 2 is provided with a centering spindle 14 which extends upwardly and terminates in a tapered portion 16, the tapered portion greatly facilitating the loading of the records upon the brackets 9, 10. The centering spindle is provided with a notch 17 formed in one side of the spindle at approximately the elevation of the lowermost record of the stack. As illustrated in Figs. 2, 6 and 7 of the drawings, notch 17 is formed to extend into the stack of records through the two lowermost supported records whereby a warped record may be moved laterally without jamming between the plunger 18 and the tapered portion 16. The movement of the notched spindle about its axis is timed with the reciprocatory movement of a plunger 18, presently to be described in greater detail, provided in the bracket 10. The plunger 18 is arranged to engage the edge of the lowermost record and to move this record laterally (normal to the axis of the spindle) so that the central aperture of the record moves into the notch 17 of the spindle and the opposite peripheral edge of the record moves into a notch 19 provided in the bracket 9. The notch 19 and the notch 17 permit the record to move sufficiently far to the left so that the right-hand edge of the record drops off of the bracket 10.

When the lowermost record has been moved laterally in this manner to the position shown in the fragmentary view of Fig. 6, the record is freed from the right-hand support, not shown, as previously stated, and begins to fall. Thereafter the force of gravity on the falling record disengages its other peripheral edge from the opposite supporting bracket 9 and the moved record is free to fall to playing position on the turntable. Normally the record drops to the turntable within a time period equivalent to that required for a few degrees of rotation of the spindle, so that the portion 17 of the spindle does not withdraw the record from the supporting bracket 9. However, if it should happen that the record did not drop to the turntable within such a time period, the rotation of the notched portion 17 of the spindle would be effective to move the falling record in a direction opposite to its first lateral movement and a distance equivalent to that of its first lateral movement. Having moved the record this distance, the spindle surface necessarily guides the record toward

the turntable until the distance between bracket 9 and the point of engagement between the record and the spindle is greater than the radius of the record at which time the record must drop freely over centering spindle 14, into playing position upon the turntable.

The left-hand bracket 9 has a small spring-biased pin 21, presently to be described in greater detail, which prevents the lowermost record from moving laterally by vibration or otherwise into releasing position prior to the time when the record is moved by the action of the plunger 18 provided in the bracket 10.

The turntable 2 is driven by a friction wheel 22A, shown in dotted lines under the left-hand flange of the turntable in Fig. 2, which is operatively connected through shaft 22 with an electric motor 23.

The detailed construction of the right-hand support is shown in Fig. 8. The bracket 10 is provided with a pair of channels 24 and 25 which support and guide in a reciprocatory motion a pair of plungers 18 and 26 respectively. Each of the plungers is biased by a respective spring 27 and 28 to the position shown in the drawings, and each is actuated and moved against the bias of its spring by a pin 29 which extends through the hollow shaft 11 and is arranged to be movable within the shaft by the provision of a pivotal bearing 30 positioned near the midpoint of the pin. Fixedly secured to the lower end of the pin 29 is a cam 31 normally biased forwardly, by the biasing action of one of the springs 27 or 28, into the path of movement of a pin 32 provided on a gear 33. The cam 31 is guided in a reciprocatory motion by a channel 35 provided in a supporting bracket 34. The reciprocatory motion of the cam and lower end of the pin 31 is transmitted by virtue of the pivotal bearing 30 to the upper end of the pin and thereby to one of the plungers 18 or 26. When the bracket 10 is in the position shown in Fig. 8, the spring-biased plunger 18 is moved in response to the reciprocatory motion of the pin 29 and disengages ten-inch records from the flange 10a; rotation of the bracket 10 through an angle of 90 degrees places the plunger 26 in position to be actuated by the pin 29 to disengage twelve-inch records from the flange 10b.

The gear 33 of Fig. 8 is shown in complete form in the upper portion of Fig. 4. Adjacent the gear 33, and in working relationship therewith, is a pinion gear 36 fixedly secured to a shaft 37 which supports and moves with the turntable. It will be noted that several teeth have been removed from the gear 33 at 38 to provide a mutilated gear. The purpose of the mutilation is to break the driving connection between this gear and the small pinion gear 36, after the gear 33 has rotated through a complete revolution and has completed one record-changing cycle.

When a record on the turntable has been completely played, the movement of the tone arm initiates the operation of a tripping mechanism, presently to be described, and causes the mutilated gear 33 to be moved sufficiently far so that its teeth mesh with the teeth of the pinion gear 36. The gear 33 is thereupon driven through one complete revolution about a shaft 39 and comes to rest again in the position shown in the drawings. As the gear 33 rotates, the pin 32 on this gear engages the cam 31 and effects a change of the lowermost record of the stack to playing

position on the turntable in the manner heretofore described.

The gear 33 is provided with a cam surface 40. An arm 41 is pivoted intermediate its ends on a bracket 42 and carries on one end a roller 43 which is biased by a spring 53 into engagement with the cam surface 40. The arrangement of these elements is more clearly seen by reference to Figs. 3 and 4 of the drawings. The roller 43, in following the cam surface 40 as the latter rotates, moves the left-hand end of the arm 41 vertically. The upward vertical movement of the left-hand end of the arm 41 raises a pin 44 vertically in a hollow shaft 45. The upper end of the pin 44 engages the under side of the tone arm 5 and the pin, in moving, raises the reproducer 4 from the surface of the record 3.

The tone arm 5 is supported on the upper end of the hollow shaft 45 which is rotatable within pedestal 53A, said pedestal being fixedly secured to the base plate 1. To the lower end of the hollow shaft 45 is fixedly clamped a lever 51. It will be evident that movement of the lever 51 effects a corresponding movement in a horizontal plane of the tone arm 5 and vice versa. Referring particularly to Fig. 4, it will be seen that the lower end of the lever 51 supports a pin 50 which moves within an aperture 49 provided in the heel of an L-shaped lever 47. The aperture 49 is sufficiently large so that the pin 50 may freely move with the lever 51 over a wide arc corresponding to the movement of the tone arm while playing a record. The lever 47 is pivoted at 48. A toe 47a of the lever 47 engages the surface of a cam 46 provided on the gear 33. The toe is continuously biased toward the cam surface by a biasing spring 52. After the reproducer has been raised from the surface of the record in the manner previously described, and as the gear 33 continues to rotate, the cam 46 moves the lever 47 in a counterclockwise rotation about its axis 48 and causes the right-hand side of the aperture 49 to engage and drive before it the pin 50. The pin, in moving, produces a corresponding movement of the lever 51 and therewith the reproducer, previously raised, in a radial direction away from the center of the record. The cam 46 is so shaped that the lever 47 ceases its counter-clockwise rotation at a time when the reproducer has been moved beyond the edge of the phonograph record.

The gear 33 continues to rotate, after the tone arm and reproducer have been moved beyond the periphery of the played record on the turntable, and engages the pin 32 with the cam 31 to cause the lowermost record of the stack to be dropped into playing position on the turntable in the manner previously described. Shortly thereafter, the cam 46 has moved to a point where the toe 47a of the lever 47 begins to move to the right under action of the spring 52. When this occurs, the left-hand edge of the aperture 49 engages the pin 50 and moves the pin, the lever 51 and the reproducer to a position where the reproducer needle is over the initial groove of the new record. The cam 40 has rotated by this time to the position shown in Fig. 3 where the contour of the cam permits the left-hand end of the lever 41 to drop vertically downward, thereby returning the needle of the reproducer 4 to playing engagement with the new record recently placed on the phonograph turntable.

The automatic record changing cycle of operations effected by a complete revolution of the gear 33 is initiated by the automatic trip mech-

anism, previously mentioned, which will now be described in greater detail. The tone arm 5, which has thus been lowered to place the phono-graph needle in engagement with the initial groove of the new record, is moved inwardly by the spiral groove on the record. The tone arm, in moving toward the center of the record, moves with it the hollow shaft 45 to which is frictionally connected a member 54 which is a part of a clutch mechanism 55. The detailed construction of the clutch mechanism is shown in Fig. 10 and will be described hereinafter. Referring particularly to Fig. 4, a lever 56 is pivotally supported at one end for rotation about the shaft 45. Thus, as the tone arm moves toward the center of the record as the record is played, the clutch 55 moves the lever 54 in a counter-clockwise direction as shown in Fig. 4. The lever 54 engages the side of the lever 56 (in a manner more clearly shown in Fig. 3) and thereby likewise moves the latter also in a counter-clockwise direction. The free end of lever 56 is formed at right angles to the lever and engages the lower end of a lever 57 which is pivoted intermediate its ends to the base plate 1. The upper end of the lever 57 engages the upper end of a lever 58 which is supported to rotate with the gear 33 and in a plane parallel to said gear. The lever 58 is pivoted intermediate its ends to the gear 33 so that said lever may be pivoted in a vertical plane (as shown in Fig. 4). When the lever 57 is moved out of engagement with the lever 58, the upper end tends to move away from gear 33 and the lower end of said lever 58 tends to move toward the gear 33 and into the path of movement of pin 59, which is fixedly secured to the same shaft that supports the small pinion 36.

Each time the gear 33 completes a revolution, the upper end of lever 58 engages the upper end of lever 57, which is so shaped that its engagement with lever 58 causes the upper end thereof to move toward the surface of gear 33 and the lower end to move out of the path of the pin 59.

As the tone arm approaches the inner groove of a record, it moves the lever 54, the lever 56 and the lever 57 in counter-clockwise directions. However, the lower end of the lever 57 carries a leaf spring 84 which lies in the path of movement of a cam 86 which is fixedly secured to the shaft 37. The cam 86 periodically strikes the spring 84 and moves the lever 57, and with it the levers 56 and 54, in a clockwise direction, the lever 54 changing its position with respect to the tone arm by virtue of the clutch 55. When the tone arm reaches the eccentric groove customarily provided as the inner groove of the record, the lever 54 can be moved in a clockwise direction only against the biasing action of the spring 63, as will presently be shown in greater detail when the construction of the clutch 55 is considered. When this occurs, the cam 86 may temporarily move the levers 57, 56 and 54 clockwise, but these levers are immediately thereafter returned in a counter-clockwise direction by the action of the spring 63. The return movement is sufficiently great so that the lever 57 is moved out of engagement with the lever 58. The latter thereupon moves under the action of its biasing spring to position the lower end of the lever 58 in the path of the pin 59. As the pin 59 rotates, it engages the lower end of the lever 58 and moves the lever, and therewith the gear 33, sufficiently far so that the teeth of the

gear 33 mesh with the teeth of the pinion 36, after which the pinion continues to drive the gear 33 through a complete revolution to effect the record-changing cycle heretofore described.

A fixed stop 85 is secured to the base plate 1 with its upturned end 86 positioned in the path of movement of the lever 54. As the tone arm is swung beyond the edge of the records during a record changing cycle, it moves the lever 54 in a clockwise direction (Fig. 4) into engagement with the stop 85. The engagement of these elements is effected, however, before the tone arm has swung to its outermost position, the lever 54 changing its angular position relative to the tone arm through the slipping connection between the tone arm and the lever 54 which is provided with the clutch 55. This positions the lever 54 well forward of the tone arm as the latter is returned toward the center of the record and ensures a positive engagement of the elements 54, 56 and 57 prior to the time when the needle of the reproducer is in the innermost groove of the record.

The construction of the clutch 55 is shown in detail in Fig. 10. A flanged sleeve 64 is fixed to the shaft 45 which also supports the tone arm. A member 54A, with an ear 62 and the lever 54 extending from it, is mounted in frictional engagement with the upper surface of the flange of member 64. A suitable washer 54B, preferably of fiber material, is placed over member 54A. A plate 60 with a turned-down ear 61 is placed over the washer 54B. A spring washer 60A is placed over plate 60. A flanged cover member 60B is fixed to the sleeve of member 64, preferably by being screwed to it so that the bottom of the flanged portion of the cover member 60B rests on the spring washer 60A. Said spring washer maintains an even frictional engagement between the plate 60 and the fiber washer 54B when the members 64 and 60B are screwed together. The spring 63 is connected to the outer flange of member 64 and the turned-down ear 61. Said turned-down ear and the ear 62 are so related that they are in contact with each other when the tone arm reaches the inner groove of the record. At such time, the cam 86, by means of the levers 54, 56 and 57, moves the ears 61 and 62 in a counterclockwise direction (as shown in Fig. 4) against the tension of spring 63. When the cam 86 moves out of relationship with levers 54, 56 and 57, the tension of spring 63 moves levers 54, 56 and 57 with enough force to release the upper end of lever 58 from engagement with lever 57, thus initiating a record-changing cycle.

When the record-supporting brackets 9 and 10 are in the position shown in Fig. 2, the respective flange portions 9a, 10a engage the peripheral edges of ten-inch records and support the records above the turntable 2. When the brackets 9, 10 are rotated manually 90 degrees, as illustrated in Fig. 5, the flange portions 9b, 10b engage the peripheral edges of twelve-inch records and support the records above the turntable. The brackets 9, 10 are locked in a selected position by the provision of a locking cam 65 (Fig. 4) secured to the lower end of the shaft 11 which supports at its upper end the bracket 9. The cam 65 is provided with notches 68, 70 and 72 which are engaged at different times by a pin 66 fixedly secured to the right-hand end of a lever 67. The lever 67 is pivotally connected intermediate its ends to the base plate 1 as shown in the drawings. A spring 69 is affixed to the left-hand end of the lever and

normally biases the pin 66 into continuous engagement with one of the notches 68, 70 or 72. The notch 68 corresponds to the positioning of the brackets 9, 10 for ten-inch records while the notch 70 corresponds to the position of the brackets 9, 10 for twelve-inch records. The notch 72 corresponds to a position of the brackets 9, 10 where the brackets are completely out of the way of records being removed from the turntable, an arrangement which facilitates unloading the played records.

It will be noted that the left-hand end of the lever 67 extends into engagement with a set screw 71 which is provided on the bottom end of the lever 47. The contour of the cam 65 is such that the left-hand end of the lever 67 allows less clockwise movement of the lever 47 under action of the biasing spring 52 whenever the pin 66 of the lever 67 engages the notch 70 which corresponds to the setting of the mechanism to play twelve-inch records. This limited angular movement of the lever 47 insures that the tone arm is properly returned to the initial groove of twelve-inch records, a return which it will be appreciated is less than that required where the tone arm is returned to the initial groove of ten-inch records. It is thus evident that the manual positioning of the brackets 9, 10 to either ten or twelve-inch record-supporting positions automatically sets the limit of return movement of the tone arm and reproducer to insure that the reproducer needle is in proper position to engage the initial groove of the particular size record being played.

Fig. 4 shows quite clearly the manner in which the link chain 13 mechanically connects the sprocket wheels 12 which are fixedly secured to the lower ends of the shafts 11. The link chain 13 is maintained under tension by a pair of idler pulleys 73.

The complete operation of the record changing mechanism will now be obvious from the above detailed description of the operation of its component parts. After a stack of records has been placed upon the appropriate brackets 9a, 10a or 9b, 10b and a record has been placed in playing position upon the turntable 2, the tone arm 5 is manually moved to place the needle of the reproducer in the starting groove of a record. The tone arm 5 moves inwardly as the needle of the reproducer follows the spiral groove of the record and eventually reaches the inner groove where the automatic trip is operated by corresponding movement of the levers 54, 56 and 57 with the tone arm, the levers 57 and 58 disengaging to permit the lower end of the lever 58 to move into the path of the pin 59 provided on the shaft of the pinion gear 36. Engagement of the pin 59 with the lower end of the lever 58 causes the gear 33 to be rotated until the teeth of this gear mesh with those of the pinion 36, after which the gear 33 is driven by the pinion through a complete revolution. As the gear 33 rotates, the cam surface 40 moves the lever 41 and raises the reproducer off of the record. Continued movement of the gear 33 causes the cam surface 46 to move the lever 47 and therewith the lever 51 to swing the tone arm beyond the edge of the played record. Shortly thereafter, the pin 32 on the gear 33 engages the cam 31 and moves the latter to cause a corresponding movement of the plunger 18 (or 26, depending upon the setting of the brackets 9, 10). The plunger 18 engages the edge of the lowermost record of the stack of records 6 and, since the plunger moves in timed relation with the spindle 14, moves the lowermost record in a direction

normal to the axis of the spindle sufficiently far so that the edge of the record drops off of its supporting bracket. The released edge of the record thereupon falls toward the turntable and the record, in falling, drags its opposite edge off of the other supporting bracket. This completely releases the record which is guided by the spindle 14 into playing position upon the phonograph turntable. The gear 33 has by this time rotated sufficiently far so that the cam 46 allows the lever 47 to move clockwise under the action of the biasing spring 52, thereupon to return the tone arm and reproducer to a position where the needle of the reproducer is over the starting groove of the record newly placed upon the turntable. At this time, the cam surface 40 has rotated to the point where the lever 41 permits the reproducer to descend into engagement with the record. Immediately thereafter, the gear 33 comes to rest in the position shown in Fig. 4 of the drawings. This completes one cycle of the automatic record changing operation. The next and following cycles of automatic operation are initiated by the automatic trip mechanism each time the reproducer needle moves to the last groove of the record.

In addition to the automatic trip mechanism previously described, there is also provided a manual, spring-biased trip lever 74 (Fig. 4) whose lower end is bent and extends through a slotted aperture in the base plate 1 to support on its end a small knob 75 (Fig. 1). The lever 74 is normally biased by a spring 77 out of engagement with the turned-over lower end of the lever 57, but may be manually moved to engage the lower end of the lever 57 thereby to move the upper end of the lever out of engagement with the trip lever 58 to manually trip the mechanism and initiate a cycle of automatic record changing operations.

The detailed construction of the record-supporting bracket 9 is shown in Fig. 9. The bracket is provided with a pair of plungers 21 and 78 which extend into a pair of respective notches 19 and 79. A channel 80 is provided to support and guide in a reciprocatory motion the plunger 21 which is normally biased by a spring 81 to the position shown in the drawings. The plunger 78 is supported and biased in a manner similar to that of the plunger 21. The purpose of the plungers 21 and 78 is to prevent the lowermost record of the stack from moving laterally into notches 19 and 79 under the action of mechanical vibration until the record is deliberately moved by the plungers 18 and 26.

A modified centering spindle construction is shown in Fig. 5. The upper end of the spindle 14 is reduced at 82 from the top to a point below the plane of the lowermost record of the stack. This construction facilitates loading and unloading the record changing mechanism with records. It may be noted that while the upper end of the spindle is reduced in the manner shown, the rotation of the spindle will insure that the central apertures of the records remain aligned to properly position the records upon the supporting brackets 9, 10.

A modification of the centering spindle 14 is shown in Fig. 11 of the drawings. The spindle here shown has the notched portion 17 previously described, but additionally is provided with a shoulder 83 at an elevation, corresponding to the lower end of the slot 17, which is below that of the lowermost record of the stack. It has been found that the provision of this shoulder greatly reduces and minimizes the noise which results from the

impact of a record falling from the stack of records previously placed on the turntable. After the right-hand edge, not shown, of the lowermost record has dropped off of its supporting bracket in a manner previously described, the record is temporarily supported adjacent its central aperture by the shoulder 83 during a short interval of time while the spindle 14 continues to rotate. This insures that the record is temporarily supported at an elevation much closer to the turntable than was the case when the lowermost record was entirely supported by its peripheral supports. Thereafter the continued rotation of the spindle permits the reduced portion 17 to engage the wall of the moved record at its centering aperture and move the record in the direction of the arrow shown in Fig. 11. However, the record can only move back to its original position with respect to the left peripheral supporting bracket 9 under the direct influence of spindle portion 17. After the record assumes its original position with respect to bracket 9, it is then in alignment with portion 83 of the spindle at which time the force of gravity effects the fall of the record. As the record falls, the distance between bracket 9 and the point of engagement between the record and the spindle becomes greater than the radius of the record whereby the record is free of that bracket. At this time the record falls to a playing position on the turntable in a plane substantially parallel thereto. Since the ultimate velocity which the record will acquire in falling varies as the square of the time required for the record to fall, the act of stopping the initial falling movement of the record by the shoulder 83 obviously results in a reduced velocity acquired by the record at the instant of its impact with records previously placed on the turntable. It is clear that in reducing the speed of the falling records and modifying their movement so that they fall in a plane substantially parallel to the turntable, the noise caused during the record-changing cycle is reduced substantially. The reduced velocity also reduces the tendency of the edge of the falling record to dent the playing surface of a record already on the phonograph turntable.

A record changing mechanism embodying the invention has a number of distinct advantages over prior record changing mechanisms of this type.

The invention permits the use of a unitary spindle which functions not only to guide records successively released from the stack of records into playing position on the turntable, but also functions to maintain the stack of records in proper position upon the supporting brackets which are positioned in spaced relation around the phonograph turntable. By forming the spindle in the manner taught by the invention, the lowermost record may be physically moved in timed relation with the movement of the spindle to initiate the release of the lowermost record from its supporting means; yet the contour of the spindle is such that the spindle maintains even the lowermost record of the stack in position upon the record supporting brackets prior to the bodily movement of the record to effect a record changing operation. Additionally, this unitary spindle has portions so formed that the falling movement of the record toward the turntable is broken in order that the velocity of the falling record be reduced as much as possible, thereby reducing to a minimum the noise which the falling record makes upon its impact

with other records previously placed on the turntable and reducing the tendency of the falling record to produce dents in the playing surface of other records, an advantage which becomes of increasing importance when very expensive records or records of rare recordings are played. The reduction of the velocity of the changing record in this manner obviously reduces the chances of chipping or breaking records by impact with other records.

A phonograph mechanism constructed in accordance with the invention has the further advantage that the mechanism automatically changes records without regard to whether the record is perfectly flat or has become warped. This is a distinct advantage since records which have become more or less permanently warped may be stacked indiscriminately with unwarped records and yet they will be handled by the machine in the same manner as though all of the records were perfectly flat.

The record supports which support a stack of records above the turntable must, of course, be adjusted to different positions radially of the turntable in order that the supports may accommodate records of different diameter. This is accomplished in accordance with the invention merely by setting manually one of the supports to the desired position corresponding to the size of the stack of records to be played, the manual adjustment of this support being transmitted by mechanical interconnection to the remaining record supports to set the latter at the desired record supporting position. The setting of the supports in this manner predetermines in an automatic manner the positioning of the reproducer during the cycle of record changing operations over the starting groove of a record on the turntable, whereby the reproducer is automatically positioned over the starting groove of records of different size in accordance with the manual positioning of the record supports.

The invention has the important advantage from a commercial standpoint that it provides a greatly improved and simplified record changing mechanism construction whose reduced size requires a minimum of space in an enclosing cabinet structure.

While there has been hereinbefore described what is at present considered the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. An automatic record-changing apparatus comprising a rotatable turntable, means for supporting a stack of records above said turntable by engaging opposite peripheral edge portions of the lowermost supported record; a spindle rotatable with said turntable, extending upwardly therefrom through the centering apertures of said stack of records, and being normally out of engagement with said stack of records, said spindle having a centering portion and a recessed portion thereabove at and below the elevation of said lowermost supported record for permitting lateral and downward movement thereof; and means for moving said lowermost supported record laterally relative to said spindle for disengaging one of its peripheral edge portions from said supporting means, said lowermost record thereafter

falling to disengage its other peripheral edge portion from said record-supporting means.

2. An automatic record-changing apparatus comprising a rotatable turntable; a pair of oppositely disposed supports for supporting a stack of records above said turntable by engaging peripheral edge portions of the lowermost supported record; a spindle rotatable with said turntable, extending upwardly therefrom through the centering apertures of said stack of records, and being normally out of engagement with said stack of records, said spindle having a centering portion and a recessed portion thereabove at and below the elevation of said lowermost supported record for permitting lateral and downward movement thereof; and means for moving the lowermost supported record laterally relative to said spindle and out of engagement with one of said supports whereby said lowermost record thereafter drops out of engagement with the other of said supports.

3. An automatic record-changing apparatus comprising a rotatable turntable; a first and second support oppositely disposed relative to said turntable for supporting a stack of records thereabove by engaging peripheral edge portions of the lowermost supported record; positioning means on each of said record supports for maintaining the supported records in a centered position over said turntable, said positioning means on said first support including a spring-biased member for permitting lateral movement of the lowermost supported record; a spindle rotatable with said turntable, extending upwardly therefrom through the centering apertures of said stack of records, and being out of supporting engagement with said stack of records, said spindle having a centering portion and a recessed portion thereabove at and below the elevation of said lowermost supported record for permitting lateral and downward movement thereof; and means on said second support for moving the lowermost supported record laterally out of engagement with said second support whereby said moved record thereafter drops out of engagement with said first support.

4. An automatic record-changing apparatus comprising a rotatable turntable; a pair of oppositely disposed supports for supporting a stack of records above said turntable by engaging peripheral edge portions of the lowermost supported record; a spindle rotatable with said turntable, extending upwardly therefrom through the centering apertures of said stack of records, and being normally out of engagement with said stack of records, said spindle having a centering portion and a recessed portion thereabove at and below the elevation of said lowermost supported record for permitting lateral and downward movement thereof; a member slidably mounted on one of said supports for moving the lowermost supported record laterally out of engagement therewith, said record thereafter falling out of engagement with the other of said supports; and means for moving said record-moving member.

5. An automatic record-changing apparatus comprising a turntable; a pair of oppositely disposed supports for supporting a stack of records above said turntable by engaging peripheral edge portions of the lowermost supported record; a centering spindle rotatable with said turntable and extending upwardly therefrom; a reduced extension on said centering spindle and being eccentric relative to said centering spindle, said

extension extending through the plane of the lowermost supported record; means for moving the lowermost supported record laterally in a first direction to free it from one of said supports; and means on said spindle for interrupting the fall of said moved record by engaging the centering aperture edge thereof, said reduced extension thereafter engaging the wall of said moved record at its centering aperture and moving it opposite to said first direction for disengaging it from said interrupting means.

6. An automatic record-changing apparatus comprising a turntable, a pair of oppositely disposed supports relative to said turntable for supporting a stack of records thereabove by engaging peripheral edge portions of the lowermost supported record; a centering pin extending upwardly from said turntable; a reduced extension on said pin extending through the plane of the lowermost supported record; a record centering head carried by said extension lying in the plane of one of the records superimposed on said lowermost supported record, and being coaxial with said centering pin, and means for shifting the lowermost supported record laterally relative to said head for disengaging said lowermost supported record from one of said supports.

7. An automatic record-changing apparatus, comprising a rotatable turntable; a pair of diametrically opposed record supports relative to said turntable for supporting a stack of records thereabove by engaging peripheral edge portions of the lowermost supported record; a centering pin rotatable with said turntable and being out of supporting engagement with said stack of records; an eccentric reduced portion on said pin extending upwardly through the centering aperture of the lowermost supported record; and means for bodily shifting the lowermost supported record laterally in one direction relative to said supports for disengaging said lowermost supported record from one of said supports and bringing the wall at its centering aperture into engagement with said reduced extension, said reduced extension thereafter moving said lowermost record in the other direction with respect to supports.

8. An automatic record-changing apparatus comprising a turntable; a pair of diametrically opposed supporting plates relative to said turntable for supporting a stack of records above said turntable and in spaced relation thereto by engaging peripheral edge portions of the lowermost supported record; a centering pin rotatable with said turntable and extending upwardly therefrom; an extension on said pin extending through the centering apertures of the supported records and formed for permitting lateral displacement of the lowermost supported record while retaining other records of said stack in centered and supported position; means associated with one of said supports for engaging the peripheral wall of the lowermost supported record; and means for actuating said record-engaging means for displacing said record laterally relative to said extension to free it from one of said supports.

9. In an automatic phonograph the combination of a movable record-supporting plate; first and second record-supporting portions on said plate for cooperating in supporting a stack of records of different diameters at different times, said first portion cooperating in supporting a stack of records of smaller diameter by engaging the peripheral edge portion of the lowermost supported record thereof and said second portion co-

operating in supporting a stack of records of larger diameter by engaging the peripheral edge portion of the lowermost record thereof; first and second members operatively associated with said plate and adapted respectively to move with respect to said first and second portions when said portions are in record-supporting position for disengaging the lowermost supported record thereon; and means for moving said first and second members at different times.

10. In an automatic phonograph the combination of a movable record-supporting plate; first and second record-supporting portions on said plate angularly disposed relative to each other for cooperating in supporting a stack of records of different diameters at different times, said first portion cooperating in supporting a stack of records of smaller diameter by engaging the peripheral edge portion of the lowermost supported record thereof and said second portion cooperating in supporting a stack of records of larger diameter by engaging the peripheral edge portion of the lowermost supported record thereof; first and second members angularly disposed relative to each other and being associated with said plate to move therewith and to move relative thereto, said first member being adapted to move with respect to said first portion when said first portion is in record-supporting position and said second member being adapted to move with respect to said second portion when said second portion is in record-supporting position; and means common to said first and second members for moving said members at different times.

11. An automatic record-changing apparatus comprising a rotatable turntable; a spindle rotatable with said turntable, said spindle extending upwardly through the centering apertures of a stack of supported records and having a reduced portion at and below the elevation of the lowermost supported record; a pair of rotatable posts diametrically opposite relative to said turntable and being associated with each other to be moved in unison in a plurality of positions; a resilient means associated with one of said posts for maintaining said posts rigidly in one of said plurality of positions at different times; a pair of supporting plates connected to the upper ends

of said posts to move therewith, each of said supporting plates having a first portion for cooperating in supporting a stack of smaller records and a second portion for cooperating in supporting a stack of larger records at different times; a first member and a second member associated with one of said plates for moving respectively over said first and second portions for disengaging the lowermost supported record from said plate; and means common to said first and second members for moving said members at different times.

12. An automatic record changer for a phonograph, including oppositely disposed means for supporting a stack of records at its opposite marginal portions and above a turntable, a centering pin rotatable with said turntable normally free from supporting engagement with said records, said pin being provided with a reduced neck portion lying in the plane of the lowermost record in the stack to permit of limited lateral movement thereof, a record centering head carried by said centering pin and lying in the plane of one or more superimposed records of the stack, and means for shifting said lowermost record laterally with respect to said head and superimposed records to free one edge thereof from one of said supporting means, said pin having a camming surface engageable by said freed record for dislodging it from the opposite supporting means.

13. An automatic record changer for a phonograph, including a pair of diametrically opposed supporting plates for supporting a stack of records above and in spaced relation to the turntable, said stack being supported at its opposite marginal portions by said plates, means associated with one of said plates for engaging the supported edge of the lowermost record, means for actuating said record engaging means for displacing said record laterally to free it from said plate, a centering pin rotatable with said turntable, and an extension on said pin extending through the central openings of said records provided with a reduced neck portion for permitting limited lateral displacement of the lowermost record and a head portion for retaining the superimposed records in centered and supported positions.

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