

June 16, 1942.

A. L. KNOX

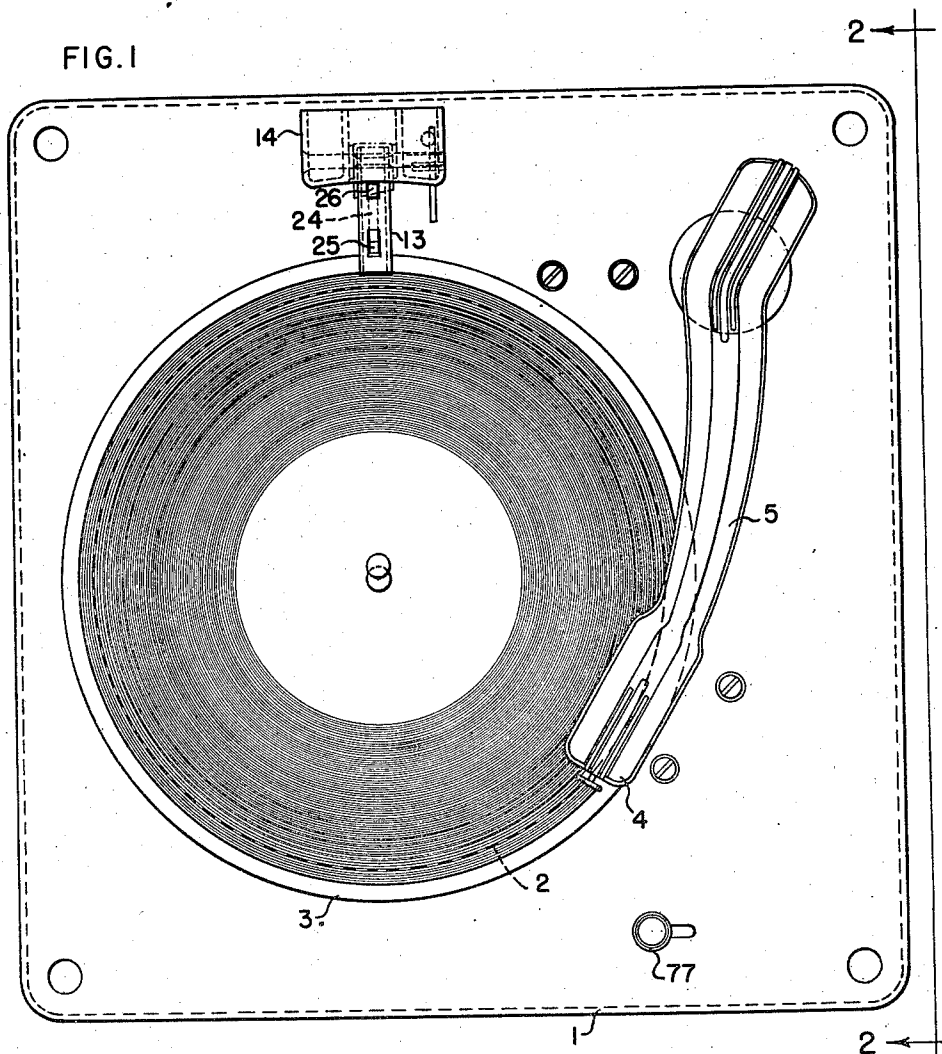
2,286,490

RECORD CHANGING APPARATUS

Filed April 29, 1940

5 Sheets-Sheet 1

FIG. 1



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FIG. 2

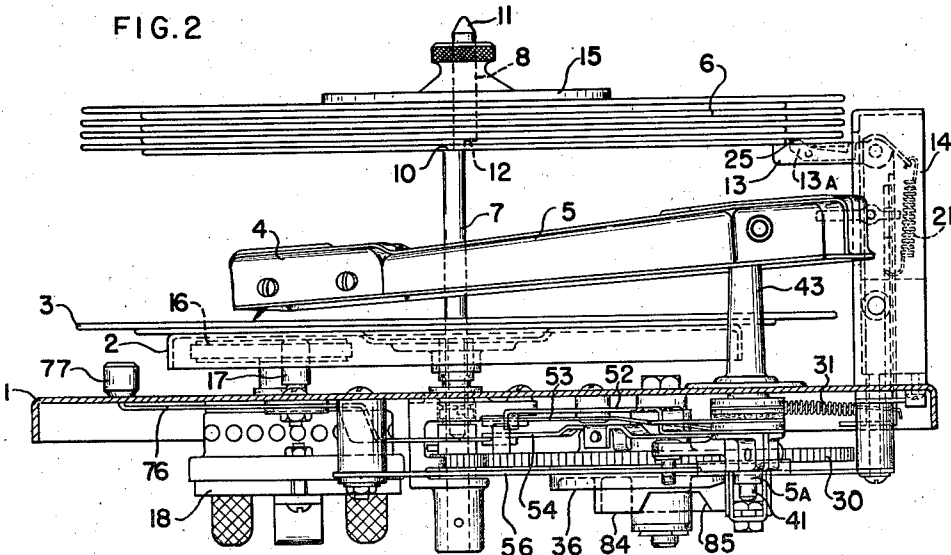
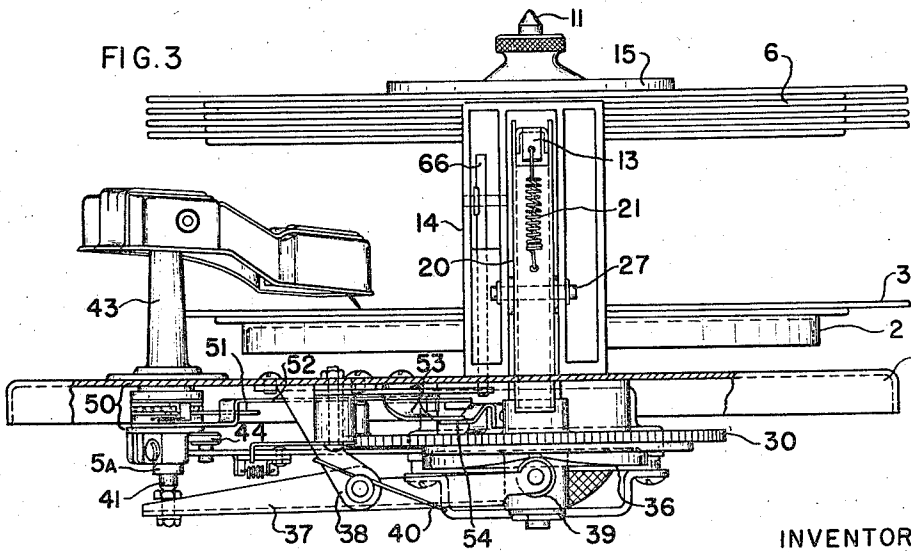


FIG. 3



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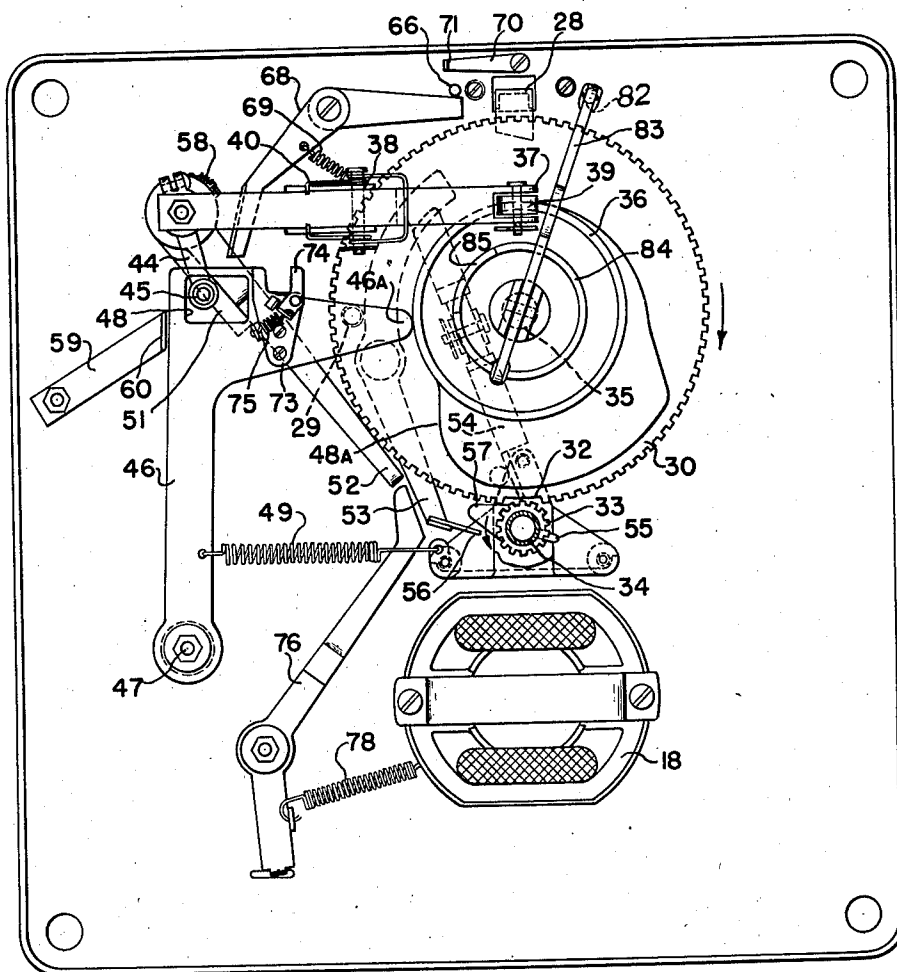
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RECORD CHANGING APPARATUS

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FIG. 4



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FIG. 5

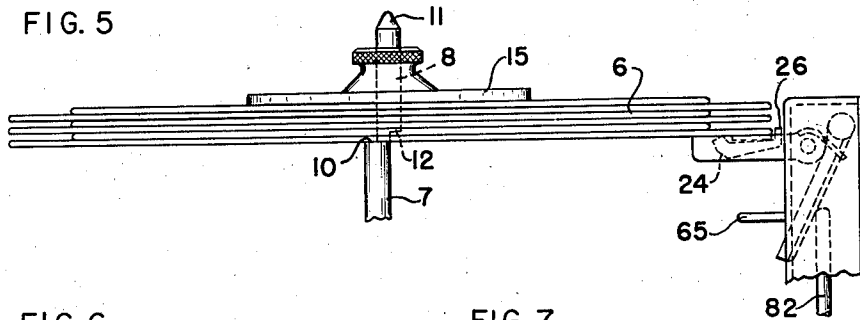


FIG. 6

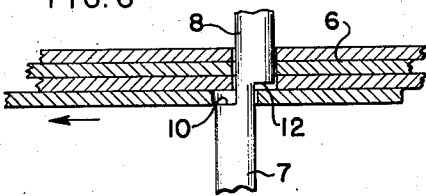


FIG. 7

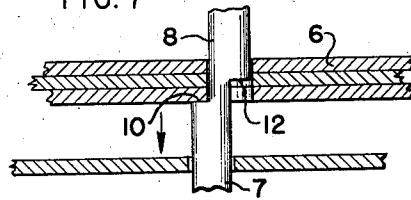


FIG. 8

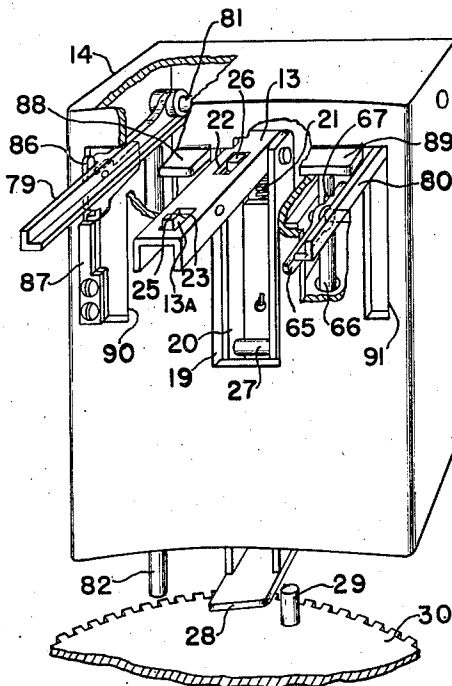


FIG. 9

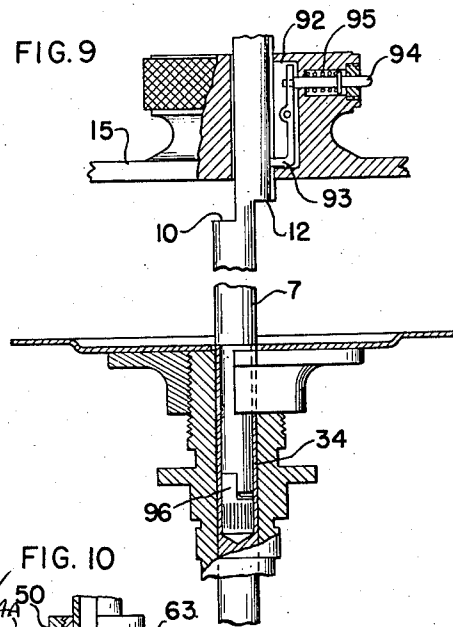
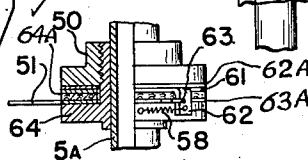


FIG. 10



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FIG. II

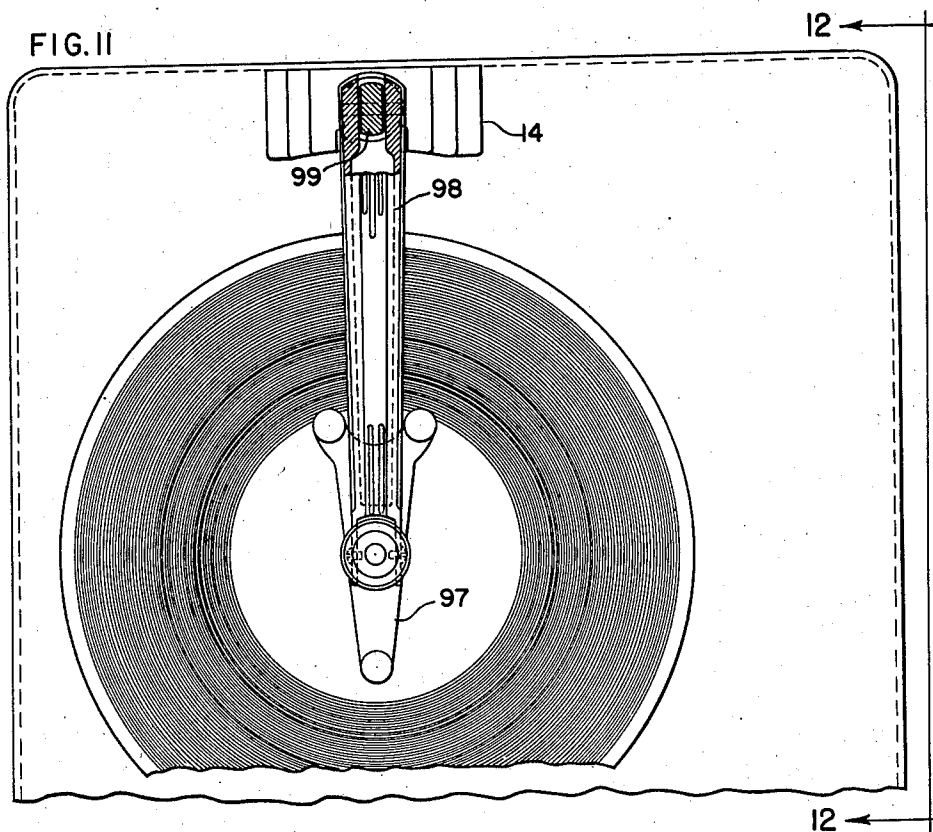


FIG. 12

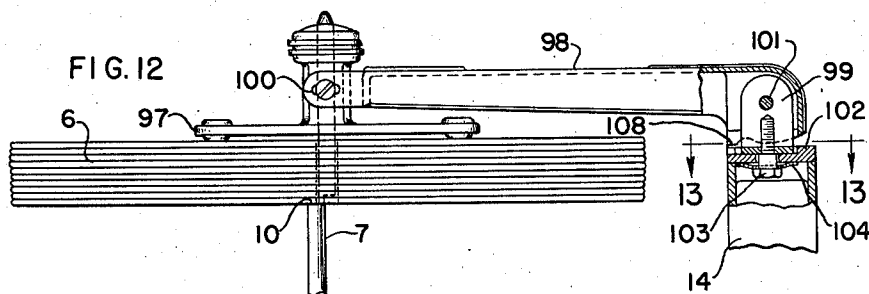
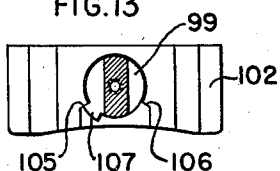


FIG. 13



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RECORD CHANGING APPARATUS

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Application April 29, 1940, Serial No. 332,252

13 Claims. (Cl. 274—10)

This invention relates to phonograph apparatus and more particularly to an improved phonograph record changer of the type wherein a stack of records of two different sizes is supported adjacent to a phonograph turntable.

Record changing apparatus of various constructions have been built previously, embodying arrangements whereby new records are automatically placed in the position of played records. In one form of these automatic record changers of the prior art, the records are stacked above the turntable and the lowermost record of the stack is released from the stack to move upon the turntable by means of a releasing mechanism in the nature of a knife which effectively cuts between the lowermost two records of the stack. In other forms of apparatus of this general type, the lowermost record of the stack is released by means of a moving member which engages the central aperture of the record. In record changing apparatus of the former type, the knife-releasing members tend to strike the edges of the records, thereby damaging the records and frequently jamming the mechanism. In record changing apparatus of the second-mentioned type, the moving member in time lacerates the edges of the record adjacent the aperture to such an extent that the record aperture frequently becomes so enlarged that the record can no longer be properly centered upon the turntable. Another disadvantage of these prior record changers is that their use is limited to records that are substantially flat. Records which are warped to any appreciable extent cannot be used with such apparatus.

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

A further object of the invention is to provide a record changing apparatus which operates with a minimum amount of noise and which does not damage the records by denting or chipping or by damaging the centering aperture.

A further object of the invention is to provide a record changing apparatus which operates efficiently even if the records are appreciably warped.

The invention possesses other objects and features, which will be clear from the following description.

In accordance with the present invention, supports are provided for a stack of records of different diameters. The supports include a spindle with a shoulder which supports the records at their centers, peripheral supports for records of

relatively small diameter and peripheral supports for records of relatively large diameter. A mechanism actuated by a record of relatively large diameter, when it moves in position of the lowermost supported record, moves the peripheral supports for the records of relatively small diameter out of normal supporting position. These peripheral supports for the smaller records automatically return to their normal supporting position after the larger record is moved from its supports to the turntable.

In accordance with another feature of this invention, a mechanism is provided which is automatically adjustable to disengage records of different diameters so that they fall in a substantially flat position to the playing position on the turntable. The advantages of this record-disengaging mechanism is that it reduces to a minimum chipping the sides of the records and scratching the surface of the records, and it does not damage the centering apertures of records so as to affect their centering function.

In accordance with another feature of this invention, a mechanism is provided for positioning the pickup arm at the starting groove of records of different sizes. Normally the mechanism is set to position the pickup arm at the starting groove of records of relatively small diameter. When a record of relatively large diameter is released from its supports, it trips a locking means which allows the pickup arm control mechanism properly to position the pickup arm at the starting groove of the larger record.

In accordance with another feature of this invention, a clutch mechanism controlled by the pickup arm is provided which is responsive to the movement of the pickup arm when it reaches the end of the record and initiates the record changing cycle.

In one embodiment of the invention, a weight, preferably slidably mounted on the spindle, is provided for balancing the records and forcing them downwardly into position to be released. The weight may be provided with a locking device for engaging the spindle. In this embodiment the spindle is removably locked to a shaft. When the locked weight is lifted for the purpose of removing the played records on the turntable and for reloading the record supports, the spindle is moved out of engagement with the shaft. The advantages of this embodiment of the invention are the ease with which the record changing apparatus may be reloaded and the reduction to a minimum of vibration noises.

In another embodiment of the invention, the

weight for balancing the supported records and forcing them into a releasable position may be pivotally mounted upon an arm and may be lifted above the end of the spindle and moved past the peripheral edge portions of records on the turntable.

In another embodiment of the invention, the records are supported solely by the spindle and balanced in position by the weight mounted on the spindle above the supported records.

For a better understanding of the invention, together with other and further objects thereof, reference is made 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 without any unplayed records;

Fig. 2 is a side elevation of the record changer showing a group of records supported over the turntable and two records on the turntable in playing position, as viewed from 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 pickup arm;

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

Fig. 5 is a partial side elevation, showing a larger record in position to be released with the record supports for the smaller records dropped out of the path of the larger record;

Figs. 6 and 7 are fragmentary views showing various positions of records in relation to the centering spindle 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 the disappearing supports for the peripheral edge portions of the smaller records, the fixed supports for the peripheral edge portions of the larger records, and the mechanism for releasing records of different diameters from their supports;

Fig. 9 is a fragmentary view showing the removable offset centering spindle, with a modification of the weight for balancing records upon the shoulder of said centering spindle.

Fig. 10 is a view of the friction clutch assembly used in the record changing apparatus;

Fig. 11 is a top plan view of the record changer showing a modification of the weight supported by a pivoted arm for balancing a stack of records upon the support above the turntable;

Fig. 12 is a partial side elevation of the record changer showing a group of records supported by the centering spindle and a partial sectional view of the arm supporting the weight upon the records, as viewed from line 12—12 of Fig. 11; and

Fig. 13 is a view taken on line 13—13 of Fig. 12, showing the means for limiting the horizontal movement of the weight supporting arm when it is manually moved.

Referring now more particularly to Fig. 1 of the drawings, the invention here illustrated embodies a record changing and reproducing apparatus including a base plate 1 supporting a horizontally rotatable turntable 2, upon which is shown a record 3 in position for reproduction. A pickup device or reproducer 4 is supported at the end of a pickup arm 5, which is pivoted at its opposite end about the vertical axis of shaft 5A (see Figs. 2 and 3) 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 apparatus, shows in greater detail the manner in which a number of unplayed records 6 are supported in a stack above the turntable by means of a spindle 7 which extends above the turntable 2. The spindle 7, presently to be described in greater detail, is provided with an offset end 8 which is formed a suitable distance above the turntable 2, thus forming a left shoulder 10 which engages the periphery of the centering aperture of the lowermost record of the stack of supported records in the manner shown in the drawings. The spindle 7 terminates in a tapered portion 11, the tapered portion greatly facilitating the loading of the records upon the shoulder 10.

The offset portion of the spindle has a right shoulder 12 at its lower end and at such elevation that the lowermost supported record can move under it. A pivoted spring biased lever 13 with a toggle member 13A fixed in a housing 14, presently to be described in greater detail, is arranged to engage the edge of the lowermost supported record and move this record normal to the axis of the spindle so that the centering aperture of the record moves from under the right shoulder 12 of the spindle and over the left shoulder of the spindle.

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 shoulder 10 and begins to fall substantially flat to the turntable, as shown in Fig. 7, and is guided by the spindle 7 into playing position upon the turntable.

The supported records 6 are balanced upon the shoulder 10 of the centering spindle in a substantially horizontal position by a suitable weight 15 slidably mounted on the offset portion 8 of the centering spindle 7. The weight 15 rests on the top record of a stack of supported records to exert a downward steadying pressure thereon.

The turntable 2 is driven by a friction wheel 16 shown in dotted lines under the left-hand flange of the turntable in Fig. 2, which is operatively connected through a friction wheel 17 with an electric motor 18.

The detailed construction of the mechanism in the housing 14 is shown in Fig. 8. The housing 14 is provided with a channel 19 which guides with a reciprocatory motion a spring-biased channel-shaped lever 20. Pivotaly secured to the upper end of the lever 20 is the lever 13, which is biased by a spring 21 to the position shown in Figs. 2, 3 and 8 of the drawings and is actuated and moved against the bias of said spring by a record moving from the supports to the turntable. The lever 13 is provided with a pair of slots 22 and 23, which guide in a reciprocatory motion the toggle member 13A. The member 13A is provided with a pair of tips or projections 25 and 26. The lever and toggle member 13 and 13A, respectively, are moved by the channel-shaped lever 20, which is arranged to move within the channel 19 by means of a pivot pin 27 positioned near the midpoint of the lever 20.

Secured to the lower end of the lever 20 is a cam 28 normally biased by a spring 31 (see Fig. 2) in a forward position into the path of movement of pin 29 provided on a mutilated gear 30. The reciprocatory motion of the cam and lower end of the lever 20 is transmitted by means of the pivotal pin 27 to the upper end of the lever 20.

This reciprocatory motion moves the lever 13 with its toggled member 13A. With a ten-inch or smaller record in position to be released as shown in Fig. 2, the tip 25 engages the peripheral edge of the record. When reciprocatory motion is transmitted to it by the lever 20, the smaller record is disengaged from the shoulder 10.

When a twelve-inch or larger record drops in position to be released from the support as shown in Fig. 5, the toggle member 13A is actuated and the tip 26 is moved in place to engage the peripheral edge of the record. Then when reciprocating action by the lever 20 is transmitted to lever 13 and toggle member 13A, the larger record is disengaged from the shoulder 10. It is to be noted that each time the pivoted lever 13 is actuated in the manner previously described for releasing records from the shoulder 10, the pivoted lever will move downwardly with the record and will be returned to its normal position by the action of its biasing spring 21 after the record has dropped in playing position upon the turntable.

Each time the cam 28 is actuated by the pin 29 on the mutilated gear 30, it is returned to the position shown in Fig. 8 by the action of the biasing spring 31 shown under the right-hand side of the base plate in Fig. 2.

The mutilated gear 30 of Fig. 8 is shown completely in the upper portion of Fig. 4. It will be noted that several teeth are removed from the gear at 32 to provide the mutilated portion. The purpose of the mutilation is to break the driving connection between this gear and a small pinion gear 33, fixedly secured to a shaft 34 which supports and moves with the turntable. After each complete revolution of the mutilated gear 30, the driving connection with pinion gear 33 is broken by the mutilated portion 32 and mutilated gear 30 comes to rest. One complete revolution of the mutilated gear 30 defines one complete cycle of record changing operation, as will be evident later.

When a record on the turntable has been completely played, the movement of the pickup arm initiates the operation of a tripping mechanism, presently to be described, and causes the mutilated gear 30 to be moved sufficiently far so that its teeth mesh with the teeth of the pinion gear 33. The mutilated gear 30 thereupon is driven through one complete revolution about its axis 35 and again comes to rest in the position shown in Fig. 4. As the mutilated gear 30 rotates, the pin 29 on the gear engages the cam 28 and effects a change of the bottom supported record to playing position on the turntable in the manner heretofore described.

The mutilated gear 30 is provided with a cam surface 36. An arm 37, pivoted intermediate its ends on a bracket 38, carries a roller 39 at one end which is biased by a spring 40 into engagement with the cam surface 36. The arrangement of these elements is more clearly seen by reference to Figs. 3 and 4 of the drawings. The roller 39, in following the cam surface 36 as the latter rotates, moves the left-hand end of the arm 37 upwardly. This movement of the left-hand end of the arm 37 raises a pin 41 vertically in the hollow shaft 5A. The upper end of the pin 41 engages the under side of the pickup arm 5 and raises the reproducer 4 from the surface of the record 3.

The pickup arm 5 is supported on the upper end of the hollow shaft 5A which is rotatable within a pedestal 43 fixed to the base plate 1. Lever 44 is fixedly clamped to the lower end of

the hollow shaft 5A. It will be evident that movement of the lever 44 effects a corresponding movement in a horizontal plane of the pickup arm 5 and vice versa. Referring particularly to Fig. 4 of the drawings, it will be seen that the free end of the lever 44 supports a pin 45 which moves within an aperture 48 in the heel of an L-shaped lever 46. Aperture 48 in the L-shaped lever 46 is sufficiently large so that the pin 45 under control of the pickup arm may freely move within it. The L-shaped lever 46 is pivoted at 47. The toe 46A of the L-shaped lever 46 engages the surface of a cam 48A provided on the mutilated gear 30. The toe is continuously biased toward the cam surface by a biasing spring 49. After the reproducer on the pickup arm has been raised from the surface of the record in the manner previously described, and as the mutilated gear 30 continues to rotate, the cam 48A moves the L-shaped lever 46 in a counter-clockwise direction about its axis 47 and causes the right side of the aperture 48 to engage and drive before it the pin 45. The pin, in moving, produces a corresponding movement of the lever 44 and the pickup arm in a radial direction away from the center of the record. The cam 48A is so shaped that it moves the L-shaped lever 46 in a counter-clockwise direction at a time when the needle of the reproducer has been raised out of engagement with a record on the turntable.

The mutilated gear 30 continues to rotate after the pickup arm and reproducer have been moved beyond the peripheral edge of the played record on the turntable, and engages the pin 29 with the cam 28 to cause the bottom supported record to be dropped into playing position upon the turntable in the manner previously described. Shortly thereafter, the cam 48A has moved to a point where the toe 46A of the L-shaped lever 46 begins to move to the right under the action of the spring 49. When this occurs, the left-hand edge of the aperture 48 engages the pin 45 and moves the pin, the lever 44 and the reproducer to a position where the reproducer needle is over the initial groove of the new record.

The cam 36 has rotated by this time to the position shown in Fig. 3, where the contour of the cam permits the left-hand end of lever 37 to drop vertically, thereby returning the needle of the reproducer 4 to playing engagement with the new record recently placed on the turntable.

The automatic record changing cycle effected by a complete revolution of the mutilated gear 30 is initiated by the automatic trip mechanism, previously mentioned, which will now be described in greater detail. The pickup arm 5, which has thus been lowered to place the phonograph needle in engagement with the initial groove of the new record, is moved inwardly by the spiral groove on the record. The pickup arm, in moving toward the center of the record, moves with it the hollow shaft 5A. The hollow shaft has secured to it a clutch 50, which frictionally engages a lever 51. The detailed construction of the clutch will be described hereafter. Referring particularly to Fig. 4 of the drawings, a lever 52 is pivotally supported at one end for rotation about the shaft 5A. Thus, as reproduction goes on and the pickup arm moves toward the center of the record, the clutch 50 moves the lever 51 in a counter-clockwise direction as shown in Fig. 4. The lever 51 engages the side of the lever 52 (in a manner more clearly shown in Fig. 3) which also moves in a counter-clockwise direction. The free end of the

lever 52 is formed at right angles to it and engages the lower end of a lever 53 which is pivoted intermediate its ends. The upper end of the lever 53 normally engages the upper end of a lever 54 which is secured to rotate with the mutilated gear 30. The lever 54 is pivoted intermediate its ends. Its upper end (as shown in Fig. 4) tends to move away from the mutilated gear 30, and the lower end tends to move toward the mutilated gear 30 and into the path of movement of a pin 55 which is fixed to the same shaft that supports the small pinion 33.

Each time the mutilated gear 30 makes a complete revolution, the upper end of the lever 54 engages the upper end of lever 53, which is so shaped that its engagement with the lever 54 causes the upper end of the lever 54 to move toward the surface of the mutilated gear 30, the lower end of the lever 54 thus moving out of the path of the pin 55.

As the pickup arm approaches the inner groove of a record, it moves the levers 51, 52 and 53 in counter-clockwise directions. However, the lower end of the lever 53 carries a leaf spring 56 which lies in the path of a cam 57 which is fixed to the shaft 34. The cam 57 periodically strikes the spring 56 and moves the lever 53, and with it the levers 52 and 51, in a clockwise direction, the lever 51 changing its position with respect to the pickup arm by means of the clutch 50. When the pickup arm reaches the eccentric groove customarily provided as the inner groove of the record, the lever 51 (Fig. 4) can be moved in a clockwise direction only against the biasing action of a spring 58, as will presently be shown in greater detail when the construction of the clutch 50 is considered. When this occurs, the cam 57 may temporarily move the levers 53, 52 and 51 clockwise (as shown in Fig. 4), but these levers are immediately thereafter returned in a counter-clockwise direction by the action of the spring 58 on the lever 51. The return movement is sufficiently great so that the lever 53 is moved out of engagement with the lever 54. Thereupon the lower end of the lever 54 moves in the path of the pin 55. As the pin 55 rotates, it engages the lower end of the lever 54 and moves it, and therewith the mutilated gear 30, sufficiently far so that the teeth of the mutilated gear 30 mesh with the teeth of the pinion gear 33, after which the pinion continues to drive the mutilated gear 30 through a complete revolution to effect the cycle of automatic record changing heretofore described.

A fixed stop 59 is secured to the base plate 1, with its upturned end 60 positioned in the path of movement of the lever 51. As the pickup arm is swung beyond the edge of the records on the turntable during the record changing cycle, it moves the lever 51 in a clockwise direction (Fig. 4) into engagement with the stop 59. The engagement of these elements is effected, however, before the pickup arm has swung to its outermost position, the lever 51 changing its angular position relative to the pickup arm through the slipping connection between the pickup arm and the lever which is provided by the clutch 50. This positions the lever 51 well forward of the pickup arm as the latter is returned toward the center of the record and insures positive engagement of the elements 51, 52 and 53, prior to the time when the needle of the reproducer is in the innermost groove of the record.

The construction of the clutch is shown in detail in Fig. 10. A flanged sleeve 64 is fixed to

the shaft 5A which also supports the pickup arm. A plate 63A with the lever 51 and an ear 63 extending from it is mounted in frictional relationship with the upper surface of the flange of the member 64. A suitable fiber washer 64A is slipped over the plate 63A. A plate 61 with the turned-down ear 62 is placed over the fiber washer 64A. A spring washer 62A is placed over the plate 61. A flanged cover member 73 is screwed on the sleeve of member 64 so that the bottom of the flanged portion of the cover member 73 rests on the spring washer 62A. Said spring washer maintains an even frictional engagement between the plate 61 and the fiber washer 64A, when the members 64 and 50 are screwed together. The spring 58 is connected to the outer flange of the member 64 and the turned-down ear 62. Said turned-down ear and the ear 63 are so related that just prior to the time when the pickup arm reaches the inner groove of the record, the bar 63 comes in contact with the ear 62. When the pickup arm reaches the inner groove of the record, the cam 57 through the levers 53, 52 and 51 moves the ears 62 and 63 in a counterclockwise direction (as shown in Fig. 4) against the tension of the spring 58. When the cam 57 moves out of relationship with the levers 51, 52 and 53, the tension of spring 58 moves the levers 51, 52 and 53 with enough force to release the upper end of the lever 53 from engagement with the lever 54, thus initiating a record-changing cycle.

When a twelve-inch or larger record is released from its support above the turntable, in the manner previously described, the peripheral edge of the larger record engages a pivoted lever 65 (Figs. 5 and 8) as it drops to the turntable.

The lever 65 is pivoted intermediate its ends and is arranged to engage a pin 66, clearly shown in Figs. 4 and 8 of the drawings. In Fig. 8 it is seen that the lever 65 engages a notch 67 in the pin 66. Thus, when the lever 65 is actuated, the movement of the lever tends to raise the pin 66 vertically.

In the upper portion of Fig. 4, there is shown a spring biased lever 68. The lever 68 is pivoted intermediate its ends, and the right-hand end of the lever extends into engagement with the pin 66. A spring 69 is affixed to the lever 68 and normally biases the lever 68 into continuous engagement with the pin 66, as shown in the drawings.

A fixed stop 70 is secured to the base plate 1 with its upturned end 71 positioned in the path of movement of the right-hand end of the lever 68. When the pin 66 is raised, which is effected after the L-shaped lever 46 has been moved to its outermost position during a record changing cycle, the lever 68 is moved about its axis by its biasing spring 69. The movement of the lever 68 as described, causes the right-hand end of the lever to engage the stop 70, and the lower end of the lever to move into the path of movement of the upper end of the L-shaped lever 46.

It will be noted that a plate 73, which is fixedly secured to the upper end of the L-shaped lever 46, is provided with a pivoted spring-biased lever 74 which is capable of being pivoted only in a counter-clockwise direction. As the L-shaped lever 46 moves in a clockwise direction under action of the biasing spring 49 to move the pickup arm toward the initial groove of a record, the lever 74 moves about its axis as it passes the lower end of the lever 68 and is returned to the position shown in the drawings by a biasing spring 75. Then the heel portion of L-shaped

lever 46 and the upper end of the plate 73 engage the lower end of lever 68. This limits the inward movement of the pickup arm (described above), thus accurately positioning the pickup arm over the starting groove of a 12-inch record.

After a record is played and the pickup arm is again swung outwardly by means of the L-shaped lever 46, the lever 74, fixed thereto, moves the lever 68 clockwise to bring it back to normal position as shown in Fig. 4.

When the mechanism is set for playing twelve-inch or larger records as previously described, the pin 66 is supported by the right-hand end of the lever 68. After the larger record is played and the record changing cycle is initiated, the L-shaped lever 46 moves in a counter-clockwise direction and moves with it the lever 74 which in turn moves the lever 68. This counter-clockwise movement of the lever 68 permits the pin 66 to drop of its own weight, thus locking the lever 68 in the position as shown in the drawings. With the lever 68 in the latter position, as the L-shaped lever 46 moves in a clockwise direction under action of the spring 49, the reproducer of the pickup arm is returned to the initial groove of the smaller records. It is thus evident that the pickup arm automatically is set properly to position the pickup arm and reproducer needle in the initial groove of the particular record that is about to be reproduced.

In addition to the automatic trip mechanism previously described, there is also provided a manual, spring-biased trip lever 76 (Fig. 4). The lower end of this lever is bent to extend upwardly through a slotted aperture in the base plate 1. To this bent end of the lever 76 is affixed a knob 77 (Fig. 1). The lever 76 normally is biased, by a spring 78, out of engagement with the turned-over lower end of the lever 53, but the lever 76 may be moved manually to engage the lower end of lever 53, thereby moving the upper end of the lever 53 out of engagement with the trip lever 54 manually to trip the mechanism and initiate a cycle of automatic record changing.

In addition to the record support provided by the offset centering spindle previously described, there also may be provided peripheral supports for the intermixed records, the details of which are shown in Fig. 8. There is provided a pair of arms 79 and 80, the tops of which extend horizontally in the plane of the shoulder 10 of the centering spindle 7 (Fig. 5), which are arranged to engage the peripheral edge of a ten-inch or smaller record. The two arms 79 and 80 are connected mechanically by a shaft 81. A pin 82 is arranged to engage the under side of the arm 79 (Fig. 8) for raising the said arms. The pin 82 is raised and lowered by the action of a pivoted lever 83. The lever is pivoted intermediate its ends and the lower end of the lever is arranged to engage a cam surface 84 provided on the mutilated gear 30. The lower end of the lever 83 is biased into engagement with the cam surface 84 by the pin 82 (Fig. 4) which engages the upper end of the lever. The cam surface 84 is provided with a cutout portion 85, shown clearly in Fig. 2. When the gear 30 has rotated sufficiently far to cause the pickup arm to be moved beyond the edge of the records and to release the next record from the supports 79 and 80 in the manner previously described, the cam 84 on the mutilated gear 30 is in position so that the cutout portion 85 allows the lower end of the lever 83 to move toward the mutilated gear

30 and the upper end of the lever to move away from the mutilated gear 30, thus permitting the pin 82 to drop. If the bottom supported record is a twelve-inch or larger record as shown in Fig. 5, the peripheral edge of the record will engage and actuate a locking member 86 pivotally connected to the arm 79 (Fig. 8). The lower portion of the locking member 86 engages the upper end of a plate 87 and is released from said plate only when a larger record drops upon the upper end of said locking member to rotate said member in a counter-clockwise direction. When the locking member 86 is released and the pin 82 is lowered, the arms 79 and 80 are guided to the position shown in Fig. 5 by a pair of rectangular apertures 90 and 91 in the housing 14. The peripheral edge of the larger record then rests upon a pair of fixed supports 88 and 89. After the larger record has been released from the supports 10, 88 and 89 and has dropped upon the turntable in the manner previously described, the mutilated gear 30 has rotated to the point where the cam surface 84 again raised the lower end of the lever 83, thus raising the pin 82, and with it the arms 79 and 80, to the position shown in Fig. 8. The locking member 86, connected to the arm 79, is so shaped that when the arm 79 is raised back to supporting position, said locking member rotates by its own weight into engagement with the plate 87 to lock the arm 79. It is thus evident that the disappearing peripheral supports 79 and 80 are automatically dropped out of the path of a larger record, and, after said record has been released and drops upon the turntable, the supports are properly returned to a locked supporting position before the record changing cycle is completed.

A modification of the record balancing weight 15 is shown in Fig. 9 of the drawings. The weight here shown is provided with a cutout portion 92 which guides with a reciprocatory motion a pivoted lever 93. A spring-biased pin 94 is secured to the upper end of the lever 93. When the last record has been released from the supports and the weight has dropped upon the shoulder 10, the lever 93 is moved into engagement with the right shoulder 12 of the centering spindle 7 by the action of a spring 95 upon the pin 94. When the weight is manually lifted, the lower end of the spindle 7 is removed from engagement with a notched member 96 affixed to the shaft 34. Thus when the spindle is removed, the reproduced records may be easily removed from the turntable. The weight may be removed from the spindle by pressing the pin 94 inwardly against the tension of the spring 95.

A modified record balancing weight is shown in Figs. 11, 12 and 13 of the drawings. The weight 97 here shown is slidably mounted on the centering spindle the same as the weight previously described. Fig. 11 shows the weight 97 upon a stack of records and pivotally affixed to the left-hand end of an arm 98. The right-hand end of the arm 98 is shown to be pivotally mounted upon a support 99.

Fig. 12 shows a stack of records 6 supported upon the shoulder 10 of the centering spindle 7. An elongated aperture 100 is provided in the left-hand end of the arm 98 for eliminating any binding action between the weight and the centering spindle, when the weight is manually lifted off the records and also when the weight 97 is lowered by the release of the bottom records from the shoulder 10. The right-hand end of the arm 98 is shown to be pivoted on a pin 101 which

is frictionally affixed to the support 99. A base plate 102 is provided as a base for the support 99. The support 99 is affixed pivotally to the base plate 102 by means of a set screw 103. A spring washer 104 is provided for maintaining a desired frictional engagement between the support 99 and the base plate 102.

Fig. 13 shows the means provided for limiting the angular movement of the weight 97 and the arm 98. A pair of stops 105 and 106 is provided in the base plate 102. When the weight 97 is in the position shown (Fig. 11), an ear 107 on the support 99 engages the stop 105 as shown in Fig. 13. When the weight is manually lifted off the stack of records 6 and the weight and arm are moved in a counter-clockwise direction away from above the records, the ear 107 on the support 99 engages the stop 106. This limited angular movement of the arm 98 insures that the weight 97 is returned properly to engage the centering spindle when a new stack of records is placed upon the shoulder of the centering spindle, and also that the arm cannot be moved so far in a counter-clockwise direction as to engage and mar the interior of the phonograph cabinet. A stop 108 is provided on the arm 98 which rests upon the base plate 102 and maintains the arm in a horizontal position, when the arm is moved to its extreme counter-clockwise position. It is thus evident that the record balancing weight described above may be preferred over the types previously described in that the weight cannot be lost when removed from the centering spindle.

The complete operation of the record changing apparatus may now be understood from the above detailed description of the operation of its component parts. After a stack of records has been placed upon the shoulder support 10 of the centering spindle 7, 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 pickup 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 mechanism is operated by corresponding movement of the levers 51, 52, 53 and 54, the levers 53 and 54 disengaging to permit the lever 54 to move into the path of the pin 55 provided on the shaft of the pinion gear 33. Engagement of the pin 55 with the lower end of the lever 54 causes the mutilated gear 30 to be rotated until the teeth of this gear mesh with those of the pinion 33, after which the mutilated gear 30 is driven by the pinion through a complete revolution. As the mutilated gear 30 rotates, the cam surface 36 moves the lever 37 and raises the reproducer off the record. Continued movement of the mutilated gear 30 causes the cam surface 48A to move the L-shaped lever 46 and therewith the lever 44 to swing the pickup arm beyond the edge of the played record. Shortly thereafter, the pin 29 on the mutilated gear 30 engages the cam 28 and moves the latter to cause a corresponding movement of the pivoted lever 13. The pivoted member 13A of the lever 13 engages the edge of the lowermost supported record and moves this record in a direction normal to the axis of the spindle sufficiently far so that the record drops off its support. The released record is guided by the spindle 7 into playing position upon the phonograph turntable. The mutilated gear 30 has by this time rotated sufficiently far so that the cam 48A allows the L-shaped

lever 46 to move clockwise under the action of the biasing spring 49, thereupon to return the pickup 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.

If the record that was just released was a larger record, as it dropped to the turntable its peripheral edge portion tripped the pivoted lever 65. The movement of lever 65 raised lever 66 out of engagement with the spring-biased lever 68. The left end of lever 68 then moved into the path of lever 74 fixed to L-shaped lever 46. When the reproducer of the pickup arm moved over the larger record, its movement was governed by the series of levers 44, 46, 74 and 68 to position it over the starting groove of the larger record.

When all of the supported records have been released into playing position on the turntable, the weight 15 has slipped into locking position on the spindle. By pulling upwardly on the weight, the spindle 7 is released from the locking device 96. This facilitates removing the played records from the turntable. In order to reload the record changing apparatus for further operation, the spindle is locked back into position by locking device 96. Then the weight 15 is removed from the spindle by pressing lever 94 and pulling upwardly. Next, a stack of records is placed on shoulder 10 of the spindle and the weight 15 is replaced on the spindle to keep the records in equilibrium in their supported position. Thus the record changing apparatus is ready for further operation.

While there has been heretofore 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 fixed vertical bearing element with a socket at its upper end; a turntable mounted on said bearing element to rotate thereon; an offset spindle removably seated in said socket and extending upwardly therefrom, said spindle having a first shoulder for supporting a stack of records by engaging the edge of the centering aperture of the lowermost record of said stack and a second shoulder spaced above said first shoulder substantially the thickness of one record; a weight slidably mounted on said spindle above said second shoulder for exerting a downward steadying pressure on a stack of supported records; and a spring biased pivotal element associated with said weight and said spindle and adapted to engage said second shoulder after the last supported record is moved off of said first shoulder.

2. An automatic record-changing apparatus comprising a rotatable turntable; a fixed offset spindle extending above said turntable, said spindle having a shoulder for supporting a stack of records by engaging the edge of the centering aperture of the lowermost record of said stack; disengaging means adapted to engage the peripheral wall of the lowermost supported record to move said record laterally free of its supports whereby said record is guided by said spindle into

playing position on said turntable; a weight slidably mounted on said spindle above said shoulder for exerting a downward steadying pressure on a stack of supported records; an arm operatively associated with said weight; a side support adjacent said turntable for supporting said arm for movement thereof in a horizontal and vertical plane; and stop means associated with said arm for cooperating with said side support for limiting the vertical movement of said arm.

3. An automatic record-changing apparatus comprising a rotatable turntable; a fixed offset spindle extending above said turntable, said spindle having a shoulder for supporting a stack of records by engaging the edge of the centering aperture of the lowermost record of said stack; disengaging means adapted to engage the peripheral wall of the lowermost supported record to move said record laterally free of said shoulder, a weight slidably mounted on said spindle above said shoulder for exerting a downward steadying pressure on a stack of supported records; an arm operatively associated with said weight; a side support adjacent said turntable for supporting said arm for movement thereof in a horizontal and vertical plane; first stop means associated with said arm and said side support for limiting the horizontal movement of said arm; and second stop means associated with said arm for cooperating with said side support for limiting the vertical movement of said arm.

4. An automatic record-changing apparatus comprising a rotatable turntable; a fixed offset spindle extending above said turntable, said spindle having a shoulder for supporting a stack of records by engaging the edge of the centering aperture of the lowermost supported record of said stack; fixed peripheral supporting means adjacent said turntable for cooperating in supporting a stack of records by engaging the peripheral edge portion of the lowermost supported record of said stack when said record is of relatively large diameter; movable peripheral supporting means adjacent said turntable for cooperating in supporting a stack of records by engaging a peripheral edge portion of the lowermost record of said stack when said record is of relatively small diameter; releasable locking means operatively associated with said movable peripheral supporting means for normally retaining said movable peripheral supporting means in supporting position, said locking means being actuated by a record of relatively large diameter when it moves into the lowermost supported position for releasing said movable peripheral supporting means to move out of supporting position; and disengaging means adapted to engage the peripheral wall of a lowermost supported record for moving said record laterally free of its supports whereby said record is guided by said spindle into playing position on said turntable.

5. An automatic record-changing apparatus comprising a rotatable turntable; a fixed offset spindle extending above said turntable, said spindle having a first shoulder for supporting a stack of records by engaging the edge of the centering aperture of the lowermost supported record of said stack and a second shoulder spaced above said first shoulder substantially the thickness of one record for cooperating in separating the lowermost supported record from the rest of said stack of supported records; fixed peripheral supporting means adjacent said turntable for cooperating in supporting a stack of records by

engaging a peripheral edge portion of the lowermost record of said stack when said record is of relatively large diameter; movable peripheral supporting means adjacent said turntable for cooperating in supporting a stack of records by engaging a peripheral edge portion of the lowermost record of said stack when said record is of relatively small diameter; releasable locking means operatively associated with said movable peripheral supporting means for normally retaining said movable peripheral supporting means in supporting position, said locking means being actuated by a record of relatively large diameter when it moves into the lowermost supported position for releasing said movable peripheral supporting means to move out of supporting position; disengaging means adapted to engage the peripheral wall of the lowermost supported record for moving said record laterally free of its supports and under said second shoulder; and means for moving said disengaging means.

6. An automatic record-changing apparatus comprising a rotatable turntable; a fixed offset spindle extending above said turntable, said spindle having a shoulder for supporting a stack of records by engaging the edge of the centering aperture of the lowermost record of said stack; fixed peripheral supporting means adjacent said turntable for cooperating in supporting a stack of records by engaging a peripheral edge portion of the lowermost record of said stack when said record is of relatively large diameter; movable peripheral supporting means adjacent said turntable for cooperating in supporting a stack of records by engaging a peripheral edge portion of the lowermost record of said stack when said record is of relatively small diameter; releasable locking means operatively associated with said movable peripheral supporting means for normally retaining said movable peripheral supporting means in supporting position, said locking means being actuated by a record of relatively large diameter when it moves into the lowermost supported position for releasing said movable peripheral supporting means to move out of supporting position; disengaging means adapted to engage a peripheral wall of the lowermost supported record; means for moving said disengaging means for moving the lowermost supported record to playing position on said turntable; and means for restoring said movable peripheral supporting means to a locked supporting position after a record of relatively large diameter has been moved to the turntable.

7. An automatic record-changing apparatus comprising a rotatable turntable; a fixed offset spindle extending above said turntable, said spindle having a shoulder for supporting a stack of records by engaging the edge of the centering aperture of the lowermost supported record of said stack; fixed peripheral supporting means adjacent said turntable for cooperating in supporting a stack of records by engaging a peripheral edge portion of the lowermost record of said stack when said record is of relatively large diameter; movable peripheral supporting means adjacent said turntable for cooperating in supporting a stack of records by engaging a peripheral edge portion of the lowermost record of said stack when said record is of relatively small diameter; releasable locking means operatively associated with said movable peripheral supporting means for normally retaining said mov-

able peripheral supporting means in supporting position, said locking means being actuated by a record of relatively large diameter when it moves into the lowermost supported position for releasing said movable peripheral supporting means to move out of supporting position; means for restoring said movable peripheral supporting means to a locked supporting position; a movable element having first and second projections and being mounted above and adjacent to said turntable and adapted to be moved laterally relative thereto, said first projection normally being adapted to engage the peripheral wall of a record of relatively small diameter and being adapted to be moved by a record of relatively large diameter as it is moved into the lowermost supported position whereby said second projection is moved to engage the peripheral wall of said record of relatively large diameter; and means for moving said element for moving a lowermost supported record to playing position on said turntable.

8. An automatic record-changing apparatus comprising a rotatable turntable; a fixed spindle extending above said turntable; means on said spindle for supporting a stack of records by engaging the lowermost supported record at the edge of its centering aperture; a movable element having first and second projections and being mounted above and adjacent said turntable and adapted to be moved laterally relative thereto, said first projection normally being adapted to engage the peripheral wall of a record of relatively small diameter and being adapted to be moved by a record of relatively large diameter as it is moved into the lowermost supported position whereby said second projection is moved to engage the peripheral wall of said record of relatively large diameter; and means for moving said element for moving a lowermost supported record to playing position on said turntable.

9. An automatic record-changing apparatus comprising a rotatable turntable; a fixed spindle extending above said turntable; means on said spindle for supporting a stack of records by engaging the lowermost supported record at the edge of its centering aperture; a member mounted above and adjacent to said turntable and adapted to be moved laterally thereof; a movable element having first and second projections spaced relative to each other and being associated with said member to be moved therewith and adapted to be moved relative thereto, said first projection normally extending above said member for engaging the peripheral wall of a record of relatively small diameter and being adapted to be moved downwardly relative to said member by a record of relatively large diameter when it is moved into the lowermost supported position whereby said second projection is moved to extend above said member for engaging the peripheral wall of a record of relatively large diameter; and means for moving said member laterally and therewith said element for moving a lowermost supported record to playing position on said turntable.

10. An automatic record-changing apparatus comprising a rotatable turntable; a fixed spindle extending above said turntable; means on said spindle for supporting a stack of records by engaging the lowermost supported record at the edge of its centering aperture; a weight slidably mounted on said spindle, above said record-supporting means for exerting a downward steady pressure on a stack of supported records; a mem-

ber mounted above and adjacent to said turntable and adapted to be moved laterally thereof; a movable element having first and second projections and being associated with said member to be moved therewith and adapted to be moved relative thereto, said first projection normally extending above said member to engage the peripheral wall of a record of relatively small diameter and being adapted to be moved downwardly relative to said member by a record of relatively large diameter as it is moved into the lowermost supported position whereby said second projection is moved to extend above said member to engage the peripheral wall of a record of relatively large diameter; and means for moving said member laterally and therewith said element for moving a lowermost supported record to playing position on said turntable.

11. An automatic record-changing apparatus comprising a rotatable turntable; a fixed spindle extending above said turntable; means on said spindle for supporting a stack of records by engaging the edge of the lowermost supported record at the centering aperture; a supporting member mounted adjacent to said turntable and adapted to be moved laterally thereof; a movable element having first and second projections and being operatively connected to said member to be moved therewith and adapted to be moved relative thereto, said first projection normally extending above said member for engaging the peripheral wall of a record of relatively small diameter and being adapted to be moved downwardly by a record of relatively large diameter when it is moved into the lowermost supported position whereby said second projection is moved to extend above said member for engaging the peripheral wall of a record of relatively large diameter; a spring means for normally maintaining said supporting member and said element in said engaging position; and means for moving said supporting member against the tension of said spring means whereby a lowermost supported record is moved to playing position on said turntable.

12. An automatic record-changing apparatus comprising a rotatable turntable; a fixed spindle above said turntable; means on said spindle for supporting a stack of records by engaging the lowermost supported record at the edge of its centering aperture; a pivotal post adjacent said turntable; a first spring means for normally maintaining said post in a non-operative position; a member connected to said post and adapted to be pivoted by a falling record out of engaging position; a second spring means for normally maintaining said member in a record-engaging position; a movable element having first and second projections and being associated with said member to be moved therewith and adapted to be moved relative thereto, said first projection normally extending above said member to engage the peripheral wall of a record of relatively small diameter and being adapted to be moved by a record of relatively large diameter as it is moved into the lowermost supported position whereby said second projection is moved to extend above said member to engage the peripheral wall of a record of relatively large diameter; and means for moving said post against the tension of said first spring whereby a lowermost supported record is moved to playing position on said turntable.

13. In an automatic phonograph including a rotatable turntable, means for moving records of two different sizes to playing position on said turntable and a pickup arm for cooperating with

a record on said turntable; a mechanism comprising pickup arm control means for moving said pickup arm outwardly from the center of a record and inwardly to the initial playing groove of a record of relatively small diameter; a driving means for said pickup arm control means; a movable member normally adapted to be in operative position with said pickup arm control means for limiting the inward movement of said pickup arm to the initial playing groove of a record of relatively large diameter; means for holding said movable member out of operative position with said pickup arm control means and being adapted

5 to be actuated by a record of a relatively large diameter as it moves to playing position on said turntable for releasing said movable member into operative position with said pickup arm control means; and an element associated with said pickup arm control means for moving said movable member out of operative association with said pickup arm control means as said pickup arm control means is driven to move said pickup arm 10 outwardly from the center of a record on said turntable.

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DISCLAIMER

2,286,490.—*Arthur, L. Knox*, Fort Wayne, Ind. RECORD CHANGING APPARATUS.
Patent dated June 16, 1942. Disclaimer filed October 9, 1943, by the
assignee, *Farnsworth Television & Radio Corporation*.

Hereby enters this disclaimer to claims 8, 9 and 10 in said specification.

[*Official Gazette November 9, 1943.*]