Aug. 15, 1939. H. M. STEPHENSON 2,169,854

PHONOGRAPH-RECORD CHANGER

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Fig. 1.

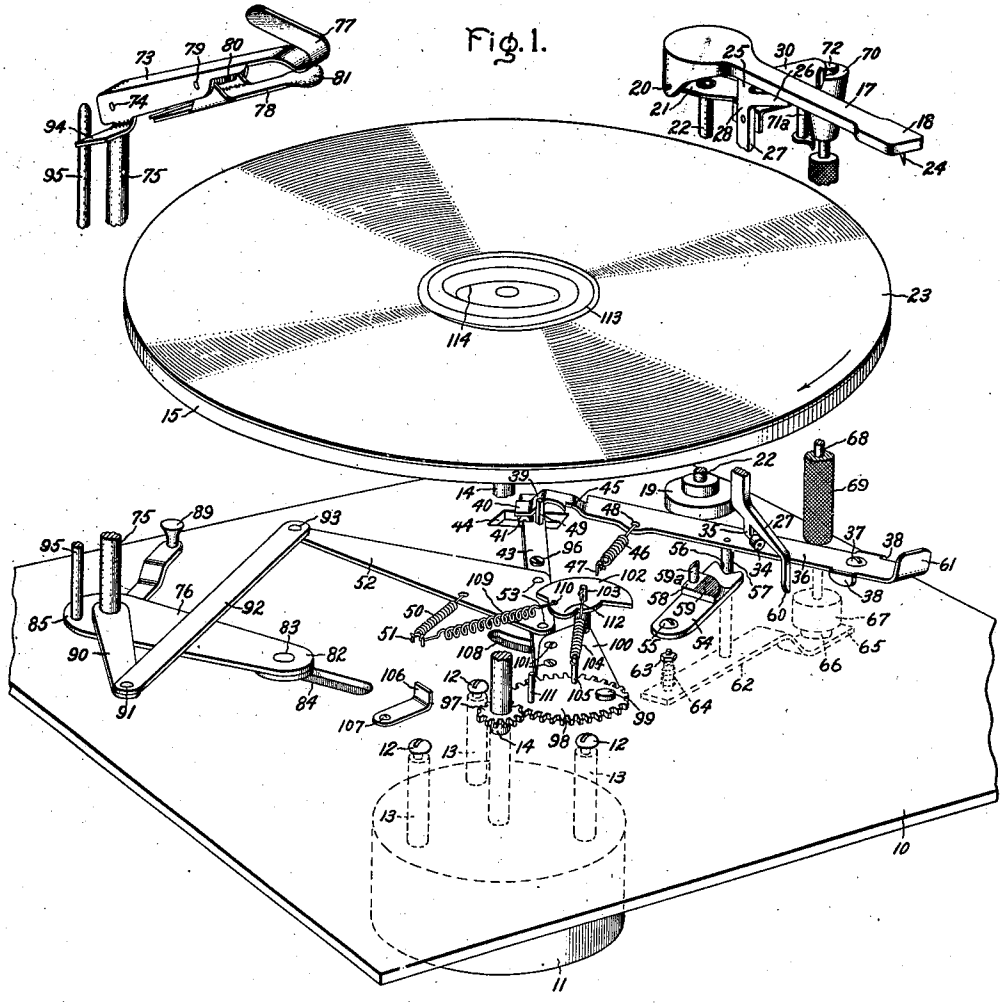
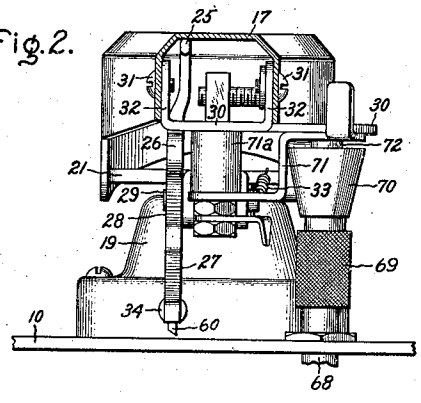


Fig. 2.



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PHONOGRAPH-RECORD CHANGER

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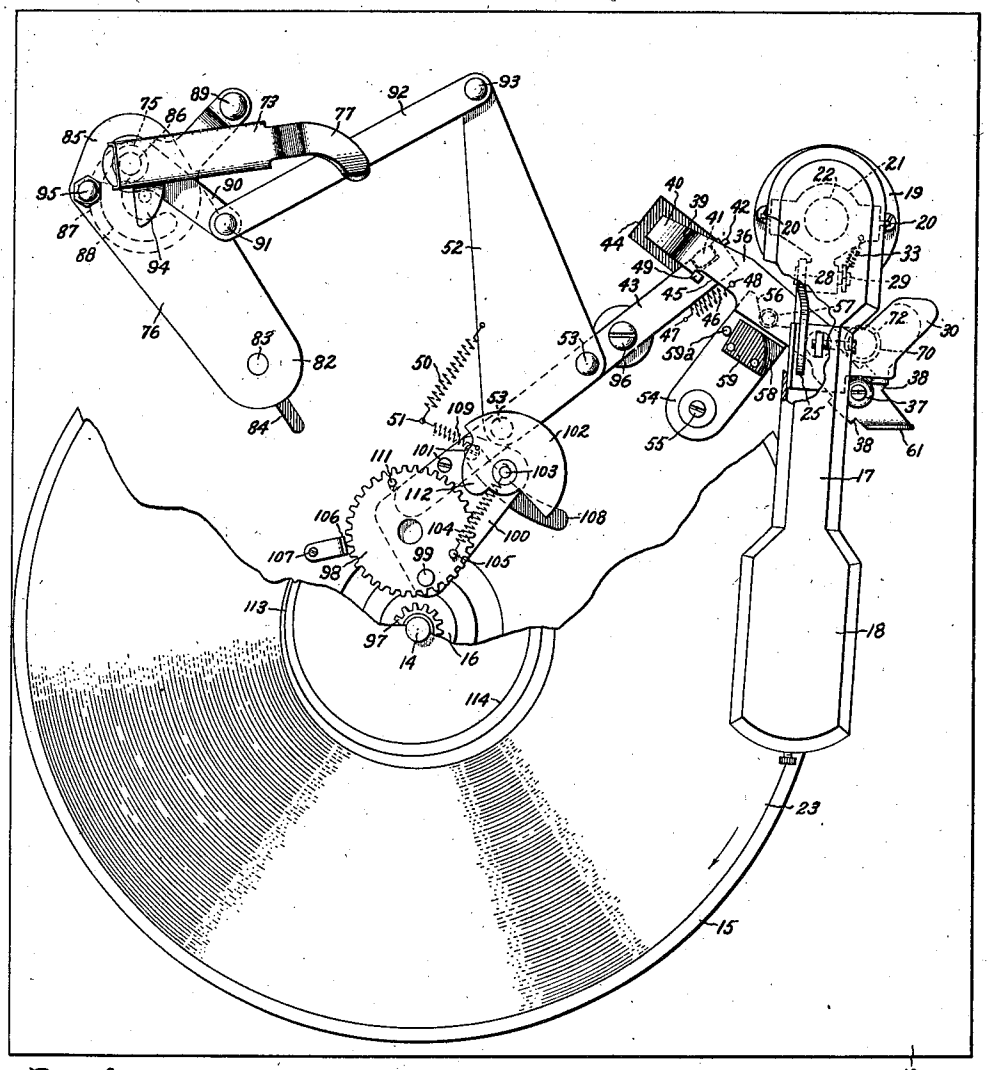


Fig. 3.

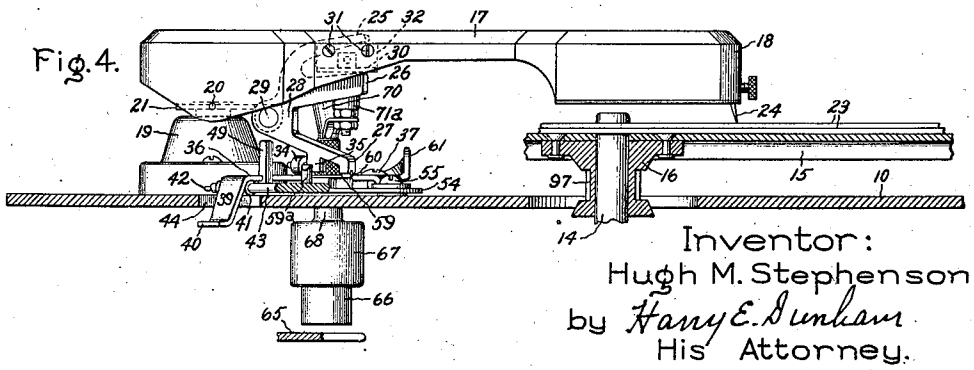


Fig. 4.

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PHONOGRAPH-RECORD CHANGER

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Fig. 5.

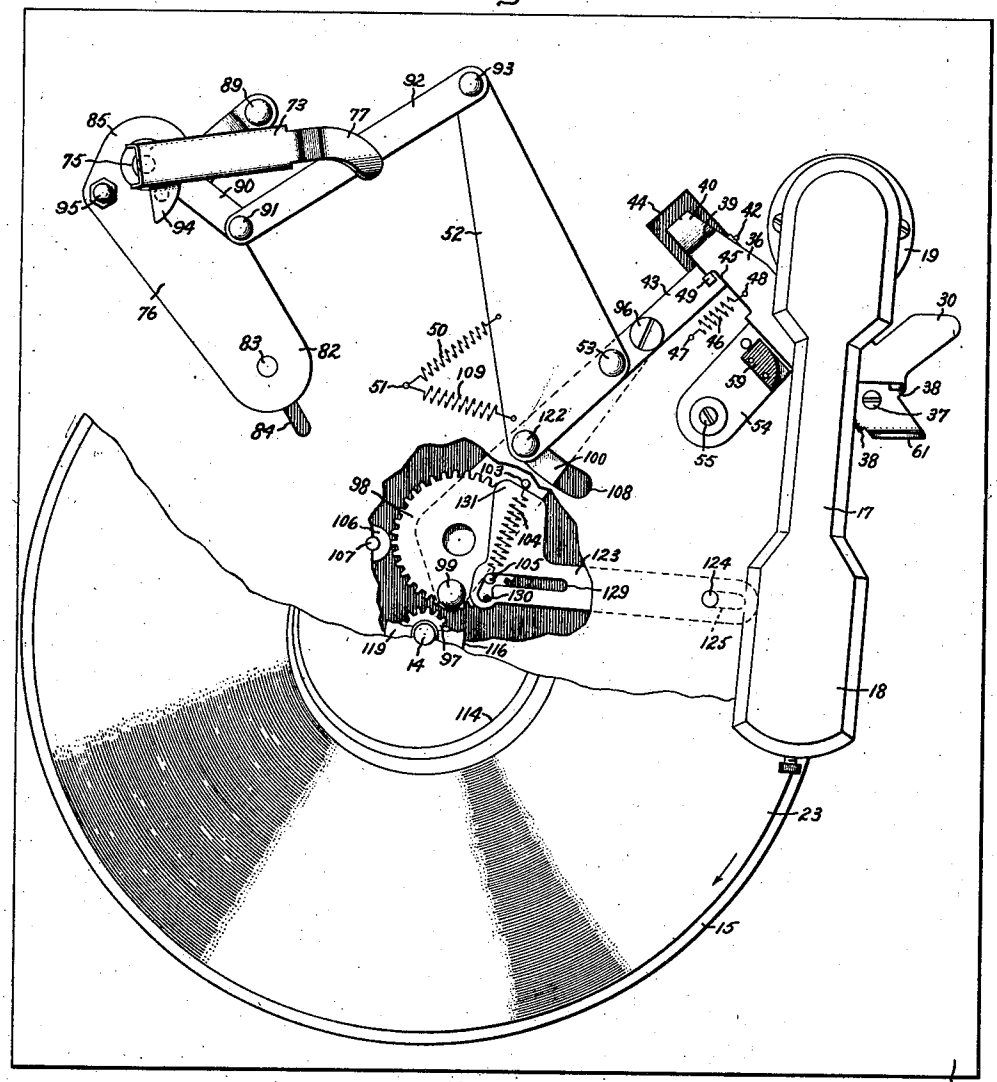
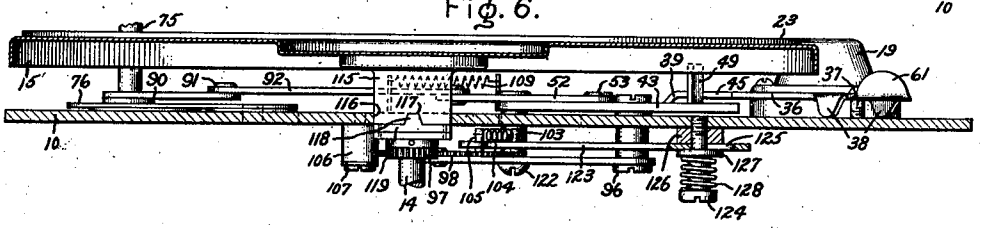


Fig. 6.



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PHONOGRAPH-RECORD CHANGER

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Fig. 7.

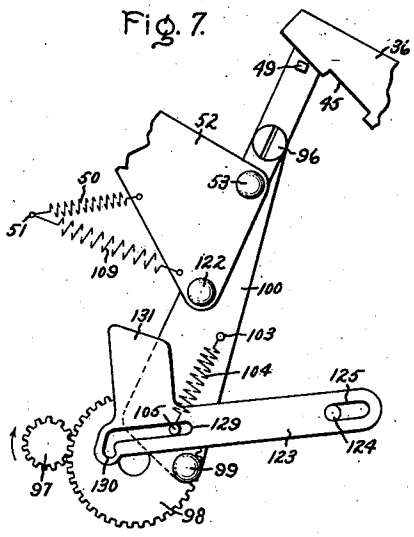


Fig. 8.

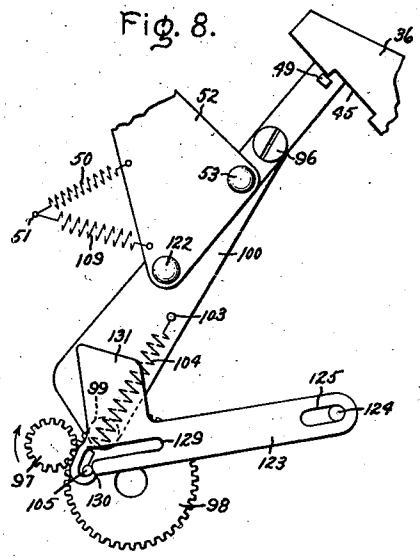
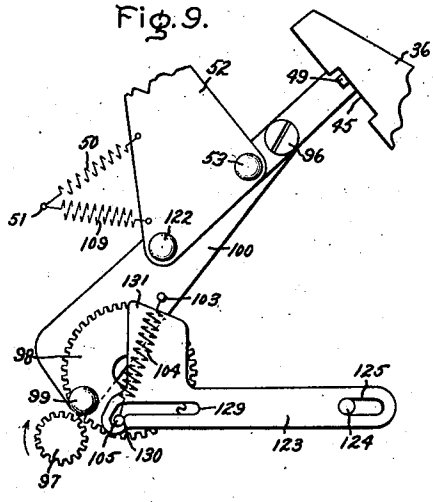


Fig. 9.



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2,169,854

UNITED STATES PATENT OFFICE

2,169,854

PHONOGRAPH-RECORD CHANGER

Hugh M. Stephenson, Fort Wayne, Ind., assignor to General Electric Company, a corporation of New York

Application March 5, 1938, Serial No. 194,145

15 Claims. (Cl. 274—1)

This invention relates to automatic phonographs, and more particularly to a record changing mechanism for this type of machine.

An object of my invention is to provide improved record changing mechanisms for phonographs.

Further objects and advantages of my invention will become apparent and my invention will be better understood from the following description referring to the accompanying drawings, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

Referring to the drawings, Fig. 1 is a partly exploded perspective view of a phonograph embodying my invention; Fig. 2 is a fragmentary view of the reproducer arm support and travel stops, partly in section; Fig. 3 is a plan view of the phonograph shown in Fig. 1, partly broken away, to illustrate the operating mechanism and shows the mechanism in its initial record playing position; Fig. 4 is a fragmentary side elevation, partly in section, of the machine shown in Figs. 1 and 3 with the mechanism in the position shown in Fig. 3; Fig. 5 is a plan view of a phonograph embodying a modification of my invention, partly broken away to illustrate the operating mechanism, and shows the mechanism in its initial record playing position; Fig. 6 is a fragmentary side elevation, partly in section, of the machine shown in Fig. 5; Fig. 7 is a fragmentary plan view of the record changer operating mechanism showing the actuating arm in its maximum displacement position; Fig. 8 is a fragmentary plan view of the operating mechanism showing the eccentrically mounted gear in its dead center position; and Fig. 9 is a fragmentary plan view of the operating mechanism showing the relative positions of the actuating arm and eccentrically mounted gear subsequent to the completion of the record removal operation and shortly after the eccentrically mounted gear has passed its dead center position.

In Figs. 1 to 4 inclusive of the drawings, I have shown an automatic phonograph having a supporting table 10 to which a driving motor 11 is secured by three screws 12 and spacers 13. The motor is provided with an upwardly extending drive shaft 14 which serves as a spindle for a record turntable 15. The turntable is mounted and secured to the shaft 14 by a hub 16 for rotation therewith. A reproducer or tone arm 17, having a reproducer 18, is pivotally supported on a hub 19 for horizontal and vertical pivotal movement by pivot pins 20 formed on a base plate 21 which is pivotally supported by a pivot pin 22 on the hub 19.

In a phonograph having an automatic record changer, the reproducer is arranged to be raised off a record and returned to a position corresponding to the beginning of a record coincidentally with the removal of the reproduced record from the turntable, after which the reproducer is gradually lowered so that the reproducer stylus engages the sound track grooves at the beginning of another record. In the illustrated arrangement, this coordinated action of the reproducer and the mechanism for removing a reproduced record is obtained by utilizing a single actuating or positioning mechanism which is driven with the turntable.

In order to reproduce a record 23, the reproducer 18 is placed on the grooves near the beginning of the record, and a reproducer stylus 24, suitably connected to any desirable amplifier, engages the sound track grooves of the record. As the record 23 is reproduced, the stylus 24 guides the reproducer 18 towards the center of the record and swings the reproducer and the base plate 21 in a horizontal direction, carrying with it a set of three spaced-apart fingers 25, 26, and 27, which are united by a common base 28 secured to a pivot pin 29 pivotally mounted on the reproducer base plate 21. A stop plate 30 extends between the fingers 25 and 26 and is secured to the underside of the reproducer arm 17 by screws 31 threadedly engaging an upwardly extending flange 32 formed on an end of the stop plate 30. A spring 33 is secured to the reproducer base plate 21 and to the pivot pin 29, so as to bias the fingers 25, 26 and 27 in a downward direction. The finger 27 extends downwardly from the two fingers 25 and 26, and is supported by a roller 34, which is rotatably secured to a projection 35 formed on the under edge of the finger 27. The roller 34 is arranged to roll on a track formed by a track arm 36 pivotally secured at one end by a screw 37 to the supporting table 10 and pivotally supported by a pair of downwardly extending flanges 38 arranged on each side of the track arm 36 adjacent the screw 27. These flanges 38 have curved under edges resting on the supporting table 10 to provide for vertical swinging of the track arm 36. The other end of the track arm is free and has a portion 39 which extends down at an acute angle to the plane of the major portion of the track arm 36 and terminates in another portion 40 which extends outwardly in substantially the

same direction as the plane of the major portion of the arm 36. This free end of the track arm is supported by a roller 41 which is rotatably secured by a pin 42 to an end of a pivoted actuating arm 43. When the phonograph is inoperative or during reproduction of a record, this end of the track arm 36 extends below the upper surface of the supporting table 10 through an opening 44 formed therein. A longitudinally extending notch 45 is formed in the track arm 36 adjacent the roller supported end 39, and a spring 46 secured by a pin 47 to the supporting table 10 and to the track arm 36 through a hole 48, biases the track arm 36 against a square latching pin 49 secured to an end of the actuating arm 43. During reproduction of a record, or when the phonograph is stopped, the latching pin 49 is arranged in engagement with an end of the notch 45, and a spring 50, secured by a pin 51 to the supporting table 10 and to the actuating arm 43 through a triangular plate 52 rigidly secured thereto by rivets 53, biases the pivoted actuating arm 43 and the latching pin in a counter-clockwise direction, as viewed in Fig. 1, into latching engagement with the end of the notch 45 in the track arm 36. In order to unlatch the end of the actuating arm, the track arm 36 is pivoted so as to move the notch 45 away from the latching pin 49. During reproduction of a record, it is desirable that the actuating arm remain latched, and upon completion of a reproduction that it should be automatically unlatched. In order to automatically unlatch the actuating arm 43 upon completion of a record, the notch 45 in the track arm 36 is automatically pivoted out of engagement with the latching pin 49 by a cam arm 54 which is pivotally secured at one end thereof by a screw 55 to the supporting table 10 and is provided with a V-notch cam surface 56 at the other end thereof which engages a downwardly extending pin 57 secured to the track arm 36. The cam arm 54 is provided with an upwardly extending boss 58 having a series of ratchet grooves 59 formed on the upper surface thereof. The outer end of the finger 27 on the reproducer extends downwardly and is provided with a thin edge 60 which is arranged to engage the ratchet grooves 59 on the cam arm boss 58 when the reproducer 18 is pivoted to a position near the turntable spindle 14. When a record is played and is completed, this thin edge 60 of the finger 27 passes over the ratchet grooves 59, which permit the sharp edge 60 to move toward the pin 59*a*, but any return movement of the sharp edge 60 will operate the cam 56. Thus, if the reproducer 18 oscillates before the finger 27 strikes the pin 59*a*, which serves as a limit stop to prevent the reproducer from crossing the record center, the ratchet will actuate the cam 56 and unlatch the pin 49 by pivoting the cam arm 54, which oscillates the pin 57 and transfers this movement to the track arm 36. This produces a pivotal and upward movement of the track arm which unlatches the latch pin 49 of the actuating arm 43. The pivotally secured end 61 of the track arm 36 extends upwardly and provides a handle for manually pivoting the track arm to manually unlatch the actuating arm 43 when desired. When the outer end of the actuating arm 43 is moved in a counter-clockwise direction as viewed in Fig. 1, it causes the downwardly extending portion 39 of the track arm to move in an upward direction as the roller 41 rolls under the portion 39 to the position shown in Fig. 1. This causes the free end of the track arm 36 to swing in an upward direction about the pivot pin 37 and the curved flanges 38, and carries the pin 57 in an upward direction to the position shown in Fig. 1. The lower end of the pin 57 is secured to a dash pot operating arm 62 which is pivotally secured at one end by a bolt and nut 63 to the supporting table 10 and is biased in a downward direction by a spring 64. The opposite and free end 65 of the dash pot operating arm 62 extends below an extension of a piston 66 which is slidable within a dash pot cylinder 67. If the pin 57 is raised by the track arm 36, it raises the free end 65 of the operating arm 62 and raises the dash pot piston 66. This moves a piston rod 68 upwardly through a supporting bearing 69 and raises a stop 70, which is secured to and movable with the upper end of the piston rod 68, coincidental with the operation of the dash pot. The finger 27 which is supported by the roller 34 on the track arm 36 also is pivoted upwardly, thereby also pivoting upwardly the finger 26, so that the outer end thereof is raised and slides along the lower surface of the stop plate 30, thereby raising it and the reproducer. If the reproducer is in a position near the center of the turntable corresponding to the end of a record, the roller 34 supporting the finger 27 will roll toward the lower end of the inclined track arm; that is, towards the screw 37, thereby laterally pivoting the reproducer in a counter-clockwise direction, as viewed in Fig. 1, until a downwardly extending stop 71 secured to the stop plate 30 engages the stop 70 on the dash pot piston pin 68, as shown in Fig. 2. The dash pot stop 70 is constructed so that when the track arm 36 is raised, the top of the stop 70 is closely adjacent the underside of the outer end of the stop plate 30 which extends over the top of the piston pin in this position, and is raised to a position closely adjacent and extending over a buffer pad 72 secured to the upper end of the piston rod 68. A clockwise rotation, of the actuating arm 43, as viewed in Fig. 1, carries the roller 41 under the downwardly extending portion 39 of the track arm 36, and allows the track arm to swing downwardly away from the roller 34 supporting the finger 27, and lowers the outer end 65 of the dash pot operating arm 62 downwardly away from the end of the dash pot piston 66. This causes the outer end of the stop plate 30 to rest on the buffer pad 72 on top of the piston rod 68, and the weight of the reproducer thereon causes the dash pot piston 66 to gradually move toward the lower end of the dash pot cylinder 67, thereby gradually lowering the reproducer until the stylus 24 again engages the beginning of a record 23. In order to provide for lowering the reproducer at the beginning of different size records, the stop 71 is pivotally secured to the stop plate 30 by a pivotal support 71*a*, and by varying the relative position of the stop 71 with respect to the outer edge of the reproducer arm 17 by pivoting it on the support 71*a*, the outermost position of the reproducer may be adjusted as desired.

A record changing or discharge mechanism is arranged to be operated by the actuating arm 43 through the triangular plate 52 and includes a laterally swinging lifter arm 73 which is pivotally mounted for vertical movement by a pivot pin 74 on a supporting shaft 75, which is pivotally secured for horizontal pivotal movement to a mounting plate 76 on the supporting table 10. The free end 77 of the lifter arm is curved and extends upwardly and angularly from the lifter

arm 73 and is arranged to guide the lifter arm along the edge of a stack of records on the turntable, so that as a lifter finger 78 engages the edge of the records, it will be just under the underside of the uppermost record. The lifter finger 78 is pivotally secured to the lifter arm 73 by a pivot pin 79 and a spring 80 biases the outer curved end 81 of the lifter finger 78 toward the curved portion 77 of the lifter arm 73. The lifter arm is arranged so that it cannot pivot downwardly below a point where the lifter finger 78 is above the top of a single record on the turntable. This insures that the last record will not be automatically removed, and the reproducer will be lowered to the turntable and will continue to play and replay the last record until the machine is stopped. In order to accommodate the lifter arm to different size records, the mounting plate 76 is slidably secured at one end 82 by a pin 83 extending through a slot 84 in the supporting table 10, and the other end 85 is secured by a pin 86 eccentrically mounted on a rotatable plate 87 and extends through an arcuate slot 88 formed in the supporting table 10. An operating handle 89 is provided for rotating the rotatable plate 87. Rotation of the rotatable plate 87 carries the mounting plate 76 and the lifter arm 73 toward or away from the center of the turntable, thereby moving the lifter arm 73 and the lifter finger 78 toward or away from the edge of a record. This arrangement provides for adjustment for use with various size records. In order to remove a record from the turntable, the lifter arm 73 is pivoted laterally by a crank 90, which is rigidly secured to the pivotal supporting shaft 75. The crank 90 is pivotally connected by a pivot pin 91 to a link 92, which is pivotally connected by a pivot pin 93 to the triangular plate 52. Rotation of the actuating arm 43 produces a relatively longer travel of the end of the triangular plate 52 to which the link 92 is secured, and this movement is transmitted through the link 92 to the crank 90 and thence to the pivoted supporting shaft 75 and to the lifter arm 73. If the lifter arm 73 is rotated clockwise, as viewed in Fig. 3, a projecting flange 94 formed on one side of the pivoted end of the lifter arm 73 engages a pin 95 rigidly secured to the mounting plate 76, thereby causing the lifter arm to pivot vertically about the pivot pin 74. This produces a combined lateral and vertical pivotal movement of the lifter arm 73 in a clockwise and upward direction. A reverse movement of the crank 90 when the lifter arm is in raised position results in a counter-clockwise, as viewed in Fig. 3, and downward pivotal movement of the lifter arm 73.

The actuating arm 43 is arranged to swing or pivot about a pivot pin 96 secured to the supporting table 10, and is arranged to operate the raising of the reproducer 18 and returning it from the end to the beginning of a record, and coincidentally to operate the mechanism for removing a record from the turntable after reproduction thereof. In order to obtain the proper sequential operation of the actuating arm 43, I provide a driving pinion gear 97 secured to the motor drive shaft 14 providing an integral structure therewith and driven thereby to rotate with the turntable 15, and a second gear 98 is rotatably and eccentrically supported by a pivot pin 99 on one end of a supporting plate 100 rigidly secured by screws 101 to the actuating arm 43. A cam 102 is pivotally supported by a pin 103 on the opposite end of the supporting plate 100, and a tension spring 104 is secured to the cam pivot pin 103 and to a pin 105 on the eccentrically supported gear 98 so as to bias the gear 98 toward the cam 102. When a record is being reproduced, the actuating arm 43 must be stationary and the gears 97 and 98 must, therefore, be disengaged. As explained above, the actuating arm 43 is normally latched unless the track arm 36 is pivoted by the reproducer operated cam 54 to disengage the pin 49 from the latch 45. A stationary stop 106 is secured by a screw 107 to the supporting table 10, and the spring 104 biases the gear 98 toward the cam 102 and against the stationary stop 106 during reproduction of a record, and this maintains the gears 97 and 98 in disengaged relation as shown in Fig. 3. A guide pin is secured to one of the screws 101 and arranged on the underside of the actuating arm 43 and extends through an arcuate slot 108 formed in the supporting table 10 to assist in properly guiding the actuating arm in its pivotal movements. When the latching pin 49 is unlatched, the spring 50 biases the actuating arm 43 in a counter-clockwise direction, as viewed in Fig. 1, thereby moving the eccentrically mounted gear 98 into meshing engagement with the driving gear 97. As viewed in Fig. 1, clockwise rotation of the driving gear 97 with the gears in mesh causes the eccentrically mounted gear 98 to rotate counter-clockwise and carry the eccentric pivot pin 99 and the actuating arm 43 in a counter-clockwise direction until the point of engagement of the gears is diametrically opposite the eccentric pivot pin 99. A spring 109 is secured by the pin 51 to the supporting table 10 and to the cam 102 through a hole 110 and is arranged to bias the actuating arm 43 in a clockwise direction, as viewed in Fig. 1, and to cooperate with the spring 104 to bias the eccentrically mounted gear 98 into engagement with the driving gear 97 by biasing the eccentric pivot pin, and therefore, the eccentrically mounted gear 98 in a counter-clockwise direction about the actuating arm pivot pin 96. Further counter-clockwise rotation of the eccentrically mounted gear produces a clockwise rotation, as viewed in Fig. 1, of the actuating arm 43, and the springs 104 and 109 bias the gears 97 and 98 into engagement until the spring pin 105, the eccentric pivot pin 99, and the cam pivot pin 103 are in a straight line, with the eccentric pivot pin 99 between the cam pivot pin 103 and the spring pin 105. This is the dead-center position of the eccentrically mounted gear 98, and corresponds to the position of the record changing mechanism after the completion of removal of a record from the turntable. Further counter-clockwise rotation, as viewed in Fig. 1, of the gear 98 moves the spring pin 105 on the side of the eccentric pivot pin 99 away from the driving gear 97, so that the spring 104 biases the eccentrically mounted gear 98 away from the driving gear 97 and turns the eccentrically mounted gear 98 in a counter-clockwise direction. An upwardly extending stop pin 111 is secured to the eccentrically mounted gear 98 and is arranged to cooperate with the cam 102 to reduce and limit the impact of the eccentrically mounted gear 98 on the stationary stop 106 produced by the counter-clockwise rotation of the eccentrically mounted gear 98 and the clockwise pivoting of the actuating arm 43. Counter-clockwise rotation of the eccentrically mounted gear under the biasing force of the spring 104 past the dead-center position carries the stop

111 into engagement with a curved portion 112 of the cam 102 and the impact thereon tends to rotate the cam 102 in a clockwise direction against the biasing force of the spring 109, and thereby dampens the rotational speed of the eccentrically mounted gear 98. The spring 109 is constructed so that the tension thereof under this clockwise rotation of the cam 102, at the instant the eccentrically mounted gear 98 passes dead center, is sufficient to prevent the rotation of the cam to release the stop pin 111 and permit the eccentrically mounted gear 98 to rotate under the biasing force of the spring 104. When the gear 98 has cleared the driving gear 97 during the return portion of the operating cycle, the spring 109 has shortened sufficiently to reduce the tension to a value which will allow the release of the stop pin 111 and allow the gear 98 to rotate clockwise until it comes to rest against the stationary stop 106.

When it is desired to reproduce a record on the phonograph, a plurality of records 23 is placed on the turntable 15 with the center pin openings in the records over the turntable center pin 14, and the reproducer 18 is placed on the outer edge at the beginning of the uppermost record. The driving motor 11 is then energized to rotate the turntable 15. As the record is reproduced, the stylus 24 pivots the reproducer 18 towards the center of the record 23, and when the record is finished, enters the spiral lead-in groove 113 and then oscillates the reproducer as the stylus 24 travels over an eccentric center groove 114. This oscillation of the reproducer causes the pointed end 60 of the finger 27 to travel over the grooves 59 of the cam arm 54, until the end of the finger 27 engages the stop 59*a* and transfers the oscillatory movement of the reproducer arm 18 to the V-notch cam 56 and causes the track arm 36 to pivot and unlatch the latching pin 49 from the end of the notch 45, thereby engaging the gears 97 and 98 as described above. The gear 97 is driven in clockwise direction, and the gear 98 therefore rotates in a counter-clockwise direction and pivots the actuating arm 43 in a counter-clockwise direction, as viewed in Fig. 1, during the first portion of the operating cycle. This counter-clockwise pivoting of the actuating arm 43 causes the end 39 of the track arm 36 to pivot upwardly and raises the roller 34 on the finger 27, and thereby raises the reproducer 18 off the end of the record 23. The roller 34 then rolls in a counter-clockwise direction and returns the reproducer 18 to a position corresponding with the beginning of the record. Coincidentally with this operation, the triangular plate 52 is rotated in a counter-clockwise direction, as viewed in Fig. 1, by the actuating arm 43 and rotates the lifter arm 73 in a clockwise direction, so that the projecting flange 94 engages the pin 95 and produces an upward pivoting of the lifter arm 73. Thus, the lifter arm 73 pivots in a clockwise and upward direction until the lifter finger 78 engages the underside of a record, and further clockwise and upward pivoting of the lifter arm 73 causes the edge of the record to become wedged between the outer end 81 of the lifter finger 78 and lifter arm 73 and tilts the record, so that the center pin hole in the record is raised off the center pin 14. As the turntable continues to rotate, the edge of the record opposite the lifter arm, which is still in engagement with the upper side of the next record below the one which is being removed from the turntable, is pivoted in a clockwise direction about the record edge which is clamped by the lifter arm 73. This causes the record which has been raised by the lifter arm to slowly slide off the top of the stack of records and the turntable and then to become disengaged from the lifter arm 73. A separate compartment may be provided on the side of the supporting table 10 for receiving records which are removed from the turntable 15 after reproduction. The foregoing operations occur from the time of the engagement of the gears until the eccentrically supported gear 98 has rotated in a counter-clockwise direction, so that the point of engagement of the gears is diametrically opposite the eccentric pivot pin 99, as shown in Fig. 1. Further counter-clockwise rotation of the eccentrically mounted gear 98 produces a clockwise rotation of the actuating lever 43 and pivots the lifter arm 73 in a counter-clockwise and downward direction and returns it to its inactive or latched position, as has been explained above. Coincidentally with this operation, the track arm 36 is swung in a downward direction as the roller 41 rolls under the angularly extending portion 39 of the track arm 36 and thereby releases the dash pot piston 66, permitting the weight of the reproducer 18 to lower the piston 66 and again place the reproducer stylus 24 on the beginning of a record. As the eccentrically mounted gear 98 rotates in a counter-clockwise direction and the spring pin 105 passes its dead center position, the spring 104 biases the eccentrically mounted gear out of engagement with the driving gear 97 and further rotates the eccentrically mounted gear in a counter-clockwise direction. The spring 109 biases the actuating arm 43 in a clockwise direction and the two springs 104 and 109 cooperate to return the eccentrically mounted gear in its inoperative position in engagement with the stationary stop 106 and returns the latching pin 49 into latching engagement with the end of the notch 45 in the track arm 36. In this manner, the record changing mechanism is again in position for the reproduction of another record.

In the modification of an automatic phonograph embodying my invention shown in Figs. 5 to 8, inclusive, of the drawings, I have shown a modified eccentric gear driving arrangement somewhat similar to that shown in Figs. 1 to 4, and corresponding elements have been given the same reference numerals. In this construction, a record turntable 15 is provided with a hub 115 extending through an opening 116 in a supporting table 10. The lower end of the hub 115 is formed with a groove 117 arranged in engagement with an upstanding clutch flange 118 formed on a clutch ring 119 which is secured to a motor drive shaft 14 for rotation therewith.

In order to reproduce a record 23, the reproducer 18 is pivotally supported on a hub 19 and is placed on the grooves near the beginning of the record, and a reproducer stylus, suitably connected to any desired amplifier, engages the sound track grooves of the record. As the record 23 is reproduced, the stylus guides the reproducer 18 toward the center of the record and swings it in a horizontal direction. During this movement the reproducer arm 17 is supported on a track formed by a track arm 36 pivotally secured at one end by a screw to the supporting table 10 and pivotally supported by a pair of curved downwardly extending flanges 38 arranged on each side of the track arm 36 adjacent the screw 37. The curved under edges of these flanges rest

on the supporting table 10 to provide for vertical swinging of the track arm 36. When the phonograph is inoperative, or during reproduction of a record, the other end 39 of the track arm 36 extends below the upper surface of the supporting table 10 through an opening 44 formed therein. A longitudinally extending notch 45 is formed in the track arm 36 adjacent the end 39, and a spring 46, secured by a pin 47 to the supporting table 10 and to the track arm 36 through a hole 48, biases the track arm 36 against a square latching pin 49 secured to an end of an actuating arm 43. During these periods, the latching pin 49 is arranged in engagement with an end of a notch 45 formed in the track arm 36. Springs 50 and 109, secured by a pin 51 to the supporting table 10 and to the actuating arm 43 through a triangular plate 52 rigidly secured thereto by a rivet 53 and a bolt 122, bias the pivoted actuating arm 43 and the latching pin 49 in a counter-clockwise direction, as viewed in Fig. 5, into latching engagement with the end of the notch 45 in the track arm 36. In order to unlatch the end of the actuating arm 43, the track arm 36 is pivoted so as to move the notch 45 away from the latching pin 49. During reproduction of a record, it is desirable that the actuating arm remain latched, and upon completion of a reproduction that it should be automatically unlatched. In order to automatically unlatch the actuating arm 43 upon completion of a record, the notch 45 in the track arm 36 is automatically pivoted out of engagement with the latching pin 49 by a cam arm 54 which is pivotally secured at one end thereof by a screw 55 to the supporting table 10 and is provided with a cam surface at the other end thereof arranged to unlatch the pin 49. The operation and construction of this mechanism is the same as that shown in Figs. 1 to 4, inclusive, and operates the cam 54 and the track 36 through ratchet grooves 59. As explained above, this unlatches the pin 49 and returns the reproducer to the starting position.

A record changing mechanism is arranged to be operated by the actuating arm 43 through the triangular plate 52 and includes a laterally swinging lifter arm 73 which is pivotally mounted for vertical movement on a supporting shaft 75. The lifter arm mechanism is operated to remove a record from the turntable when the reproducer has been removed from the record and returned to a position above the record starting point and is controlled and operates as described with respect to Figs. 1 to 4.

The actuating arm 43 is arranged to swing or pivot about a pivot pin bolt 96 secured to the supporting table 10, and is arranged to operate the raising of the reproducer 18 and returning it from the end to the beginning of a record, and coincidentally to operate the mechanism for removing a record from the turntable after reproduction thereof. In order to obtain the proper sequential operation of the actuating arm 43, I provide a driving pinion gear 97 secured to the motor drive shaft 14 providing an integral structure therewith and driven thereby to rotate with the turntable 15, and a second gear 98 is rotatable and eccentrically supported by a pivot pin 99 on one end of a supporting plate 100 rigidly secured by the bolts 122 and 96 to the actuating arm 43. A tension spring 104 is secured to a pin 103 on the supporting plate 100 away from the pivot pin 99 toward the pivot bolt 96 and to a pin 105 on the eccentrically supported gear 98, so as to bias the gear 98 toward the pivot bolt 96. When a record is being reproduced, the actuating arm 43 must be stationary and the gears 97 and 98 are, therefore, disengaged. As explained above, the actuating arm 43 is normally latched, unless the track arm 36 is pivoted by the reproducer operated cam 54 to disengage the pin 49 from the latch 45. A resilient stationary stop 106 is secured by a screw 107 to the supporting table 10, and the spring 104 biases the gear 98 toward the pivot bolt 96 and against the stationary stop 106 during reproduction of a record. This maintains the gears 97 and 98 in disengaged relation, as shown in Fig. 5. To provide for easy removal of the turntable 15, I arrange the supporting plate 100 and the associated driving and guiding elements for the actuating arm 43 below the surface of the supporting table 10, and the bolt 122 extends through an arcuate slot 108 formed in the supporting table 10 to assist in properly guiding the actuating arm 43 in its pivotal movements. A guiding arm 123 is slidably and pivotally secured to the supporting table 10 by a screw 124 threadedly engaged in an opening in the supporting table 10 and loosely extending through a longitudinally extending slot 125 in one end of the guiding arm 123. A spacing block 126 extends about the screw 124 and is arranged between the upper surface of the guiding arm 123 and the underside of the supporting table 10, and a washer 127, arranged about the screw 124, is biased against the under side of the guiding arm 123 by a coil spring 128 for supporting the guiding arm 123 in position. An angular and longitudinally extending slot 129 is formed in the other end of the guiding arm 123 and extends about the spring pin 105 to aid in guiding the movements of the eccentrically mounted gear 98.

Upon completion of a record reproduction, the latching pin 49 is unlatched, and the spring 50 biases the actuating arm 43 in a counter-clockwise direction, as viewed in Fig. 5, thereby moving the eccentrically mounted gear 98 into meshing engagement with the driving gear 97. As viewed in Fig. 5, clockwise rotation of the driving gear 97 with the gears in mesh causes the eccentrically mounted gear 98 to rotate counter-clockwise and to carry the eccentric pivot pin 99 and the actuating arm 43 in a counter-clockwise direction until the point of engagement of the gears is diametrically opposite the eccentric pivot pin 99 as shown in Fig. 7. The spring 109 is arranged to bias the actuating arm 43 in a clockwise direction, as viewed in Figs. 5, 7, 8, and 9, and to cooperate with the spring 104 to bias the eccentrically mounted gear 98 into engagement with the driving gear 97 by biasing the eccentric pivot pin 99, and, therefore the eccentrically mounted gear 98, in a counter-clockwise direction about the actuating arm pivot pin 96. Further counter-clockwise rotation of the eccentrically mounted gear produces a clockwise rotation of the actuating arm 43, and the springs 104 and 109 bias the gears 97 and 98 into engagement, and the spring pin 105 slides in the slot 129 toward the end of the guide arm 123. When the spring pin 105 reaches the outer end of the longitudinally extending portion of the slot 129, further rotation of the eccentrically mounted gear 98 carries the pin 105 along the angularly extending portion 130 of the slot 129 and slides the guide arm 123 longitudinally until the screw 124 engages the outer end of the slot 125. This motion continues until the spring pin 105, the eccentric pivot pin 99, and the spring pin 103 are

in a straight line, with the eccentric pivot pin 99 between the spring pins 103 and 105, as shown in Fig. 8. This is the dead center position of the eccentrically mounted gear 98 and corresponds to the position of the record changing mechanism after completion of the operation of removing a record from the turntable. Further counter-clockwise rotation of the gear 98 moves the spring pin 105 on the side of the eccentric pivot pin 99 away from the driving gear 97, as viewed in Fig. 8, so that the spring 104 biases the eccentrically mounted gear 98 away from the driving gear 97 and turns the eccentrically mounted gear 98 in a counter-clockwise direction. Further movement of the eccentrically mounted gear 98 causes it to unmesh from the driving gear 97, and the guiding arm 123 is then slid longitudinally by the tension of the spring 104 acting through the pin 105 on the outer end of the slot 130 until the screw 124 engages the inner end of the longitudinally extending slot 125. As shown in Fig. 9, this movement turns the eccentrically mounted gear 98 in a counter-clockwise direction and guides it back to its reset position out of engagement with the driving gear 97. As the eccentrically mounted gear turns counter-clockwise and the supporting plate 100 turns clockwise, a cam 131, formed as a projection on the end of the guiding arm 123, engages the spring pin 103, and the tension of the spring 104 turns the gear 98, so that the spring pin 105 slides to the inner end of the angular portion 130 of the slot in the arm 123. The eccentric gear 98, the supporting plate 100, and the actuating arm 43 continue to turn or pivot under the biasing force of the springs 104 and 109, until the eccentrically mounted gear again comes to rest in engagement with the resilient stop 106. The operation of the reproducer and the record lifting mechanisms in this construction is the same in Figs. 1 to 4, inclusive, and this modification provides a more positive guiding of the eccentric gear and facilitates removal of the turntable from the driving mechanism.

While I have illustrated and described particular embodiments of my invention, modifications thereof will occur to those skilled in the art. I desire it to be understood, therefore, that my invention is not to be limited to the particular arrangements disclosed, and I intend in the appended claims to cover all modifications which do not depart from the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a phonograph having a record turntable and a reproducer, a driving gear, a pivoted arm, a second gear, means including a support rotatably supporting said second gear by said pivoted arm out of engagement with said first-mentioned gear during the operation of reproducing of a record, means for moving said second gear into engagement with said first-mentioned gear upon completion of a record for pivotally actuating said arm, means for resiliently biasing said second gear about its support on said arm to said engaged and disengaged positions during said operations of the phonograph, means responsive to actuation of said pivoted arm for removing a record from said turntable, and means responsive to the actuation of said pivoted arm by said gears for returning said reproducer from the end to the beginning of a record.

2. In a phonograph having a record turntable and a reproducer, a driving gear, a pivoted arm, a second gear, means including a support for eccentrically and rotatably supporting said second gear by said pivoted arm out of engagement with said first-mentioned gear during the operation of reproducing of a record, means for moving said second gear into engagement with said first-mentioned gear upon completion of the reproduction of a record, means for resiliently biasing said second gear about its eccentric support on said arm to said engaged and disengaged positions during said operations of the phonograph, means responsive to actuation of said pivoted arm for removing a record from said turntable, and a mechanism associated with said pivoted arm and controlled thereby for raising said reproducer from a record and returning it to the beginning thereof.

3. In a phonograph having a record turntable and a reproducer, a driving gear, a pivoted arm, a second gear, means for supporting said second gear eccentrically and rotatably on said pivoted arm out of engagement with said first-mentioned gear during the operation of reproducing of a record, means for moving said second gear into engagement with said first-mentioned gear upon completion of a reproduction for pivotally actuating said arm by the rotation of said gears, means for resiliently biasing said second gear about said eccentric support on said arm to said engaged and disengaged positions, and a mechanism associated with said pivoted arm and controlled thereby for removing a record from said turntable upon actuation of said arm by said gears.

4. In a phonograph having a record turntable and a reproducer, a driving gear, a pivoted arm, a second gear, means for supporting said second gear eccentrically and rotatably on said pivoted arm out of engagement with said first-mentioned gear during the operation of reproducing of a record, means for moving said second gear into engagement with said first-mentioned gear upon completion of a record for pivotally actuating said arm, means for resiliently biasing said second gear about said eccentric support on said arm to said engaged and disengaged positions, and means responsive to the actuation of said pivoted arm for returning said reproducer from the end to the beginning of a record and for removing a record from the turntable.

5. In a phonograph having a record turntable and a reproducer, a driving gear, a pivoted arm, a second gear, means for supporting said second gear rotatably on said pivoted arm out of engagement with said first-mentioned gear during the operation of reproducing of a record, means for moving said second gear into engagement with said first-mentioned gear upon completion of a record for pivotally actuating said arm, means for resiliently biasing said second gear about said rotatable support on said arm to said engaged and disengaged positions, means responsive to the actuation of said pivoted arm by said gears for returning said reproducer from the end to the beginning of a record and for coincidentally removing a record from said turntable, and means for biasing said gears into disengaged position and for returning said second gear to an inactive position.

6. In a phonograph having a record turntable and a reproducer, a driving gear, a pivoted arm, a second gear, means for supporting said second gear eccentrically and rotatably on said pivoted arm out of engagement with said first-mentioned gear during the operation of reproducing of a record, means for moving said second gear into

engagement with said first-mentioned gear upon completion of the reproduction for pivotally actuating said arm by the rotation of said gears, means for resiliently biasing said second gear about said eccentric support on said arm to said engaged and disengaged positions during said operations of the phonograph, a mechanism associated with said pivoted arm and controlled thereby for removing a record from said turntable upon actuation of said arm, means for disengaging said gears after removal of a record, and means for returning said mechanism and said second gear to an inactive position upon disengagement of said gears.

7. In a phonograph having a record turntable and a reproducer, a driving gear, a pivoted arm, a second gear, means for eccentrically and rotatably supporting said second gear on said pivoted arm, means for resiliently biasing said second gear to an out of engagement position with said first-mentioned gear during reproduction of a record and for resiliently biasing said second gear to engaged position with said first-mentioned gear upon completion of the reproduction to pivotally actuate said arm by the rotation of said gears, a mechanism associated with said pivoted arm for removing a record from said turntable upon actuation of said arm after reproduction of a record, and means arranged to cooperate with said resilient biasing means to disengage said gears after removal of a record from the turntable and for biasing said mechanism and said second gear to an inactive position upon disengagement of said gears.

8. In a phonograph having a record turntable and a reproducer, a driving gear, a pivoted arm, a second gear, means for eccentrically and rotatably supporting said second gear on said pivoted arm, means for resiliently biasing said second gear to an out of engagement position with said first-mentioned gear during reproduction of a record and for resiliently biasing said second gear to engaged position with said first mentioned gear upon the completion of the reproduction to pivotally actuate said arm by the rotation of said gears, a mechanism responsive to the actuation of said pivoted arm by said gears for removing a record from said turntable upon actuation of said arm after reproduction of a record, means for raising said reproducer from a record and returning it to the beginning of a record coincidental with the removal of a record from said turntable, and means for biasing said gears into disengaged position and for returning said mechanism and said second gear to an inactive position.

9. In a phonograph having a record turntable and a reproducer, a driving gear, a pivoted arm, a second gear, means for rotatably supporting said second gear on said pivoted arm, means for resiliently biasing said second gear to an out of engagement position with said first-mentioned gear during reproduction of a record, means arranged to cooperate with said first-mentioned resilient biasing means for resiliently biasing said second gear to engaged position with said first-mentioned gear upon completion of the reproduction to pivotally actuate said arm by the rotation of said gears in engagement, a mechanism associated with said pivoted arm for removing a record from said turntable upon actuation of said arm after reproduction of a record, and means for resiliently biasing said pivoted arm to an inactive position and arranged to cooperate with said first-mentioned and second resilient biasing means for resiliently biasing said second gear into engagement with said first-mentioned gear over a portion of the operative cycle of actuation of said pivoted arm, said first-mentioned and third-mentioned resilient biasing means being arranged to cooperate to disengage said gears after removal of a record from the turntable and to bias said mechanism and said second gear to an inactive position upon disengagement of said gears.

10. In a phonograph having a record turntable and a reproducer, a driving gear driven with said turntable, a pivoted arm, a second gear, means for eccentrically and rotatably supporting said second gear on said pivoted arm, a cam rotatably supported on said pivoted arm, a stationary stop, means including a spring secured to said cam and to said second gear for biasing said second gear against said stop and out of engagement with said first-mentioned gear during reproduction of a record, means including said first-mentioned spring and a second spring for biasing said second gear into engagement with said first-mentioned gear upon completion of the reproduction to pivotally actuate said arm by the rotation of said gears, a mechanism associated with said pivoted arm for removing a record from said turntable upon actuation of said arm after reproduction of a record, means including a third spring for biasing said cam and said pivoted arm to an inactive position and arranged to cooperate with said first-mentioned spring and second spring for biasing said second gear into engagement with said first-mentioned gear over a portion of the operative cycle of actuation of said pivoted arm, said first-mentioned and third springs being arranged to cooperate to disengage said gears after removal of a record from the turntable by said mechanism and to bias said mechanism and said second gear to an inactive position upon disengagement of said gears, and means including a stop on said second gear arranged to cooperate with said cam for controlling the clearance of the disengaged gears during the return portion of the operating cycle of said second gear to an inactive position against said stationary stop.

11. In a phonograph having a record turntable and a reproducer, a driving gear, a pivoted arm, means including a second gear eccentrically and rotatably supported by said pivoted arm out of engagement with said first-mentioned gear during reproduction of a record and movable into engagement therewith upon completion of a reproduction for pivotally actuating said arm by the rotation of said gears; a mechanism associated with said pivoted arm and controlled thereby for removing a record from said turntable upon actuation of said arm by said gears, means for disengaging said gears on completion of the record removal operation of said mechanism, and means including a guide for guiding said eccentrically supported gear out of engagement with said driving gear to inactive position upon said disengagement thereof.

12. In a phonograph having a record turntable and a reproducer, a driving gear, a pivoted arm, a second gear, means for rotatably supporting said second gear on said pivoted arm, a stop, means for resiliently biasing said second gear out of engagement with said first-mentioned gear into inactive position against said stop during reproduction of a record, means arranged to cooperate with said first-mentioned resilient biasing means for resiliently biasing said second gear into engagement with said first-mentioned gear

upon completion of the reproduction to pivotally actuate said arm by the rotation of said gears, a mechanism associated with said pivoted arm for removing a record from said turntable upon actuation of said arm after reproduction of a record, means for resiliently biasing said pivoted arm to an inactive position and arranged to cooperate with said first-mentioned and second resilient biasing means for resiliently biasing said second gear into engagement with said first-mentioned gear over a portion of the operative cycle of actuation of said pivoted arm, a guiding arm, means for pivotally and slidably supporting said guiding arm, means utilizing said guiding arm and said first-mentioned and third-mentioned resilient biasing means for disengaging said gears after removal of a record from the turntable and for guiding and biasing said mechanism and said second gear to an inactive position upon disengagement of said gears.

13. In a phonograph having a record turntable and a reproducer, a driving gear, a pivoted arm, a second gear, means for eccentrically and rotatably supporting said second gear on said pivoted arm, a stationary stop, means including a spring secured to said arm and to said second gear for biasing said second gear against said stop and out of engagement with said first-mentioned gear during reproduction of a record, means including said first-mentioned spring and a second spring for biasing said second gear into engagement with said first-mentioned gear upon completion of the reproduction to pivotally actuate said arm by the rotation of said gears, a mechanism associated with said pivoted arm for removing a record from said turntable upon actuation of said arm after reproduction of a record, means including a third spring for biasing said pivoted arm to an inactive position and arranged to cooperate with said first-mentioned spring and second spring for biasing said second gear into engagement with said first-mentioned gear over a portion of the operative cycle of actuation of said pivoted arm, said first-mentioned and third springs being arranged to cooperate to disengage said gears after the record removal operation of said mechanism and to bias said mechanism and said second gear to inactive position upon disengagement of said gears, and means including a pivoted guiding arm for guiding said second gear out of engagement with said driving gear during the return portion of the operating cycle of said second gear to inactive position against said stationary stop.

14. In a phonograph mechanism of the type comprising a record discharge mechanism and a tone arm positioning mechanism, means for actuating the record discharge mechanism comprising a movable element operably connected to the record discharge mechanism and the tone arm positioning mechanism, a pinion integral with the drive shaft of the phonograph mechanism, gear means associated with the movable element to actuate said element, the gear means being movable into and out of a path to effect engagement with said pinion, means for maintaining said gear means in engagement with said pinion, and means moving said gear means into a disengaged path after said element has been actuated a predetermined amount.

15. In a phonograph mechanism of the type comprising a record changing mechanism and a tone arm positioning mechanism, means for actuating said record changing mechanism comprising a movable element operably connected to said record changing mechanism and said tone arm positioning mechanism, gear means on the drive shaft of said phonograph mechanism, other gear means associated with said movable element to actuate said element, said other gear means being movable into and out of a path to effect engagement with said drive shaft gear means, means for maintaining said other gear means in engagement with said drive shaft gear means, and means moving said other gear means into a disengaged path after said element has been actuated a predetermined amount.

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