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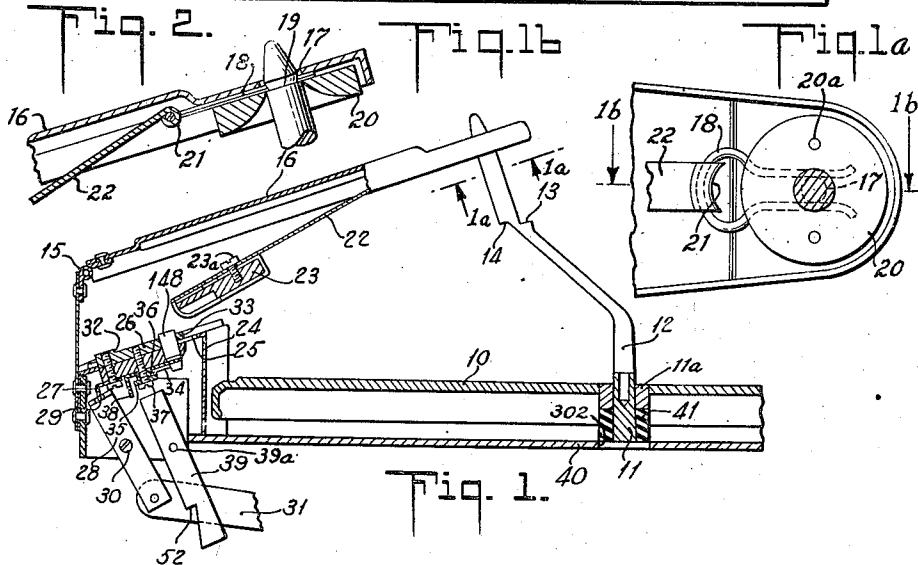
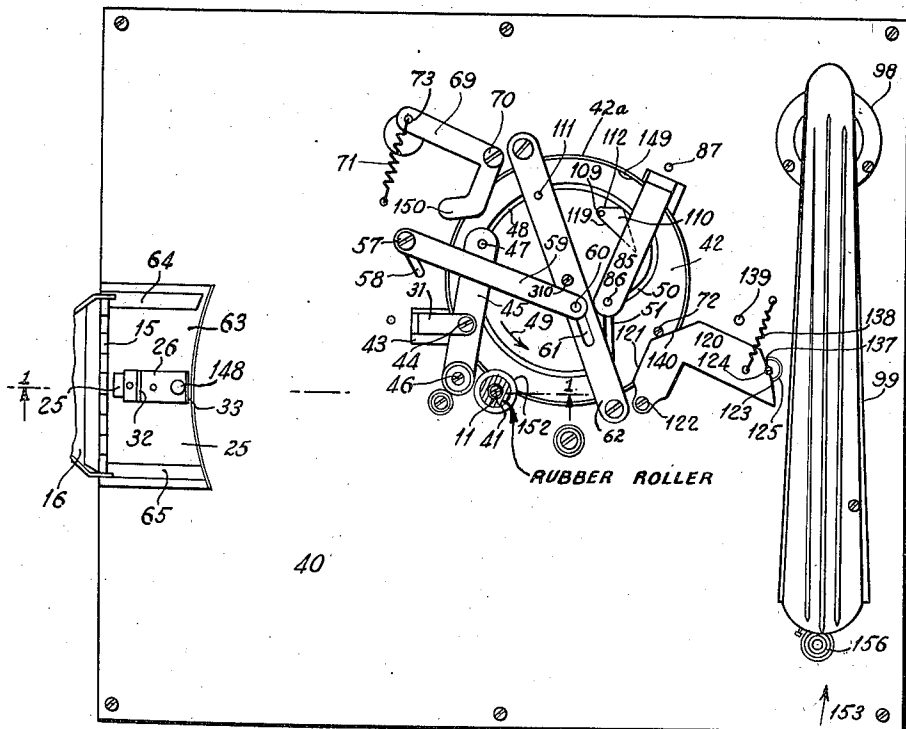
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2,435,264

AUTOMATIC RECORD CHANGER FOR PHONOGRAPHS

Filed June 10, 1942

3 Sheets-Sheet 1



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AUTOMATIC RECORD CHANGER FOR PHONOGRAPHS

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Fig. 3.

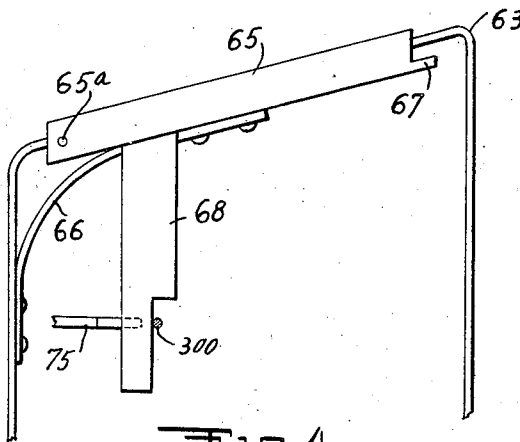
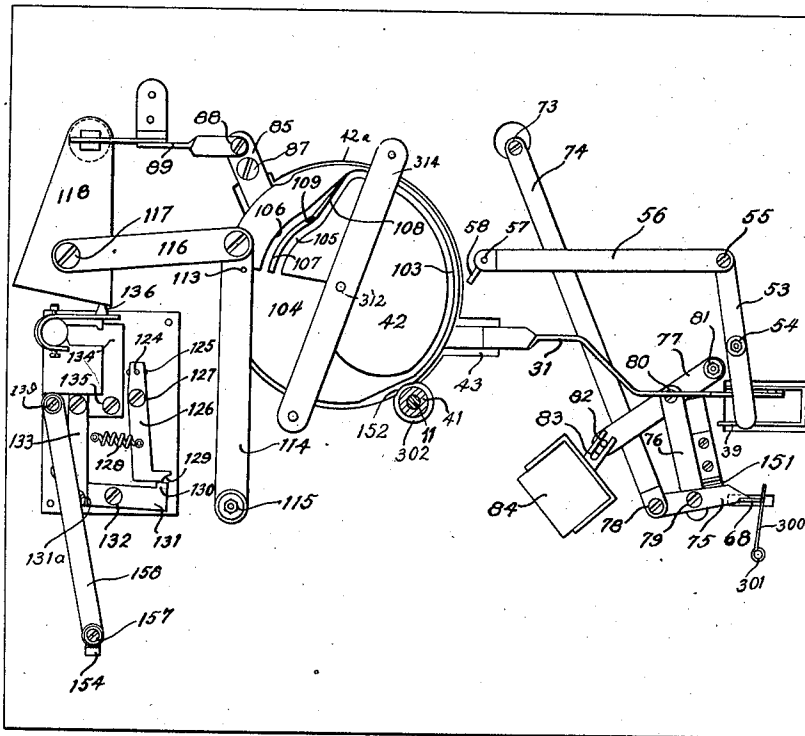


Fig. 4.

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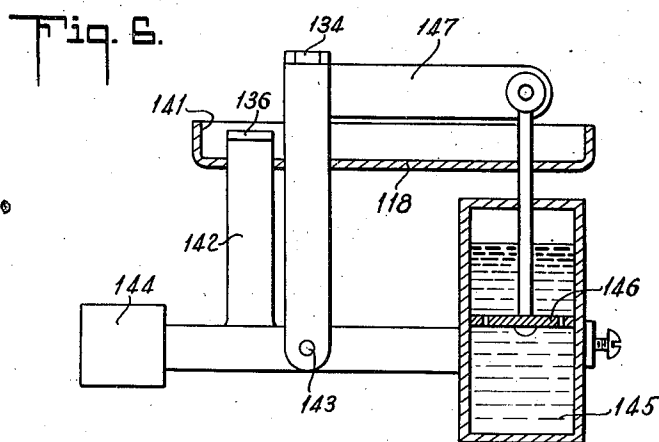
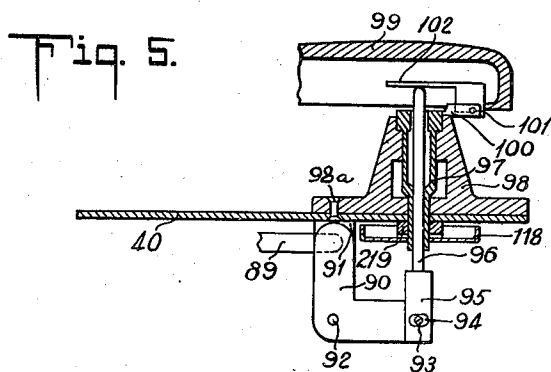
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AUTOMATIC RECORD CHANGER FOR PHONOGRAPHS

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3 Sheets-Sheet 3



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AUTOMATIC RECORD CHANGER FOR
PHONOGRAPHS

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6 Claims. (Cl. 274-10)

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My invention relates to an arrangement in automatic record changers for phonographs.

A known kind of automatic record changers for phonographs is provided with a guide pin for the center perforation of the phonograph records, formed in such a way that when a record is released from a stack held in a tilted position above the turntable, the record is by its own weight fed downwardly to the playing position at the center of the turntable. Such record change arrangements were, however, only usable for records of the same diameter. If the stack contained alternately small and large records, the feeding could not take place with accuracy.

The present invention refers to an arrangement by which this difficulty is removed. In accordance with the present invention the records are not only carried at their center perforation but also at least at one place along the edge, and if small records as well as large records are carried in this way, and are fed from the bottom of the stack, it is necessary in order that the records be free from the carrying arrangement arranged at the edge, that the guide pin be formed in such a way that a sufficient great side displacement of the records is obtained. According to the invention the guide pin is of such a form that the center perforation of the record, during the movement of the record from stacked position into playing position, is displaced in radial direction with relation to the turntable a distance which is at least equal to the difference in radius between the largest and the smallest record. Usually this radial difference is equal to one inch or 2.5 cm.

Automatic record changers are, however, as a rule further provided with arrangements which cause the pick-up arm to be elevated from the record just played, to be swung out, so that there is room for the change of record, to be again swung in over the initial groove on the new record and to be lowered to this initial groove. However, the initial groove in a record is located at a different radius, dependent upon the size of the record, and the position in which the pick-up arm should be lowered will therefore be different. For this reason there must be mechanism responsive to the diameter of the record. This is also part of the present invention.

The character of such mechanism and of other details of the invention will be apparent from the following description of one form of the invention, but it is to be understood that substantial modifications may be made within the scope of the invention. The invention is described in

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connection with the annexed drawings, in which Fig. 1 is an enlarged vertical section taken on the line 1-1 of Fig. 2, the guide pin for the records being shown, and the supporting arm being in supporting position for the guide pin; Fig. 1a is an enlarged sectional view on the line 1a-1a of Fig. 1; Fig. 1b is a sectional view on the line 1b-1b of Fig. 1a; Fig. 2 is a plan view showing the supporting arm 16 broken away and swung to the left out of supporting position; Fig. 3 is a plan view from below showing the chassis plate and mechanism below the chassis plate; Fig. 4 is an enlarged view of a portion of the mechanism employed to automatically open the motor switch after the last record has been played; Fig. 5 is an enlarged cross-sectional view of the mechanism for raising and turning the pick-up arm; and Fig. 6 is a cross-sectional view of dash pot arrangement for causing only rapid radially inward movement of the pick-up arm to initiate a record change.

The turntable in Fig. 1 is indicated by reference character 10. It is secured to a vertical shaft 11 by means of a bushing 11a, which is driven by the usual motor. There is mounted on the shaft 11 a guide pin 12 for the records, which is of a special kind. Guide pins of the known kind are provided with a notch 13, directed upwards, and a notch 14, diametrically opposed to the first mentioned notch and directed downwards. The distance between these notches, measured perpendicularly to the plane of the notches, is very little greater than the greatest thickness of a record, but in any case less than the total thickness of the two thinnest records, which may be played. Such guide pins act in such a way, that when the stack of records, mounted on the notch 13 is moved sideways, only that record which is in the lowest position in the stack may be displaced under the notch 14, so that it is freed and may fall down on the turntable 10 or on the records already on the turntable the record thereby being guided by cooperation between the part of the guide pin 12 below the notches and the center perforation of the record.

From these earlier known guide pins the guide pin 12 differs by both form and angle of inclination. The inclination is chosen in such a way that the record, during its movement downwards along the guide pin is displaced sideways a distance of at least 2.5 cm. or one inch, which is half the difference in diameter between a ten inch record and a twelve inch record.

The records rest with the edges of the center

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perforation against the notch 13, and simultaneously the records rest with one point of their periphery against the feed down mechanism, shown to the left in Fig. 1. The mechanism includes an arm 16, which may be swung about a hinge 15, said arm being at its outer end provided with a perforation 17, through which extends the top of the guide pin 12. This serves for securing the guide pin 12 against any tendency to be rotated by rotation of the shaft 11. The perforation 17 suitably is provided with a hair pin spring 18, shown in Figs. 1 and 1a, which engages a groove 19 in the guide pin, the position of the arm 16 thereby being fixed so that it is centered with respect to the upper end of pin 12 and does not fall down on to the records. About the perforation 17 there is further secured by screws 20a a guide collar 20 in order to facilitate the centering of the perforation 17 right with respect to the top of the guide pin 12.

The spring 18 is extended to form a hinge 21 for a further arm 22, which is at its other end provided with a weight 23, secured thereto in any suitable manner, as indicated at 22a, which normally rests on the stack of records above or adjacent to a support, provided by the record changing mechanism to the left in Fig. 1.

The record changing mechanism is carried by a frame 24 with a rectangular opening 25, in which a record pusher 26 moves. The pusher 26 includes upper and lower plates secured together by screws and forming longitudinally extending grooves at their mating edges which embrace the edges of the opening 25 in frame 24. The record pusher is mounted in the opening 25 in such a way that it can move to and fro a small distance in the lengthwise direction of the opening, parallel to the plane of the paper in Fig. 1, being guided by the edges of the opening 25. This movement is effected by an angular part 27, cooperating with a catch member 29 arranged at one end of a lever 28. The lever 28 may be turned about a stud 30, and it is further turnably connected to a pull bar 31, which obtains its movement from a cam disc construction, which shall be further described in the following.

The record pusher 26 carries two push portions 32 and 33, the former of which is intended for records of the greater diameter and the latter one of which for records of the smaller diameter. The push portion 33 is provided with a test pin 148, but this pin, in order not to prevent the contact of a large record with the push portion 32 as well as to indicate for another purpose in a manner which is further described below, if a large record or a small record is placed at the bottom of the stack, is so arranged that it may be pushed down into the body of the record pusher 26 against spring action. The spring action is caused by means of a flat spring 34, connected between a washer 35 on a cap 36 and the head of a screw 37, and bearing against a part 38 connected to the lower end of the test pin 148. The left end of part 38 is angular and the part is arranged in such a way that it may be displaced downwardly while being guided by the neck of the cap 36. The member 38 will move in synchronism with the movement of the record pusher. If a small record is placed as the lowest record in the stack, the test pin 148 in a certain moment during the movement of the record pusher will be in its elevated position, and the angular part 38 during its movement will in such case pass above and out of contact with a lever 39 turnable about a fixed pivot 39a. If, however,

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a large record should be placed at the bottom of the stack, the test pin 148 and the member 38 will be forced down, so that the latter during its movement will catch the end of the lever 39. In a manner, which shall be explained later, this results in the pick-up arm being lowered when in the proper position for the needle to enter the starting groove in a large record, whereas the pick-up arm will otherwise be lowered when in a position for the needle to enter the starting groove in a small record. This arrangement is also controlled by means of the said cam disc.

In Fig. 2 the record change arrangement is shown with the turntable removed. Between the turntable 10 and the chassis plate 40, see also Fig. 1, the driving shaft 11, which passes through an opening 302 in the plate, is surrounded by a rubber ring 41, which cooperates with the periphery of a cam disc 42. The cam disc is mounted in an opening 42a in the plate 40 and is rotatably supported on a shaft having a bearing 310 in a bar 62 spanning the opening 42a above the plate 40, and a bearing 312 in a similar bar 314 below the opening. The cam disc 42 is provided with a plurality of grooves, some of which are in its upper face, while the remainder are in its lower face. At present the function of the groove in the upper face will be explained. The pull bar 31, shown in Fig. 1, which is placed below the chassis plate 40, is bent in such a way in S-form, that it extends through an opening 43 in the chassis plate 40 to its upper side. There it is pivotally connected to an intermediate point 44 of a lever 45, which is pivotally connected to the chassis plate by a stud 46. The lever 45 at its free end carries a guide pin 47, directed downwards, which constitutes a cam follower cooperating with the groove 48 in the cam disc 42.

The cam disc 42 is provided with a recess 152 in its periphery of sufficient size so that the rubber roller 41 may freely rotate therein. However a very small movement of the cam disc causes the rubber roller to ride up on to the periphery of the cam disc, and the cam disc will then be rotated by roller 41, which is continuously driven by the phonograph motor. The rubber roller continuously rotates in clockwise direction, and the cam disc therefore will rotate in counter-clockwise direction, as indicated by the arrow 49. The arrangements for starting the rotation of the cam disc will be further described below in another connection.

It may now be assumed that a record has just been fully played, and that as a consequence thereof rotation of the cam disc is started in order to cause a record change. This first causes different members, which shall be described in the following, to act in order to elevate the pick-up arm and swing it to the side, respectively. These operations are completed by the time that the pin 47 comes into cooperation with the inwardly directed part 50 of the groove 48. Due to the movement of the pin in the groove the lever 45 will be turned in clockwise direction about the stud 46, thereby moving the pull bar 31 to the right, as viewed in Figs. 1 and 2.

From Fig. 1 it is evident that this results in a turning of the lever 28 in a counter-clockwise direction, whereby the record pusher 26 will be moved to the left in the figure. To begin with it will now be assumed that a small record is placed as the lowest record in the stack. This record normally rests with its outmost edge on the upper side of the test pin 148, so that this is pushed down. During the first moment of the movement

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to the left of the record pusher 26, however, the test pin 148, as well as the push member 33, will be displaced outwardly beyond the periphery of the record, so that the test pin 148 is pressed into its upper position due to the action of the spring 34.

The movement of the record pusher to the left is continued until the pin 47 has reached the radially innermost point of the bend 50—51 in the groove 48, and is again moved outwards by the outwardly directed part 51 of the groove. The lever 45, the pull bar 31 and the lever 28 then will move back into their initial positions, but now the push member 33 will give the record an impulse for displacement to the right, immediately before the record pusher has fully reached its initial position. This impulse is sufficient to free the record from the notch 13, and it slides downwards along the guide pin 12 into playing position on the turntable 10.

During the continuous rotation of the cam disc 42 the pick-up arm is moved back inwardly, until the needle is above the initial groove of the new record, and thereafter it is lowered.

On the other hand, if it is assumed that the lowest record in the stack is a large record, the test pin 148 will not only be pushed down when the sequence of movement begins, but it will also remain in pushed down position during all of the to and fro movement of the record pusher 26. As a result, the angular part 38, during its return movement will catch the lever 39 and thereby pivot this lever in clockwise direction. The lower end of the lever 39 is provided with a notch 52, which cooperates with a further lever 53, shown in Fig. 3.

The lever 53 in Fig. 3 is pivoted about a stud 54 and it is pivotally connected at 55 to the pull bar 56, which is at its other end provided with a pin 57. This pin extends through a lengthened slot 58 in the chassis plate and is on the upper side of the chassis plate connected to a further bar 59. This bar carries a pin 60 at its end which pin influences parts connected to the cam disc in such a way that the pick-up arm is always lowered in the correct position, regardless of the size of the record.

The pin 60 is guided in a slot 61 in a bar 62, the ends of which are supported by the chassis plate in spaced relation thereto above the cam disc 42.

When the lever 39, Fig. 1, is turned in clockwise direction due to a large record being placed as the lowest record in the stack, the lever 53 is pivoted counterclockwise, as seen in Fig. 3, and the pull bar 56 is displaced to the left in Fig. 3, and due to the connection by means of the pin 57, the bar 59 is displaced to the right, as seen in Fig. 2. The movement of bar 59 is guided by the pins 57 and 60 sliding in the slots 58 and 61, respectively. Consequently due to the movement of the bar 59 the pin 60 moves radially outwardly in the slot 61. This radial movement determines, in a manner which shall be described below, the radius at which the pick-up arm is lowered.

It may occur that the record just being placed in the turntable by means of the above mentioned operations is not only the lowest but also the last record in the stack. In this case, obviously, the phonograph motor should be stopped when the record in question is fully played. For this purpose the following mechanism is employed:

The table 63, Fig. 2, on to which the edge of

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the stack of records rests, and in which the record pusher 26 moves, is provided near its outer edges with two rails 64 and 65 in order that the records shall not be damaged due to the friction against the table.

One of these rails, for instance the rail 65, however, is movably arranged in such a way, see Fig. 4, that it serves as a means for indication if further records are contained in the stack. For this purpose the rail 65 is pivoted at one end at 65a and urged upwardly by the blade spring 66, until stopped by a projection 67, mounted on the under-side of the rail, contacting the lower edge of the table 63. An arm 68, spring pressed by spring 300 mounted on a pin 301, is connected to the rail 65 for transmitting the impulse to the mechanism for stopping the motor, when the last record has been removed from the stack. The stopping of the motor takes place by means of the following parts:

On the upper side of the chassis, see Fig. 2, a bellcrank lever 69 is pivoted at 70 and so arranged with relation to the cam disc 42, that one arm extends over the cam disc. The other arm is biased counterclockwise by a spring 71 which is connected between the chassis plate and the upper end of a stud 73 carried by arm 69. Hence, the arm extending over the cam is urged into the path of a pin 72, mounted on the cam disc, which causes the bellcrank lever 69 to be turned about the journal 70 in clockwise direction for each revolution of the disc. By means of the stud 73 this movement is transferred to a pull bar 74, which is mounted on the under-side of the chassis. The other end of the pull bar 74 is connected with a system of levers including the levers 75 and 77 pivotally connected to the connecting rod 76. The lever 75 is movably connected at one end to the pull bar 74, and at its opposite end this lever is provided with a notch, which cooperates with the above mentioned arm 68, when this is in the upper position, which it occupies when the last record has been removed from the stack. Approximately at the middle point of the lever 75 there is connected the connecting rod 76 by means of the pin 79 and the other end of this rod 76 is connected by a pivot 80 to the lever 77. The lever at one end is movably connected at the pivot 81 to the chassis, whereas the lever 77 carries at its other end a pin 82, which cooperates with the fork-shaped arm 83 of the switch 84 of the motor.

It is assumed that the last record has been placed on the turntable, that the playing of it has been completed and that in a manner, which shall be further described below, a new record change operation has begun. As a consequence of the record having been played, rotation of the cam disc 42 is initiated in order to execute the following operations, namely, elevating the pick-up arm from the record, swinging the pick-up arm outwardly beyond the periphery of the record, driving the record pusher backwards in order to engage the edge of a new record, displacing this record so that it falls down on the turntable, swinging the pick-up arm in over the record and lowering the pick-up arm on to the record. At the moment when the record pusher is in its backward position, the pin 72 strikes the lever 69, thus swinging it in clockwise direction. This causes the pull bar 74 to be displaced in a direction upwards in Fig. 3, whereby it will pivot the lever 75 counter clockwise about the pin 79. If a record is left in the stack, the rail 65 is pressed down, and the arm 68 is in its ineffective posi-

tion, the end of the lever 75 therefore not contacting the arm 68. Hence, the lever 75 merely pivots about pin 79, and no motion is transmitted to connecting rod 76. If the record just played was the last one in the stack, the rail 65 consequently is pressed upwards by the spring 66, the arm 68 thereby having been moved to its effective position. The lever 75 immediately at the beginning of its turning movement touches the arm 68, and a continued turning of the lever 75 about pin 79 as a flexed center is not possible. The connecting rod 76 is hence moved upwardly and turns the lever 77 in counter-clockwise direction, whereby the pin 82 turns the fork-shaped arm 83 to open the switch 84, as shown in Fig. 3. The motor thereby is stopped, and will not operate until another stack of records has been put in place and the motor has been started manually.

The cam disc 42 at its periphery is provided with a further recess 149. At the moment when the current to the motor is cut off, this recess 149 is aligned with the rubber-coated roller 41, which turns freely out of contact with the edges of the recess. The driving of the cam disc by the roller 41 therefore ceases momentarily, and the cam disc will stop, provided that no other driving impulse is introduced.

If the latest changed record was not the last record in the stack, the lever 75 does not contact arm 68 and the lever 69 after having been swung out by the pin 72 is thereafter swung back to its normal position by the spring 71. During the last named movement the pin will be contacted by the inclined edge 150 of lever 69, and this edge consequently will press the pin in a direction urging the cam disc to continue its rotation in the direction of the arrow 49. The cam disc is thus prevented from stopping, in spite of the roller 41 momentarily being in the recess 149.

If on the other hand the latest changed record was the last one in the stack, the cam disc stops with the roller 41 in the recess 149. This action is caused by cooperation between the different levers in the lever construction in Fig. 3. When the switch 84 is brought into open position, which is the position shown in the figure, the lever 77 is pivoted further in clockwise direction by the action of the usual toggle spring in switch 84, whereby the connecting rod 76 is moved further in an upwardly direction. The left end of lever 75 is thus brought into contact with a stop 151, the lever 75 thereafter turning in counter-clockwise direction about the stop 151 as a fulcrum, whereby the lever 74 is displaced upwards. This results in the lever 69, Fig. 2, being swung in clockwise direction so as to prevent the inclined edge 150 from bearing against the pin 72. Consequently, the cam disc 42 does not receive the impulse necessary to cause the roller 41 to engage the side of recess 149.

When the records on the stack have been removed and a new stack mounted in position on the record pusher arrangement, the motor is again started by closing the switch 84. This movement causes a turning in clockwise direction of the lever 77, the lever 75 and the pull bar 74 thereby being freed for movement under influence of the spring 71, which causes the lever 69 to continue its earlier interrupted movement, the pin 72 thereby being given the impulse required for starting the cam disc.

The different movements caused by the cam disc are divided between the first half revolution

and the second half revolution of the cam disc. During the first half revolution there is caused in the following order: elevating the pick-up arm, swinging the pick-up arm outwardly beyond the turntable and driving back the record pusher. Thereupon the roller 41 enters the recess 149, and, if the arrangement is brought to a stop, the pick-up arm will consequently remain in its swung out position, so that removal of the stack of records from the turntable may freely take place. During the second half revolution of the cam disc, which is begun after a new stack of records has been put in place and the switch 84 closed, the record pusher is first carried forwards, so that a record is dropped on the turntable, thereafter the pick-up arm is swung in over the initial groove of the record, and finally the pick-up arm is lowered to engage the needle with the initial groove, so that the playing of the record begins.

The arrangement is in other words such that during normal record changing the cam disc rotates a full revolution, but if the latest changed record is the last one in the stack, the rotation of the cam disc stops after the first half revolution, and in this position the cam disc will remain, until the arrangement is again started, whereupon the cam disc will continue its interrupted movement with the other half revolution, and at subsequent change of record a full revolution will take place.

Now the movement of the pick-up arm will be described.

For elevating and lowering of the pick-up arm the following mechanism is provided. An S-shaped arm 85 is arranged with one part above and the other part below the chassis plate. The part placed above the chassis plate carries a pin 86 cooperating with the groove 48 in the cam disc. The arm 85 is pivoted by means of a stud 87 connected to the chassis plate, and its other end is connected to a pull bar 89, visible in Figs. 3 and 5, by means of a pin 82. The pull bar 89 is arranged to transmit the movement of the arm 85, caused by the cam edge, to bellcrank lever 90 (Fig. 5), which is pivotally mounted at 92 on a bracket 91, extending downwardly from the chassis. The other end of the lever is connected by a pin 93 and a slot 94 with the head 95 of vertically extending pin 96.

The pin 96 extends through the pedestal 98 of the pick-up arm 99, guided by a sleeve 97, which is turnably arranged in the pedestal, so that the turning of the pick-up arm is made possible. The pedestal 98 is secured to the chassis plate 40 in any suitable manner, as by the rivet 98a. At the upper end of the sleeve 97 a projecting part 100 is connected, to the opposite end of which the pick-up arm is pivoted at 101. Consequently the pick-up arm may be swung about the journal 101, so that the elevation of the pick-up arm from the turntable is made possible. A plate 102 is secured to the pick-up arm so as to be contacted by the upper end of the pin 96. The upwards and downwards movements of the pin therefore will cause the pick-up arm to be elevated and lowered, respectively.

The arrangement functions in the following way:

The position of the cam disc 42, shown in Fig. 2, corresponds to the normal playing position, in which the pick-up arm is lowered on to the record. When the cam disc 42, in a manner which shall be described below, is rotated after a record has been fully played, the pin 86 will

first be moved outwardly by the part 51 of the groove 48, the arm 85 thereby being pivoted counter-clockwise, as viewed in Fig. 2, and the pull bar 89 being moved to the left in Fig. 5. This pivots lever 90 counter-clockwise and elevates pin 96, which also causes elevation of the pick-up arm 99 from the record. By means, which shall be further described in the following, the pick-up arm is thereafter swung out from the record. The means by which a new record is placed above the last one on the turntable, have already been described. After completing the change of record the pick-up arm is again turned backwards above the first groove in the new record, and thereafter it is lowered. During this whole operation the pick-up arm is maintained at a fixed height above the turntable, as the pin 86 moves in that part of the groove 48 which is concentric with the center of rotation of the cam disc 42. At the moment when the change of record has been completed and the arm is brought back into the position exactly above the initial groove of the new record, however, the pin 86 enters the inwards directed part 50 of the groove 48, and the arm 85 is returned to its normal position. Consequently, the pull bar 89 is displaced to the right, the lever 90 is turned to its normal position, and the pin 96 is lowered in such a way that the pick-up arm is lowered on to the new record. Hereafter the playing of this record begins.

The cam disc 42 is not only provided with the groove 48, shown in Fig. 2, but on its under-side there are additional grooves as shown in Fig. 3. Through an angle of substantially 120° the groove 103 is arranged concentrically about the center of rotation of the cam disc 42. Somewhat more than 120° of the cam disc is occupied by a substantially expanded part 104 of the groove, whereas the remaining part of the disc is occupied by the two substantially parallel grooves 105 and 106, respectively, which are separated by means of a wall 107. At one end of this wall a pointed lever or switch rail 108 is movable about a pin 109, which extends through the cam disc 42. On the upper-side of the cam disc a triangular control body 110 is fixed to the pin 109 and serves to determine the position of the switch rail 108.

In Fig. 2 the control body 110 is shown in its normal position. If the control body assumes a different position, it is automatically restored to the normal position, when the cam disc 42 rotates about 30° from the initial position by a pin 111, extending downwardly from the bar 62, which contacts the edge 112 of the control body 110. The switch rail 108 is shown in Fig. 3 in its normal position.

When the cam disc is rotated for causing change of records, the arm 85 is moved due to the cooperation of the pin 86 with the groove 51. As described above, this elevates the pick-up arm from the record. About a 30° turn of the cam is required to complete the elevation, and thereafter the pin 86 enters the concentric part of the groove 48. Somewhat later on, however, a pin 113, arranged on an arm 114, contacts one of the edges of the wide, extended part 104 of the groove 103. The pin 113 thereby is guided into the groove 103, whereby the arm 114 is swung outwardly. The arm 114 is pivoted by means of a pin 115, connected to the chassis. A pull bar 116, which is movably connected at 117 with the outer end of the arm 114, transmits the movement of the arm 114 to an arm 118, which is for another purpose formed in a special manner. In other respects the function of the arm 118 will be

described below in another connection. However, the arm 118 is connected to a collar 219, which is fastened to the sleeve 97, see Fig. 5. The movement of the arm 118 therefore will cause the pick-up arm 99 to be swung outwardly into a position in which it is beyond the turntable.

The pick-up arm remains in this position, as long as the pin 113, Fig. 3, remains in the concentric part of the groove 103. When entering the inwardly inclined part of the groove, however, the pin 113 will be brought nearer to the center of the cam disc, and consequently also the pick-up arm will be turned inwardly over to the turntable. If the switch rail 108 is in the position shown, the pin will be guided into the groove 105. The part of the groove 105 which is along side the wall 107 is concentric with the center of the cam disc, and consequently the pick-up arm is not pivoted. This position of the pick-up arm corresponds to the initial groove of a small record. The part 50 of the groove on the upper face of the cam disc corresponds in angular location to the groove 105, and functions by means of the arm 85 to lower the pick-up arm on to the initial groove of the record.

The movement of the cam disc automatically stops in a way which shall be described below, the cam disc thereby again occupying its position of rest, shown in Fig. 2 and Fig. 3. In this position the pin 113 under normal circumstances is placed in the enlarged part 104 of the groove, exactly in arcuate alignment with the opening of the groove 105. However, the playing of the record now takes place, and due to the spiral character of the groove in the record, the pick-up arm is pivoted inwardly towards the center of the record. This movement is by means of the arm 118, the pull bar 116 and the arm 114 transmitted to the pin 113, so that this pin approaches the inner wall of the enlarged space 104. When the next record change takes place, the pin 113 is therefore adjacent to the inner wall of the space 104, and the arm 114 will in the manner, above described, again be pivoted outwardly, until the pin 113 enters the groove 103.

As previously described the pin 148, see Fig. 1, is arranged for indicating if the lowest record in the stack, that is, the record which is to be played next, is of a large or a small diameter. Assuming that this record has a large diameter, the pin 148 is depressed by the record, and hence the part 38 cooperates with the lever 39 so that the pin 60, Fig. 2, is displaced outwardly in the slot 61. When the control body 110, during the rotation of the cam disc, comes into contact with the pin 111, the control body is carried into its normal position, which means that the switch rail 108 is put into such a position that the groove 103 communicates with the groove 105. However, the control body 110, during its continued rotation, comes into contact with the pin 60, provided that this has been displaced to its outer position, the edge 119 of the control body thereby contacting the pin 60. In this way the switch rail 108 is put into the position in which the groove 103 communicates with the groove 106. This movement of the switch rail takes place just before the pin 113 leaves the groove 103, and consequently the pin will not be conducted into the groove 105 but instead into the groove 106. Consequently, the pick-up arm is not turned so far inwardly over the turntable, but is brought to a somewhat more outwardly position, corresponding to the initial groove of a large record.

Normally the shaft 11 of the turntable rotates

continuously during the change of record as well as during the playing of a record. However, the cam disc 42 makes but a single revolution each time a record is changed, and remains stationary during the playing of a record. In order to disengage the periphery of the cam disc from contact with the rubber roller 41 on the shaft 11 there is a recess 152 in the periphery of the cam disc 42. The recess 152 is so narrow that even very small displacement of the cam disc 42 in the direction of the arrow 49, Fig. 2, is sufficient to bring the periphery of the cam disc into contact with the rubber roller 41, so that a further revolution of the cam disc 42 is started. The arrangements now will be described which impart the impulse of movement to the cam disc 42, so that its rotation is started.

The impulse producing means includes the lever 120 which cooperates with the pin 72. During the rotation of the cam disc 42 the pin 72 will contact the edge 121 of the lever 120 just before the roller 41 enters the recess 152, whereby the lever 120 is pressed outwardly about its journal 122. At its outer, free end the lever 120 is provided with a cam surface 123, which contacts a pin 124. The pin extends through a hole 125 in the chassis from a lever 126, which is situated on the under-side of the chassis, and which may thus be seen in Fig. 3.

From Fig. 3 it is evident that the lever 126 is movable about the journal 127 and is biased in a counter-clockwise direction by means of a spring 128. The spring 128 therefore tends to press the pin 124 against the cam surface 123.

At its opposite end the lever 126 is provided with a cam surface, which contains a notch 129 for cooperation with a tooth 130 on an arm 131 which is journaled at 132 on the chassis.

The arm 131 is connected by means of pivot 131a to a pull bar 133 and a bell-crank lever 134, movable about the journal 135, and provided with a projection 136. The arm 118 cooperates with the projection 136, and for this purpose the arm 118 has the form of a cup, open on the upper side, as shown in Fig. 5. Thus, during the last part of the outward movement of the pick-up arm, the arm 118 catches the projection 136, whereby the lever 134 is turned in clockwise direction, consequently moving the pull bar 133 and the arm 131. The tooth 130 thus engages the notch 129, whereby the lever 126 is locked in such a position that pin 124 engages a notch 137 on the cam surface 123, see Fig. 2. Consequently the lever 120 is locked in the position shown in the figure, from which it tends, however, to move under influence of a spring 138.

It is now assumed that the playing of a record is almost completed. Due to the movement of the pick-up arm inwards towards the center of the record the arm 118 has also turned, so that its other upwardly extending edge is almost in contact with the projection 136. When the needle enters the part of the groove which rapidly approaches the center at the end of each record, the arm 118 is swung rapidly into contact with the projection 136, thereby displacing this projection in such a way that the lever 134 is turned in counter-clockwise direction. The pull bar 133 will cause a corresponding turn of the arm 131, so that the tooth 130 is disengaged from the notch 129. Consequently the lever 120 is free to turn under the influence of the spring 138, and this lever therefor is rapidly turned until it contacts a pin 139 in the chassis plate. Simultaneously the pin 124 is forced outwardly by the cam

surface 123 against the action of the spring 128.

When the lever 120 is driven in counter-clockwise direction under influence of the spring 138, its inclined edge 140 contacts the pin 72, which results in an impulse for rotation in counter-clockwise direction of the cam disc 42. The periphery of the cam disc contacts the rubber roller 41, and one turn of the cam disc together with the operations occurring during it is started. These operations have above been described each per se, and a further description thereof is therefore not necessary. However, it is evident from the above, that the different operations are as follows:

First the pick-up arm is elevated from the record by means of the pin 86 cooperating with the groove 51. Thereafter the pick-up arm is turned outwardly by means of the pin 113 cooperating with the edge of the wide part 104 of the groove on the under-side of the cam disc. Thereafter the pin 47 cooperates with the part 50 and thereafter with the part 51 of the groove 48 in order to bring the record pusher backwards and thereafter again forwards, thereby displacing a record, which falls down on the turntable. The groove part 105 or 106 will thereafter cooperate with the pin 113 in order to turn the pick-up arm backwards into the position of the initial groove of the record, whereafter the pin 86, guided by the groove part 50 will cause the pick-up arm to be lowered on to the record. At this moment the rubber roller 41 again enters the recess 152, and as the roller is out of contact with cam disc 42, the latter will stop. In this connection it should be observed that the pin 86 contacts the edge of the groove 51, practically perpendicular to the direction of movement, and therefore a large force is required to start the cam disc rotating. The friction of the cam disc in connection with this resistance against movement is sufficient to prevent its inertia from carrying it beyond the position of rest.

During the final part of the above described rotational movement of the cam disc, the pin 72 contacted the edge 121 of the lever 120. As a consequence hereof the cam surface 123 was displaced in relation to the pin 124 so that the spring 128 turned the lever 126 sufficiently far in counter-clockwise direction to cause the tooth 130 to engage the notch 129. The tooth 130 engaged the notch 129 because the edge of the arm 118 was against the projection 136. After the tooth 130 has engaged the notch 129, the pin 124 is held in its position, and the cam surface 123 prevents the arm 120 from being turned by spring 138 until the pin 124 is again released.

The above described arrangement for starting and stopping the cam disc 42 functions reliably, if the inner, steeper sound groove on the record is always situated on the same radius. However this is not the case. The sound grooves of all standard records of the same size begin at the same radius at the outer edge of the record, but dependent upon the length of the recorded piece, the inner sound modulated grooves are at different radii. From this inner groove there extends the so-called change groove, provided with a greater steepness. This groove consequently may be at different radii. In order to eliminate the uncertainty of the movement of the projection 136 caused hereby, a connecting link between the projection 136 and the lever 134 is provided, which functions in such a way that only rapid movements of the projection 136 causes the lever 134 to be moved, whereas slow movement of

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the projection 136 does not cause a corresponding movement of the lever 134. Thus the lever 134 is moved for releasing the tooth 130 from the notch 129 only when the projection 136 is moved by the outer edge of the arm 118 at a speed which is greater than the normal speed of movement under influence of the sound modulated part of the sound groove of the record.

The arrangement is shown in Fig. 6.

The arm 118, which is cup-shaped, is in this figure shown in section. The projection 136 extends into the cup-shaped arm, as described above. It is now assumed that the arm 118 is moving slowly in such a direction that the edge 141 thereof contacts the projection 136. As long as this movement is slow, it will only cause the T-shaped arm 142 to be turned about the pivot 143, so that the weight 144 is elevated, and the cylinder 145 is lowered. The cylinder 145, together with the ported piston movable therein, constitutes a dash pot, which is filled with oil. The piston 146 is pivotally connected with an arm 147 which is secured to the earlier mentioned lever 134. As long as the movement of the projection 136 takes place sufficiently slowly, there is but little resistance to movement of the cylinder 145 with respect to the piston 146, as the oil may flow without difficulty through the orifices of the piston 146. Consequently the lever 134 will not be moved. When, however, the sound modulated part of the groove of the record is played out, and the pick-up arm passes into the steeper part of the groove, the projection 136 will be displaced with a speed which is greater than that permitted by the dash pot arrangement 145-146. Consequently, the piston 146 will be moved with the cylinder 145, and the arm 147 and the lever 134 will be caused to follow the movement of the projection 136 with the action above described.

In hitherto known record changers, it has been difficult to change a record at other times than when the record has been completely played. It may occur that one wishes to play a pile of records through, but it is discovered that there is a bad record in the lot and it is desired to change the record before it has been played completely. The arrangements heretofore used required that the pick-up arm be lifted by hand and brought inwardly to cause operation of the record changing apparatus. However, this has distinct disadvantages. In practice it has proved that as a rule the records are damaged by such movements with the hand, and operation is difficult, especially in record changers of the above mentioned type where the pick-up arm is in an inaccessible location in the space between the turntable and the stack of records. Furthermore, the desired action cannot be caused without rather great movements of this arm, as the pick-up arm is usually in one of the outermost turns of the groove, but the record changing mechanism influenced by the change groove is usually of such a kind that it is only sensitive to a change groove which is arranged rather close to the center of the record.

These disadvantages are done away with by the provision of a manual release arrangement for the locking pin 124. This consists in a bar 153 being connected to the end of bellcrank lever 134 by means of a pivot 159. The other end of the bar 158 is provided with a pin which extends through a slot in the chassis plate and carries a button 156 at its upper end, see Fig. 2. If one desires to cause a change of records during the

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playing of a record, the button 156 is pressed in the direction of the arrow 153. This causes the lever 134 to turn in counter-clockwise direction, whereby the pull bar 133 and the arm 131 release the connection between the tooth 130 and the notch 129. The pin 124 is disengaged from surface 123 in the manner described above, so that the inclined surface 140 on the lever 120 strikes the pin 72 in order to start the cam disc.

I claim:

1. In an automatic record changer for changing mixed records of large and small diameter, a turntable, an arm extending upwardly in an inclined direction from the center of said turntable, means for retaining a stack of records on the upper end of said arm with said arm extending through the center perforation of each record, and means for engaging the periphery of the lowermost record in said stack and for displacing said lowermost record radially with respect to the stack, the horizontal distance between the center of said lowermost record and the center of said turntable being at least as great as one-half the difference between the diameters of large and small records, whereby a record, as it moves along said inclined arm from the bottom of the stack to said turntable, is further displaced radially through said horizontal distance.

2. In an automatic record changer for changing mixed records of large and small diameter, a turntable, an arm extending upwardly in an inclined direction from the center of said turntable, a shoulder formed on said arm near the upper end thereof for retaining a stack of records with the portion of said arm above said shoulder extending through the center perforation of each record, a record pusher positioned to contact the edge of the lowermost record in said stack, projections on said pusher spaced apart a distance substantially equal to the difference between the radii of a large and small record, the horizontal distance between said shoulder and the center of said turntable being at least as great as said difference in radii, and means for moving said record pusher to displace said lowermost record from said shoulder, whereby the record slides down said inclined arm to said turntable and is displaced radially through said horizontal distance.

3. In an automatic record hanger for changing mixed records of large and small diameter, a turntable, an arm extending upwardly in an inclined direction from the center of said turntable, a shoulder formed on said arm near the upper end thereof for retaining a stack of records with the portion of said arm above said shoulder extending through the center perforation of each record, a record pusher positioned to contact the edge of the lowermost record in said stack, projections on said pusher spaced apart a distance substantially equal to the difference between the radii of a large and small record, the horizontal distance between said shoulder and the center of said turntable being at least as great as said difference in radii, means for moving said record pusher to displace said lowermost record from said shoulder, whereby the record slides down said inclined arm to said turntable and is displaced radially through said horizontal distance, a pivotally mounted pick up arm, means for swinging said arm outwardly from said turntable, a member associated with said record pusher and displaceable by the said lowermost

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record if the latter is a large record, and means under the control of said member for swinging said pick up arm inwardly over said turntable the proper distance to engage the initial groove in the record deposited on the turntable.

4. In an automatic record changer for changing mixed records of large and small diameter, a turntable, an arm extending upwardly in an inclined direction from the center of said turntable, a shoulder formed on said arm near the upper end thereof for retaining a stack of records with the portion of said arm above said shoulder extending through the center perforation of each record, a record pusher positioned to contact the edge of the lowermost record in said stack, projections on said pusher spaced apart a distance substantially equal to the difference between the radii of a large and small record, means for moving said record pusher to displace said lowermost record from said shoulder, whereby the record slides down said inclined arm to said turntable, the inclination of said arm being such that the record is displaced radially a distance equal to at least said difference in radii, a pivotally mounted pick up arm, means for swinging said arm outwardly from said turntable, a vertically extending pin displaceably mounted in said record pusher, a spring urging said pin upwardly, said pin being located so as to be contacted and depressed by said lowermost record if the latter is a large record, and means under the control of said pin for swinging said pick up arm inwardly over said turntable the proper distance to engage the initial groove in the record deposited on the turntable.

5. In an automatic record changer for changing mixed records of large and small diameter, a turntable, an arm extending upwardly in an inclined direction from the center of said turntable, a shoulder formed on said arm near the upper end thereof for retaining a stack of records with the portion of said arm above said shoulder extending through the center perforation of each record, a record pusher positioned to contact the edge of the lowermost record in

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said stack, projections on said pusher spaced apart a distance substantially equal to the difference between the radii of a large and small record, means for moving said record pusher to displace said lowermost record from said shoulder, whereby the record slides down said inclined arm to said turntable, the inclination of said arm being such that the record is displaced radially a distance equal to at least said difference in radii, a pivotally mounted pick up arm, means for swinging said arm outwardly from said turntable, means normally operating to swing said pick up arm inwardly over said turntable the proper distance to engage the initial groove in a small record, a vertically extending pin displaceably mounted in said record pusher, and a spring urging said pin upwardly, said pin being located so as to be contacted and depressed by said lowermost record if the latter is a large record, said last mentioned means being operative as a result of displacement of said pin to swing said pick up arm inwardly the proper distance to engage the initial groove of a large record.

6. A device as claimed in claim 2 including a pivotally mounted weighted arm bearing on the uppermost record in said stack substantially above said record pusher.

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