Sept. 30, 1947. H. V. ALEXANDERSSON ET AL 2,428,258

AUTOMATIC PHONOGRAPH RECORD-CHANGER

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Fig. 1.

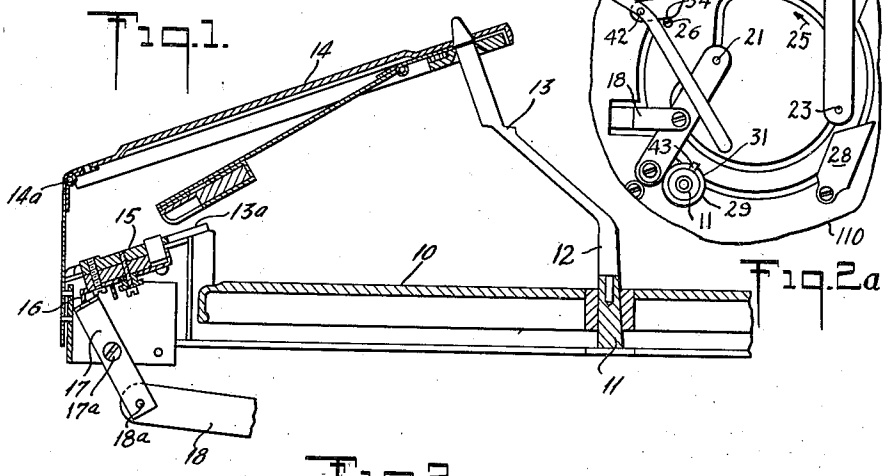
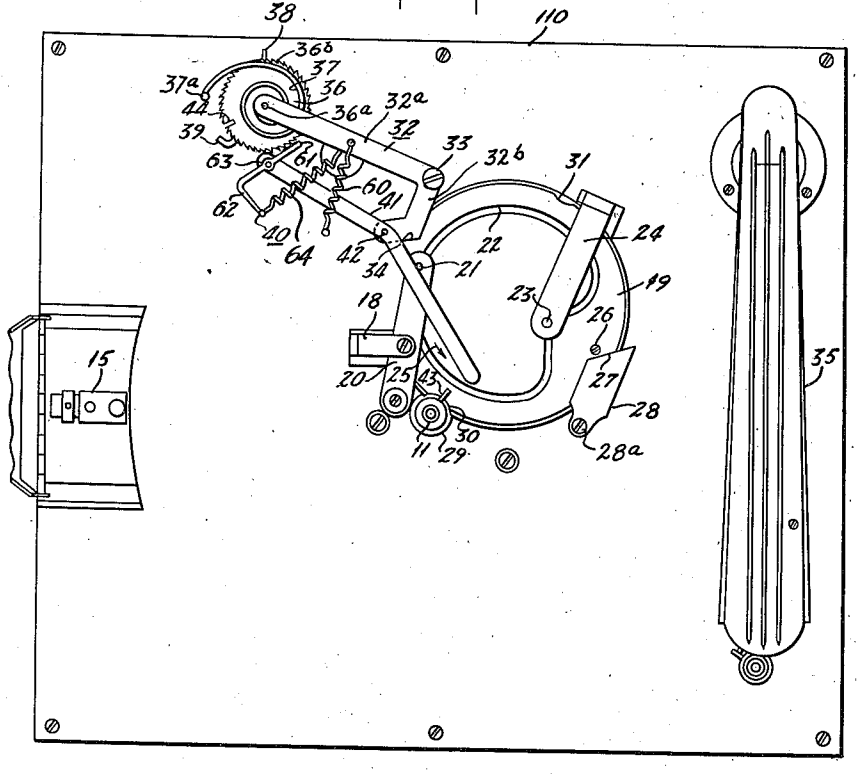


Fig. 2a

Fig. 2.



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Fig. 3.

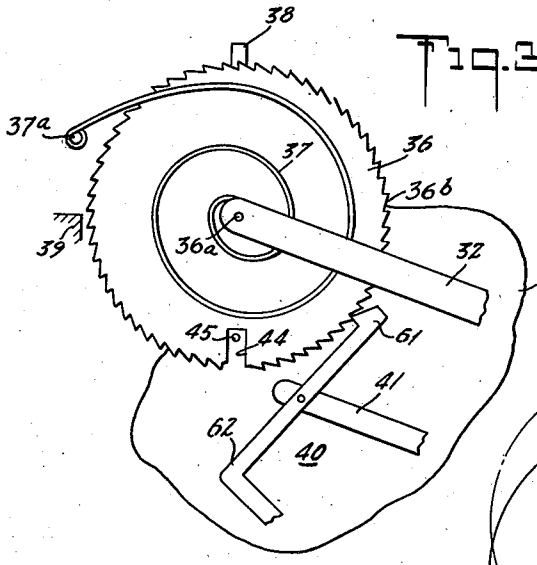


Fig. 4.

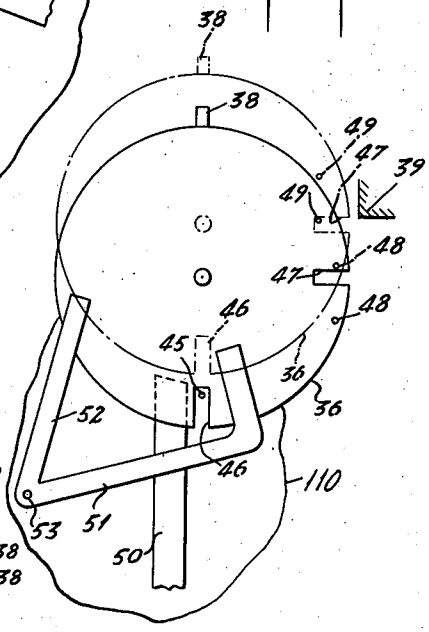


Fig. 5.

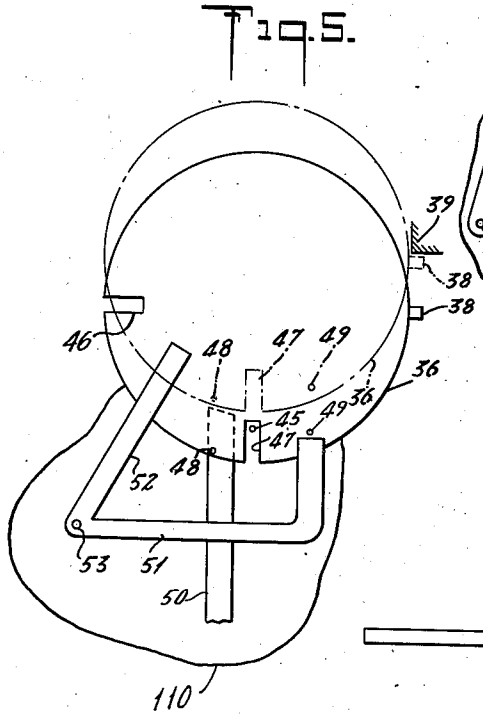
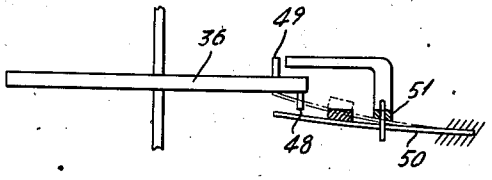


Fig. 6.



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Fig. 7.

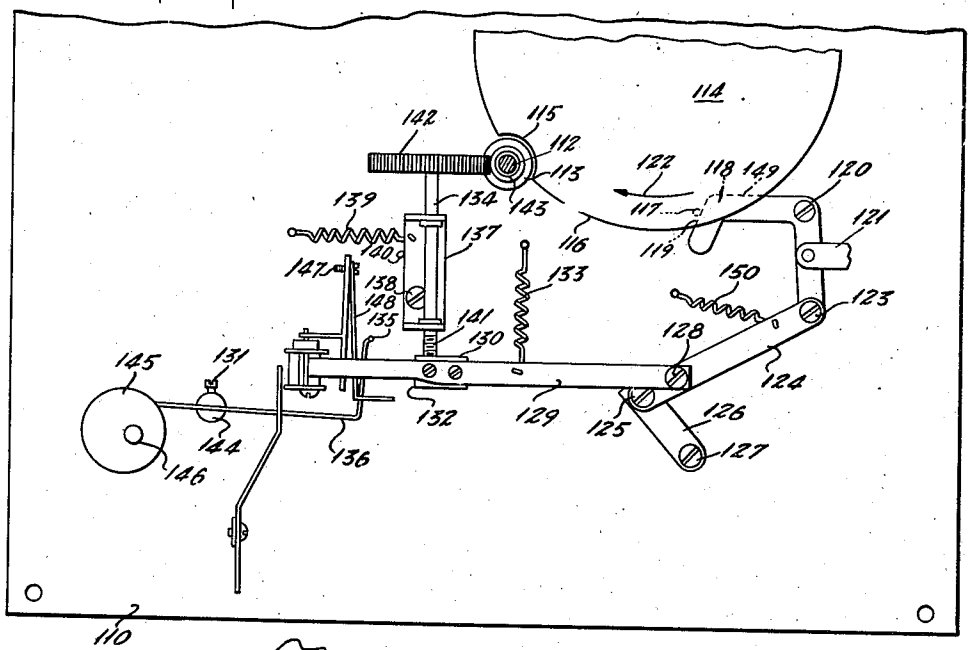


Fig. 8.

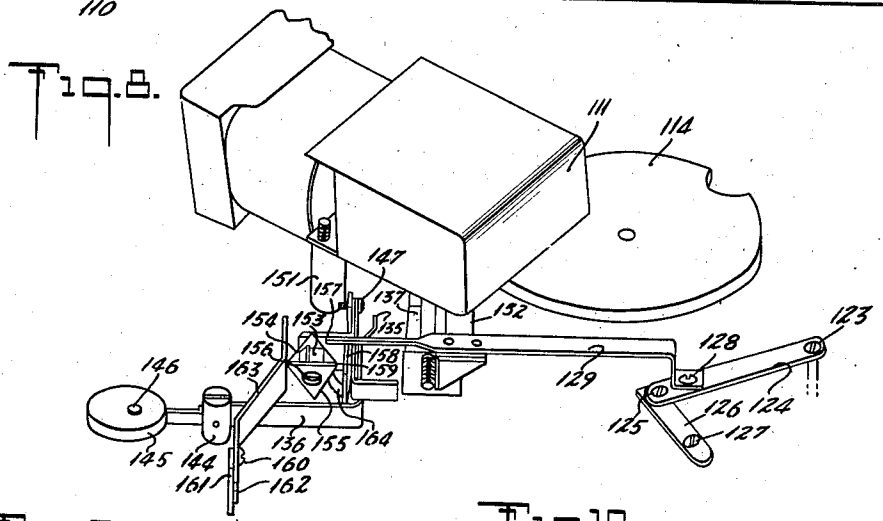


Fig. 9.

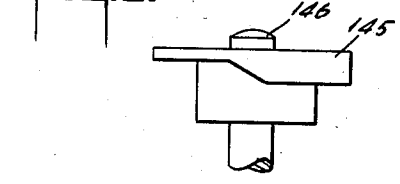
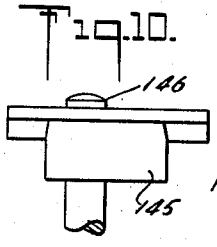


Fig. 10.



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AUTOMATIC PHONOGRAPH RECORD-CHANGER

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In Sweden March 20, 1942

13 Claims. (Cl. 274—10)

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Our invention relates to automatic record-changers for phonographs.

In automatic record-changers for phonographs there has been employed means for changing records with the least possible delay. Also, attempts have been made to control the changing manually so that, if desired, a longer interval between records may be obtained, a record may be replayed, or the playing of a record may be interrupted.

The present invention refers to an improved arrangement in record-changers, by means of which it is possible to control the time elapsing between the end of a first record and the beginning of a second record, and by which it is also possible to cause a rapid record-changing every second time, alternating with a record-changing consuming a longer interval.

In automatic record-changers for phonographs there are as a rule three different phases of the operation of the record changers, the first phase of which is started by the needle entering the final groove of the record, which has a pitch greater than that of the sound-reproducing groove. During this phase the pick-up arm is elevated from the record, and is swung out beyond the record. During the phase following thereafter a new record is fed down from the supply pile on to the record on the turntable which has just been played, and during the last phase the pick-up arm is again brought in over the record and lowered in such a way that the needle engages the initial groove of the record just fed down.

When it is desired to prolong the record-changing period, it is specially suitable to delay the beginning of the third phase for a predetermined, preferably controllable time. Even though the invention is hereinafter described in connection with two different embodiments, in which arresting of the record changing takes place at the beginning of the third phase, it is obvious that the invention is not limited thereto, but that it may also be used in connection with means initiating the first or the second phase.

The invention will be further described in connection with the annexed drawings, in which

Fig. 1 is a side cross-sectional view of one embodiment of my invention taken through the center of the turntable and a portion of the record changing mechanism;

Fig. 2 is a top view of the device shown in Fig. 1, but with the turntable removed;

Fig. 2*a* is a view of certain of the parts shown in Fig. 2, but in the positions which they occupy

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when the cam disc has rotated one-half revolution;

Fig. 3 is a top view on an enlarged scale of a portion of the device shown in Fig. 2;

Fig. 4 is a view similar to Fig. 3, but showing a modification of the mechanism illustrated in the preceding figure;

Figure 5 is a top view of the mechanism shown in Fig. 4, but with certain parts in different positions;

Fig. 6 is a side view of the mechanism shown in Figs. 4 and 5;

Fig. 7 is a top view of a second embodiment of the invention;

Fig. 8 is a perspective view of the apparatus shown in Fig. 7; and

Figs. 9 and 10 show details of the apparatus illustrated in Figs. 7 and 8.

The turntable in Fig. 1 is designated by reference character 10. It is fixed to the shaft 11 of the driving motor, said shaft further being provided with a prolongation 12 for carrying the pile of records not yet played. In this position the records rest upon a shoulder 13 on the shaft as well as on a record pusher table 13*a*, shown at the left in Fig. 1. The free upper end of the shaft is engaged by a member 14 hinged at 14*a*. A record pusher 15 is movable in a slot formed in the table. The movement of the record pusher is caused by means of an angular part 16, an arm 17 pivotally mounted at 17*a* and a connecting rod 18 pivotally connected at 18*a* to arm 17 and cooperating with said part 16. During the changing of a record the connecting rod 18 is moved by means of a cam disc 19, shown in Fig. 2. For this purpose the connecting rod 18 extends through an orifice in the chassis plate and is pivotally connected to an arm 20, which carries a cam follower 21, cooperating with a cam groove 22 in the cam disc 19.

The same groove also cooperates with a further cam follower 23 at the end of an arm 24, the function of which is to cause the pick-up arm to be elevated and lowered before and after the record-changing, respectively. A further groove may be arranged for instance on the lower side of the cam disc 19 for swinging the pick-up arm in and out over the record. As the specific means for accomplishing this form no part of the present invention a more detailed description thereof is not given.

The purpose of the cam disc 19 thus is to drive the means which cause the pick-up arm to be elevated and swung out, the new record to be fed down and the pick-up arm thereupon to be

swung in and lowered on to the new record. The impulse-giving means, which cause the beginning of each of the three above mentioned phases therefore are arranged to influence the cam disc 19 in such a way that it is put into rotation in the direction indicated by the arrow 25. This, for instance, may be caused by the inclined edge 27 of an arm 28 striking a pin 26 on the disc. Arm 28 is pivotally mounted at 28a on the chassis plate. The motive force for the continuous movement of the cam disc is thereafter obtained from the same motor which drives the turntable, a roller 29 being arranged on the shaft 11 for driving the record disc, said roller cooperating with the periphery of the cam disc 19. In order to enable the cam disc to remain stationary during the playing of a record there is arranged a recess 30 in the periphery of the cam disc, which is just large enough so that the roller 29 may freely rotate within it. A similar recess 31 is arranged in the periphery of the cam disc, which may suitably be positioned diametrically opposite to the first mentioned recess. The purpose of this recess is to cause the cam disc to remain stationary during a shorter or longer interval of time during the changing of records, preferably while the pick-up arm is swung out. The same recess is free from the roller 29 when the phonograph has been stopped.

When it is not desired to stop the motor, or when some interval of time is not to take place during the changing of records, the cam disc should be driven over the dead point arising when the roller 29 enters the recess 31. For this purpose there is arranged a bellcrank 32 having arms 32a and 32b, biased by a spring 60, said bellcrank being turnable about the point 33. Arm 32b is provided with an inclined surface 34, the purpose of which is to give the cam disc in cooperation with the pin 26 the impulse required for carrying it over the said dead point.

The arrangement so far described functions in the following manner: It is assumed that a record has just been fully reproduced. The pick-up needle will then enter the final groove of the record which has a greater pitch, and the more rapid turning movement of the pick-up arm 35 caused thereby, causes in some manner, which forms no part of this invention, the arm 28 to be turned in counter-clockwise direction. The inclined edge 27 thereby strikes the pin 26, which causes the cam disc to be turned slightly in the direction of the arrow 25. This small turning movement, however, is sufficient to cause the roller 29 to ride up on the periphery of the cam disc 19, which will thereby due to friction between the roller and the periphery continue the movement just started. During the first part of this movement the pick-up arm is elevated from the record disc and swung out, whereafter the record pusher 15 is moved backwards, so that it will contact the lowest of the records placed in the pile. Possibly the record pusher may thereafter also be moved forwards, so that the record thus caught is pushed down into playing position on the turntable 10.

At this moment, as is shown in Fig. 2a, the recess 31 has just come opposite the roller 29, and the cam disc therefore would have a tendency to stop, if the pin 26 had not contacted the arm 32b and turned this arm in clockwise direction. The pin 26, at this moment, has just passed the angle of the arm and is thus in contact with the inclined surface 34 of the arm 32b. If there is obstruction to the swinging back of the arm 32b

under influence of the spring 60, the inclined surface 34 will act in the same manner as the inclined surface 27, so that the cam disc will obtain an impulse for continuous movement, the pick-up arm during this movement again being carried in over the initial groove of the new record and lowered into said groove, the reproduction thereafter taking place. The cam disc will thereafter again be in the position shown in Fig. 2.

However, the arm 32a of the bellcrank has pivotally mounted thereon at 36a a disc 36, which is loaded by a spiral spring 37 connected at its inner end to the disc and having its outer end anchored to the chassis at 37a, which spring tends to turn the disc in counter-clockwise direction. The last named turning movement is limited by a pin 38 on the disc and a stop 39 mounted on the chassis. Further, the disc 36 is provided with at least one substantially radial groove 44, the function of which shall be further described in connection with the remaining figures of the drawings. Finally, the disc is provided with teeth 36b along its periphery, cooperating with an escapement mechanism 40. This is arranged at one end of an arm 41, which is pivoted at the point 42 on the end of the arm 32b. The other end of the arm 41 extends to the vicinity of the roller 29, which is provided with a projection 43 for cooperation with the arm 41 during certain circumstances, described below.

The escapement 40 consists of an angular arm 62, provided with a hook 61, said arm being pivoted at the point 63 of the arm 41. Between the arms 62 and 32a there is arranged a spring 64 for two purposes, namely partly in order to keep the hook 61 in engagement with the teeth of the disc 36, and partly in order to provide a pulling force on the arm 41 for turning in clockwise direction.

The disc 36 may be made as shown in Fig. 3. In this arrangement there is only one radial groove 44 present. This groove cooperates with a pin 45, connected to the chassis plate and extending upwardly therefrom. This arrangement functions in the following way: When the pin 26 is first brought into contact with the arm 32, the pick-up arm is elevated and swung out from the turntable. It is immaterial whether the record-changing has already taken place, or if this will take place a moment later. Upon the continuous rotation of the cam disc, however, the bellcrank 32, due to the cooperation of the arm 32b with the pin 26, will be turned in clockwise direction, which causes the disc 36, mounted on the end of the arm 32a to be displaced upwardly, as viewed in Figs. 2 and 3. This causes the slot 44 to be moved out of engagement with the pin 45. The spring 37 then immediately will drive the disc 36 in counter-clockwise direction until the projection 38 contacts the stop 39. The angular position of this stop is adjustable by means of an arm, which is turnable about a centre, coinciding with the centre of the disc 36 in this just mentioned position, swung upwards.

After the pin 26 has passed the bend of the arm 32b, the disc 36 will be brought back a negligible distance, but not to the position shown in Figs. 2 and 3. The pin 45 now will engage the teeth 36b on the periphery of the disc 36 and thus prevent the disc from moving all the way back into its position of rest, shown in Figs. 2 and 3. Consequently, also the arm 32a will remain in its swung out position, and the impulse for continuous rotation of the cam disc, which otherwise is caused by the inclined surface 34 pressing the pin 26, will be delayed. The cam disc will therefore

remain in a position at which only the first half of the record-changing operations have been carried out.

By the swinging in clockwise direction of the arm 41, its end, which is positioned in the vicinity of the shaft 11 has been turned into the path traversed by the projection 43 during the rotation of the shaft. This projection therefore will cause a displacement of the arm for each revolution, which causes the escapement mechanism to move the disc 36 step-by-step in clockwise direction. Simultaneously the pin 45 passes over one tooth 36b of the disc 36 and in this way prevents the disc from moving back at the next contact between the projection 43 and the arm 41. During this movement, therefore, the slot 44 gradually moves to the position in which it may be entered by the pin 45. The time required to carry the groove 44 into this position, of course will be dependent upon the position of the stop 39. When the groove 44 has come opposite to the pin 45, the disc moves back into its position of rest, the inclined surface 34 simultaneously giving the pin 26 an impulse for continuous movement of the cam disc, and the arm 41 is brought beyond the path of travel of the projection 43. The record-changing therefore continues, and the new record will begin to be reproduced.

By the above described arrangement a controllable time will lapse during each change of record. Suitably the arrangement is made in such a manner, that this time is controllable from a minimum of only a few seconds, required for a continuous rotation of the cam disc, to about one minute.

As mentioned above, it is desirable to control the record-changing in such a way that firstly a predetermined number of records, for instance two records, are reproduced without a longer interval during the record-changing than is absolutely necessary, whereafter a longer interval occurs during the record-changing, thereafter again the same number of records are changed without intervals, and so on. An arrangement, satisfying this requirement, is shown in Figs. 4, 5 and 6, wherein Figs. 4 and 5 show a top view corresponding to Fig. 3, and Fig. 6 shows a side view.

In order that Figs. 4 and 5 may be clearer, the escapement mechanism 40, the spring 37 and the bellcrank 32 are omitted. Each of the figures shows the disc 36 in two different positions, one indicated by a full line, and the other by a broken line.

The disc 36, in the arrangement according to Figs. 4, 5 and 6, is provided with two radial slots 46 and 47, corresponding to the slot 44 in the arrangement according to Fig. 3, but there is only a single pin 45. The disc 36 carries two further pins 48 and 49, of which the pin 48 extends in one direction, for instance downwardly in Fig. 6, whereas the pin 49 extends upwardly. For cooperation with the pin 48 there is present a leaf spring 50, which is fixed to the chassis, as evident from Fig. 6. This spring is arranged to be set to different degrees, depending upon the position of an arm 51 of an L-shaped member 51—52, which is turnable about a pivot point 53.

The arrangement functions in the following way: The initial position during reproduction is that indicated by the full line in Fig. 4. After the record has been reproduced, and consequently movement of the cam disc 19 has been initiated, the pin 26, in the manner previously described, causes a turning of the bellcrank 32 in clockwise direction. This turning causes the disc 36 to be displaced from the position indicated by the full line into a position indicated by a broken line. Hereby the pin 45 is freed from the slot 46, and in a manner, which is also described above, the disc 36 will rapidly rotate under influence of a spring 37, until the projection 38 contacts the stop 39. This rotation takes place in counter-clockwise direction.

For the function of the arrangement it is of importance to remember, that this rapid rotation under influence of the spring 37 takes place at the moment when the pin 26 passes the bend of the arm 32b, the disc 36 therefore being in its outmost position, that is the position most remote from the normal position.

The stop 39 in Figs. 4 and 5 has been shown in one of its extreme positions of adjustment, that is, turned as far as possible in clockwise direction. If the stop had been adjusted to a position other than its extreme position, the arrangement would have functioned exactly in the same manner as the arrangement according to Fig. 3, and the elements additionally present in the arrangement according to Figs. 4, 5 and 6, would have no function. However, the extreme position of the stop 39 is chosen in such a way that when the disc is in this position the slot 47 is right before the pin 45, and consequently there is nothing to prevent the bellcrank 32 from swinging back into the normal position shown in Fig. 2. The inclined surface 34 therefore will strike the pin 26, which causes the cam disc 19 to continue its movement without an appreciable pause. Thus the disc 36 is carried into its temporary position of rest, which is shown in Fig. 5 with full lines. During the backwards movement of the disc, however, the pin 49 will contact the edge of the arm 51 on the L-shaped member 51—52, this part therefor turning in clockwise direction about the pivot 53. This causes two different actions. Firstly the arm 51 will slide over the spring 50, so that this is allowed to bend closer to the disc 36, see Fig. 6. Secondly the part 52 of the arm will be turned in over the disc, so that it is placed in the way of the pin 49, when the disc is again rotated.

When the spring 50 is allowed to approach the disc 36, however, it comes to rest upon the top of the pin 48, this movement therefore not being completed.

After the disc 36 has moved to its position of rest now described, which is shown in full lines in Fig. 5, the cam disc 19 will continue its rotation, and a new record will be reproduced. After this record has been reproduced, however, a new function of the cam disc 19 will be initiated, and the pin 26 will therefore again strike the arm 32b. The disc 36 then is brought out from the position, shown in full lines in Fig. 5 and into a position which is shown with broken lines in the same figure. Hereby the end of pin 48 slides on the spring 50 until it is clear of the spring, whereupon the latter will contact the underside of the disc 36, as shown in Fig. 6 with a broken line, and by cooperation between the pin 48 and the spring 50 the disc is prevented from again moving back into the full line position. Therefore, the inclined edge 34 does not contact the pin 26. Instead the arm 41 will be struck by the pin 43, so that the escapement mechanism will begin to work. The disc 36 then is turned back into the broken line position shown in Fig. 4 and thereafter it will

again be returned slowly to its initial position shown with full lines.

Already after the first step, however, the pin 48 will slide down the edge of the spring 50, and the disc 36 will then move a small distance backwards in the direction towards the position which is shown in Fig. 5 in full lines. Consequently, the pin 45 engages behind one of the teeth 36b of the disc 36 and holds this disc against backwards movement, as the hook 61 is moving to engage the next tooth.

After the disc has been turned about 30°, the pin 49 will contact the edge of the arm part 52 of the L-shaped member. The pin 49 then will move the L-shaped member into the position indicated in Fig. 4.

After the disc 36 has been turned so far that the slot 46 coincides with the pin 45, the disc 36 is brought back into its initial position, shown with full lines in Fig. 4, and the bellcrank 32 will be turned so that the inclined surface 34 gives the pin 25 the impulse required for continuous movement of the cam disc.

In the above stated manner no retarding of the record-changing due to the function of the escapement mechanism took place when changing from the first to the second of the above mentioned records but, on the other hand, a delay was effected when changing from the second to the third record. In this manner two records will always be played in immediate and rapid succession, but after the reproduction of every second record a longer interval occurs.

In the arrangement according to Fig. 7, 110 is the chassis plate, on which the parts are mounted. The shaft of the motor is indicated 112 in the figure, and the rubber-coated roller mounted on this shaft is indicated 113, said roller cooperating with a cam disc 114. The cam disc is provided with two preferably diametrically disposed recesses only one of which, 115, is shown in the figure The recesses are arranged in such a way that the roller 113 may rotate freely within them, whereas even a small impulse for rotation of the cam disc 114 causes the roller 113 to ride up on the outer periphery 116 of the cam disc 114, so that the latter is rotated by the roller.

It is assumed that the cam disc 114 has obtained an impulse for movement, whereby the roller 113 has moved up on to its periphery, and that the cam disc has been turned through an angle corresponding to the first phase of movement. At the end of this phase of movement the recess 115 approaches the position where the roller 113 is placed, and simultaneously herewith the second phase of the record-changing begins, during which the new record is fed down onto the turntable. At the end of the second phase of the record-changing the roller 113 enters the recess 115 so that the cam disc stops. The continued rotation of the cam disc thereafter is dependent upon an impulse being given for beginning of the third phase of changing. It is assumed that certain means are arranged under the chassis plate 110 for causing this action. These means consist of a pin 117 extending downwardly from the cam disc 114 and a bellcrank 118 with an inclined surface 119. The bellcrank 118 is turnable about the shaft 120 under influence of a link 121, which is assumed to indicate in some manner, which is not essential to the invention, that the third phase may begin.

It is evident from the figure that upon turning of the bellcrank 118 in clockwise direction, the inclined surface will contact the pin 117, so that the cam disc 114 is driven in the direction of the arrow 122. This causes, as mentioned above, the roller 113 to ride up on to the outer periphery 116 of the cam disc, which latter is driven through a further angle, corresponding to the third phase of the record-changing.

In this form of the invention, however, arrangements are provided for arresting the impulse means 117—118—119—120—121 during a time which may be determined within wide limits. For this purpose the lever 118 is by means of a joint 123 connected to a link 124, which is in its turn by means of the joint 125 connected to an arm 126, fixed to the chassis by means of the joint 127. The link 124 at 128 is connected to a second arm 129, which forms the real arresting means.

Below the arm 129 there is fixed a downwardly extending angular part 130 having a vertical edge 132. The arm 129 is biased by a spring 133 in clockwise direction about the point 128. This turning, however, is prevented by one of the following two means, namely either a turnable shaft 134, the function of which will be further described hereinafter, or a pin 135, which extends upwardly from a lever 136.

The turnable shaft 134 is carried in a U-shaped part 137, which is turnably connected to the chassis by means of the stud 138. The part 137 is biased by a spring 139 in counter-clockwise direction. This turning, however, is arrested by means of a pin 140. At the end which contacts the arm 129 the shaft 134 is threaded, as evident at 141, and at the other end it carries a worm wheel 142, which may be brought into mesh with a worm 143, fixed on the shaft 112 of the motor. In the position shown in the figure the worm wheel 142 is turned out of mesh with the screw 143. However, it is evident that a turning in clockwise direction, that is against the action of the spring 139, will cause the worm wheel 142 to mesh with the worm 143.

The arm 136 carrying the pin 135 is mounted for universal movement at the point 144, the mounting arrangement consisting of a plug, turnable in the chassis and formed with a groove. The arm 136 extends through the groove, where it is jointed by means of a horizontal screw 131, so that the arm can be turned in vertical direction. The free end of the arm 136 is guided by a manually controllable cam 145, which is turnable by means of a knob not shown in the drawing as well as by the shaft 146 into an arbitrary position. The form of the cam is evident from Figs. 9 and 10. It is immediately evident from the drawing, that by turning the cam 145 the arm 136 will also be swung in clockwise direction or counter-clockwise direction in a horizontal plane, whereby the pin 135 will be brought closer to or further away from the edge of the arm 129.

For a purpose, which will be further described below in connection with Fig. 8, the cam 145 is arranged double-acting, so that it does not only cause a swinging of the arm 136 about the turning position of the plug 144 in clockwise or counter-clockwise direction but also a pivoting upwards or downwards about the screw 131. At the point 147 an angularly bent arm 148 is pivotally mounted so that its free end rests on the bent part of the arm 136. Consequently, the arm 148 will be elevated or lowered depending upon the position of the arm 136 about the screw 131. In the following it is assumed that the arm 148 is in the highest position. In this position the

arm 129 rests on the edge of the arm 148, on which it may slide.

In the hitherto described parts the action of the arrangement is the following:

During the rotating movement of the disc 114, and at the time of transition from the first to the second of the above mentioned three record-changing phases, the pin 117 strikes the edge 149 of the bellcrank 118, whereby this bellcrank is turned in counter-clockwise direction against the action of a spring 150, which is connected between the chassis and the arm 124. This moves the arm 124 to the right in the plane of the drawing, and the arm 129 is moved in the same direction. During the first part of the movement of the arm 129 in the direction to the right, however, the arm is not pivoted, as the vertical edge of the angularly bent piece 130 engages the edge of the threaded shaft 141. When the arm 129 approaches its extreme right hand position, at the time the pin 117 rides over the corner of the bellcrank 118, the angularly bent part 130 will be free from the threads 141. The spring 133 then will turn the arm 129 in clockwise direction about the point 128, until the arm contacts the pin 135. In this position the arm is arrested. At the following backwards movement of the arm 129 under influence of the spring 150 the edge 132 of the angularly bent piece 130 will engage one of the threads on the threaded shaft part 141. Because of the pressure from the edge 132 the U-shaped member 137 will thereby be turned about the point 138 against the action of the spring 139, so that the worm wheel 142 meshes with the worm 143. Consequently the shaft 134 is rotated, and the edge 132 will be moved downwards in Fig. 7, so that the arm 129 is turned in counter-clockwise direction against the action of the spring 133. After a time, which is dependent upon the speed of the shaft 134 and the number and pitch of threads 141, the part 132 will be fed beyond the last thread 141 and fall over the outer end of the shaft 134. Thus, movement of the arm 129 towards the left is no longer arrested, and the bellcrank 118 will therefore under influence of the spring 150 suddenly be turned into its extreme position, in which the edge 119 contacts the pin 117, and the cam disc 114 will consequently be turned in such a way that the recess 115 is moved to the left and the roller 113 rides up on to the outer periphery 116 of the cam disc.

The third phase of the record-changing thus has been started.

From the above it is evident, that it is possible by means of the cam 145 to manually control the number of threads, which the edge 132 must traverse, and thus to determine the interval before the bellcrank 118 strikes the pin 117 to cause a resumption of the rotation of the disc 114. Consequently, it is possible to effectively control the time during which the record-changing action is arrested, until the third phase of the record-changing action may begin.

In order that an extension of time shall occur only at each second record-changing, means are provided to cause the arm 129 not to function when no extension of time shall take place. The arrangements for this purpose are more clearly evident from Fig. 8, to which it is referred in the following.

In Fig. 8 the driving motor 111 is shown as carried by the supports 151 and 152. The parts not visible due to the driving motor, however, will be seen from Fig. 7 with sufficient clearness. The remaining parts visible in Fig. 7 have been indicated in Fig. 8 with the same reference indications.

In addition to the parts above described in connection with Fig. 7, the following parts are shown in Fig. 8: A control member 153 is formed with a saw toothed cylindrical body. It will be assumed that the number of saw-teeth along the cylindrical periphery is six. The body is at its ends connected with two triangular plates 154 and 155, which are disposed so that the end of one plate corresponds to the side of the other plate. The control member is arranged to be turned about a bolt 156, which is mounted in the part 157, the latter being rigidly connected to the chassis plate 110.

The control member 153 is so arranged in relation to the free end of the arm 129, that this end during the above described normal action of the timing arrangement passes freely directly above the teeth 36b. If, however, the cam 145 is turned half a revolution the lever 136 will be turned about the horizontal shaft 131 (see Fig. 7), so that the right hand end of this lever, as well as the arm 148, are moved into a lower position. Due to the tension from the inclined spring 133 (see Fig. 7) the arm 129 will be lowered, but not as much as the arm 148 so that it does not slide on the edge of the arm 148 but instead on a member 158 rigidly connected with the chassis. In this lower position the teeth of the control member 153 are in the path of the free end of the arm 129, and hence by each movement to and fro of this arm the free end of the arm will contact one tooth on the control member 153, so that this is turned one sixth of a revolution.

During the step by step turning movement of the control member 153 the triangular plate 154 will be in the position shown in Fig. 8 after alternate steps, whereas after intermediate steps it will be in the position in which the triangular plate 155 is shown in Fig. 8.

As previously described the disc 114 is rotated and causes the elevation of the pick-up arm, its swinging out and the feeding of a new record on to the turntable. At this moment the bellcrank 118 (see Fig. 7) is turned so that the arm 124 (see Fig. 8) and also the arm 129 are displaced to the left. The arm 129 during the last mentioned movement to the left brings the control member 153 and the triangular plate 154 into the position shown in Fig. 8. Simultaneously the disc 114 is started for causing the third phase of the record-changing to start. When after this new record has been played a new record-changing begins. First the pick-up arm is elevated from the record and swung out into its position beyond the turntable. Thereafter the bellcrank 118 is turned in counter-clockwise direction, so that the arms 124 and 129 are moved to the right. Under influence of the spring 133 thereafter the arm 129 is swung in such a way that the sharp edge 132 cooperates with the threads 141 of the shaft 134. The position of the threads with which the edge 132 cooperates, is determined by the pin 135, which is connected to the arm 136. Simultaneously the rotation of the shaft 134 is started, so that the angularly bent part 130 is slowly driven towards the end of the threads 141. When finally the part 130 passes over the end of the shaft 134, due to the influence of the spring 150 the arm 129 is brought to the left. In this position it cooperates with the next tooth on the control member 153, which is thereby turned in counterclockwise direction

in Fig. 8, so that the corner 159 is swung upwards at an angle, corresponding to a sixth of a revolution.

By this turning movement of the triangular plate 154, however, the corner 159 will thereafter cooperate with the arm 129. This cooperation takes place in the following manner:

When the record now being reproduced is fully played, a new record-changing operation begins in the same manner as previously described. In this operation there is also involved the displacement of the arm 129 to the right so that the arm shall be turned in clockwise direction and the sharp edge 132 be brought into cooperation with the threads 141. The last named movement, however, is prevented inasmuch as the corner 159 of the triangular plate 154 is now in the way of the free end of the arm 129, so that this arm cannot be turned. At the movement of the bell-crank 118 in clockwise direction, caused by the spring 150, therefore the arm 129 will freely and without impediment move to the left, as the part 130 is continuously free of the outer end of the shaft 134. No extension of time will therefore take place in the moment now described.

However, the arm 129 engages a tooth on the control member 153, and therefore this member is turned a further one sixth of a revolution. Thereby it will again come into a position corresponding to the position shown in Fig. 8, although the control member actually has been turned one third of a revolution from the position shown in Fig. 8.

At the next record-changing the arm 129 will again be brought to the right, but now the triangular plate 154 does not prevent the arm 129 from being swung in clockwise direction under influence of the spring 133, and consequently the edge 132 will this time again come into cooperation with the threaded part 141 of the shaft 134.

Thus, in this manner each alternate record-changing will take place with a delay and each intermediate record-changing will take place without any delay, depending upon the position of the control member 153 and the triangular plate 154, respectively.

However, it may occur, that the record-changer is provided with arrangements which allow some extra function of the record-changer, for example repeating of a record. Such arrangements then function in such a way that a control means is operated, for instance a push button during the playing off of the record to be repeated. When the record is fully played as usual a record-changing will begin, but the control means prevents the feeding of a new record and consequently the same record will be played again.

In a case of repeating it is, however, obvious, that the listener wants to hear the record again without pause, whereas it may occur that the time extension arrangement is in such a position that a pause will occur before repetition while the record following thereafter will be played immediately.

In such and similar cases it is obviously of importance that by simple means it shall be possible to cause a correction of the position of the control body 153, so that the record changing next after the correction will take place without extension of time. Possibly the arrangement for correction of the position of the control body may be arranged to be operated by the same push button which causes a record to be repeated.

For this purpose, as shown in Fig. 8 an arm is pivoted at the screw 160, which is connected to a part 161 projecting from the chassis. The free end 162 of the arm 163 is assumed to be connected with some adjusting knob available from the outside, such as the knob for effecting repetition, and which functions in such a way that by moving the same the arm 163 is turned downwards in Fig. 8 so as to strike a corner of triangular plate 155 and automatically turn the plate one sixth of a revolution into the position shown for plate 154 in Fig. 8, that is the corner 159 is now elevated into the position in which it cooperates with the free end of the arm 129 for preventing cooperation between the edge 132 and the threaded part 141 of the shaft 134.

When now the next record-changing begins, the arm 129 will first be displaced to the right and thereafter again to the left. Due to cooperation between the arm 129 and the corner 159 the last named displacement will not be arrested and no pause will occur. On the other hand the arm turns the control member 153 one sixth of a revolution so that at the subsequent record-changing a pause will again enter.

Now it is obvious that the control body, in the case of the push button being depressed insufficiently, would be able to take a lot of intermediate positions between its above mentioned two positions of rest, whereby a most dissatisfying operation of the device would result. For preventing the control member from stopping its movement in such intermediate positions the teeth are arranged to cooperate with a plate spring 164, which will always bring the control body in one of the exact positions of rest.

Of course, the invention is not limited to the form of execution thereof shown above, but substantial modifications may be made, without departing from its scope. For instance the control arrangement of the three phases contained in the record-changing might not contain a cam disc or corresponding cam means, but the same advantage may be obtained by any control arrangements usable for the purpose. In the form of execution according to Figs. 1–6 it is for instance possible by arranging more than two grooves of the type 46, 47 to cause more than two records, for instance three records, to be reproduced in rapid succession after each other, with a pause following the playing of the third record.

What is claimed:

1. In a phonograph, a disc rotatable through a cycle to effect an automatic record change, a rotating member for driving said disc, said disc having a recess in which said member is freely turnable between cycles, means actuated by the completion of a record for giving said disc a rotational impulse to bring the disc into engagement with said member, said disc being formed with an additional recess in which said member is freely turnable during said cycle, means for giving said disc a rotational impulse to bring the disc into engagement with said member when the latter is in said additional recess, and means for delaying the actuation of said last-mentioned means.

2. In a phonograph, a disc rotatable through a cycle to effect an automatic record change, a rotating member for driving said disc, said disc having a recess in which said member is freely turnable between cycles, means actuated by the completion of a record for giving said disc a rotational impulse to bring the disc into engagement with said member, said disc being formed with an additional recess in which said member

is freely turnable during said cycle, an element resiliently displaced by said disc as said additional recess approaches said rotating member, and means actuated by the return of said displaced element for giving said disc a rotational impulse to bring said additional recess past said rotating member.

3. In a phonograph, a disc rotatable through a cycle to effect an automatic record change, a rotating member for driving said disc, said disc having a recess in which said member is freely turnable between cycles, means actuated by the completion of a record for giving said disc a rotational impulse to bring the disc into engagement with said member, said disc being formed with an additional recess in which said member is freely turnable during said cycle, an element resiliently displaced by said disc as said additional recess approaches said rotating member, a slotted cam carried by said element, a fixed pin normally positioned in the slot, means for turning said cam when said element is displaced so that said slot is out of alignment with said pin, said pin contacting the unslotted portion of the cam to retain said element in displaced position, means for relatively slowly turning said cam to return said slot into alignment with said pin, resilient means for returning said element to its initial position when said slot becomes aligned with said pin, and means on said disc located in a path of travel of said element during its return for giving the disc a rotational impulse to bring said additional recess past said rotating member.

4. In a phonograph, a disc rotatable through a cycle to effect an automatic record change, a rotating member for driving said disc, said disc having a recess in which said member is freely turnable between cycles, means actuated by the completion of a record for giving said disc a rotational impulse to bring the disc into engagement with said member, said disc being formed with an additional recess in which said member is freely turnable during said cycle, an element resiliently displaced by said disc as said additional recess approaches said rotating member, a slotted cam carried by said element, a fixed pin normally positioned in the slot, means for turning said cam when said element is displaced so that said slot is out of alignment with said pin, said pin contacting the unslotted portion of the cam to retain said element in displaced position, an escapement mechanism for relatively slowly turning said cam to return said slot into alignment with said pin, resilient means for returning said element to its initial position when said slot becomes aligned with said pin, and a projection on said disc located in a path of travel of said element during its return for giving the disc a rotational impulse to bring said additional recess past said rotating member.

5. In a phonograph, a disc rotatable through a cycle to effect an automatic record change, a rotating member for driving said disc, said disc having a recess in which said member is freely turnable between cycles, means actuated by the completion of a record for giving said disc a rotational impulse to bring the disc into engagement with said member, said disc being formed with an additional recess in which said member is freely turnable during said cycle, an element displaced by said disc as said additional recess approaches said rotating member, resilient means tending to return said element to its initial position, a cam carried by said element and formed with two peripherally spaced slots, a pin normally positioned in one of said slots, means for turning said cam when said element is displaced to turn said one slot is out of alignment with said pin, means for selectively limiting the turning of said cam so that the other of said slots is brought into alignment with said pin, whereby said element is immediately returned by said resilient means to its initial position or so that both slots are out of alignment with said pin, said pin contacting the unslotted portion of the cam to retain said element in its displaced position, means for relatively slowly turning said cam when both slots are out of alignment to return said one slot into alignment with said pin whereby said element is then returned to its initial position by said resilient means, and means on said disc located in a path of travel of said element during its return to give the disc a rotational impulse to bring said additional recess past said rotating member.

6. In a phonograph, a disc rotatable through a cycle to effect an automatic record change, a rotating member for driving said disc, said disc having a recess in which said member is freely turnable between cycles, means actuated by the completion of a record for giving said disc a rotational impulse to bring the disc into engagement with said member, said disc being formed with an additional recess in which said member is freely turnable during said cycle, an element displaced by said disc as said additional recess approaches said rotating member, resilient means tending to return said element to its initial position, a rotatable shaft having a threaded end, means on said element brought into engagement with the thread when the element is displaced for retaining the element in displaced position, means to rotate said shaft to advance the last-mentioned means to the end of said thread to release said element, and means on said disc located in a path of travel of said element following its release for giving the disc a rotational impulse to bring said additional recess past said rotating member.

7. In a phonograph, a disc rotatable through a cycle to effect an automatic record change, a rotating member for driving said disc, said disc having a recess in which said member is freely turnable between cycles, means actuated by the completion of a record for giving said disc a rotational impulse to bring the disc into engagement with said member, said disc being formed with an additional recess in which said member is freely turnable during said cycle, an element displaced by said disc as said additional recess approaches said rotating member, resilient means tending to return said element to its initial position, a rotatable shaft having a threaded end, means on said element brought into engagement with the thread when the element is displaced for retaining the element in displaced position, means responsive to engagement of the means on said element with said threaded end for imparting rotary movement to said shaft to advance the means on said element to the end of said thread to release said element, and means on said disc located in a path of travel of said element following its release for giving the disc a rotational impulse to bring said additional recess past said rotating member.

8. In a phonograph, a disc rotatable through a cycle to effect an automatic record change, a rotating member for driving said disc, said disc having a recess in which said member is freely

turnable between cycles, means actuated by the completion of a record for giving said disc a rotational impulse to bring the disc into engagement with said member, said disc being formed with an additional recess in which said member is freely turnable during said cycle, an element displaced by said disc as said additional recess approaches said rotating member, resilient means tending to return said element to its initial position, a rotatable shaft having a threaded end, a gear on said rotatable member, a gear meshable therewith mounted on said shaft, a spring normally maintaining said gears out of mesh, means on said element brought into engagement with the thread on said shaft when the element is displaced for retaining the element in displaced position, means responsive to engagement of the means on said element with said thread for meshing said gears for imparting rotary movement to said shaft to advance the means on said element to the end of said thread to release said element, and means on said disc located in a path of travel of said element following its release for giving the disc a rotational impulse to bring said additional recess past said rotating member.

9. In a phonograph, a disc rotatable through a cycle to effect an automatic record change, a rotating member for driving said disc, said disc having a recess in which said member is freely turnable between cycles, means actuated by the completion of a record for giving said disc a rotational impulse to bring the disc into engagement with said member, said disc being formed with an additional recess in which said member is freely turnable during said cycle, a rotatable shaft having a threaded end, an element displaced by said disc as said additional recess approaches said rotating member, resilient means tending to return said element to its initial position, manually adjustable means for varying the amplitude of the displacement of said element, means on said element brought into engagement with the thread on said shaft when the element is displaced for retaining the element in displaced position, means to rotate the shaft to advance the means on said element to the end of said thread to release said element, and means on said disc located in a path of travel of said element following its release for giving the disc a rotational impulse to bring said additional recess past said rotating member.

10. In a phonograph, a disc rotatable through a cycle to effect an automatic record change, a rotating member for driving said disc, said disc having a recess in which said member is freely turnable between cycles, means actuated by the completion of a record for giving said disc a rotational impulse to bring the disc into engagement with said member, said disc being formed with an additional recess in which said member is freely turnable during said cycle, an element displaced by said disc as said additional recess approaches said rotating member, resilient means tending to return said element to its initial position, a rotatable shaft having a threaded end, means on said element engageable with the thread on said shaft when the element is displaced for retaining the element in displaced position, means to rotate said shaft to advance the last-mentioned means to the end of said thread to release said element, means adjustable to prevent the engagement of the means on said element with said thread for immediately releasing said element and means on said disc located in a path of travel of said element following its release for giving the disc a rotational impulse to bring said additional recess past said rotating member.

11. In a phonograph, a disc rotatable through a cycle to effect an automatic record change, a rotating member for driving said disc, said disc having a recess in which said member is freely turnable between cycles, means actuated by the completion of a record for giving said disc a rotational impulse to bring the disc into engagement with said member, said disc being formed with an additional recess in which said member is freely turnable during said cycle, an element displaced by said disc as said additional recess approaches said rotating member, resilient means tending to return said element to its initial position, a rotatable shaft having a threaded end, means on said element engageable with the thread on said shaft when the element is displaced for retaining the element in displaced position, means to rotate said shaft to advance the last-mentioned means to the end of said thread to release said element, a toothed member rotatable into one position to prevent the engagement of the means on said element with said thread for immediately releasing said element, said toothed member being rotatable into another position permitting such engagement, means to rotate said toothed member from either of said positions to the other, once for every revolution of said disc, and means on said disc located in a path of travel of said element following its release for giving the disc a rotational impulse to bring said additional recess past said rotating member.

12. In a phonograph, a disc rotatable through a cycle to effect an automatic record change, a rotating member for driving said disc, said disc having a recess in which said member is freely turnable between cycles, means actuated by the completion of a record for giving said disc a rotational impulse to bring the disc into engagement with said member, said disc being formed with an additional recess in which said member is freely turnable during said cycle, an element displaced by said disc as said additional recess approaches said rotating member, resilient means tending to return said element to its initial position, a rotatable shaft having a threaded end, means on said element engageable with the thread on said shaft when the element is displaced for retaining the element in displaced position, means to rotate said shaft to advance the last-mentioned means to the end of said thread to release said element, a toothed member rotatable into one position to prevent the engagement of the means on said element with said thread for immediately releasing said element, said toothed member being rotatable into another position permitting such engagement, and means on said disc located in a path of travel of said element following its release for giving the disc a rotational impulse to bring said additional recess past said rotating member, the teeth on said member being located in a path of travel of said element for engagement of a tooth by said element during its release for turning the toothed member from either of said positions to the other.

13. In a phonograph, a disc rotatable through a cycle to effect an automatic record change, a rotating member for driving said disc, said disc having a recess in which said member is freely turnable between cycles, means actuated by the completion of a record for giving said disc a ro-

tational impulse to bring the disc into engagement with said member, said disc being formed with an additional recess in which said member is freely turnable during said cycle, an element displaced by said disc as said additional recess approaches said rotating member, resilient means tending to return said element to its initial position, a rotatable shaft having a threaded end, means on said element engageable with the thread on said shaft when the element is displaced for retaining the element in displaced position, means to rotate said shaft to advance the last-mentioned means to the end of said thread to release said element, a toothed member rotatable into one position to prevent the engagement of the means on said element with said thread for immediately releasing said element, said toothed member being rotatable into another position permitting such engagement, means on said disc located in a path of travel of said element following its release for giving the disc a rotational impulse to bring said additional recess

past said rotating member, the teeth on said member being located in a path of travel of said element for engagement of a tooth by said element during its release for turning the toothed member from either of said positions to the other, and manually operable means for turning said toothed member from either of said positions to the other.

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