May 5, 1953 S. A. STOLBERG 2,637,559

AUTOMATIC PHONOGRAPH

Filed Aug. 6, 1947 6 Sheets-Sheet 1

Fig. 1.

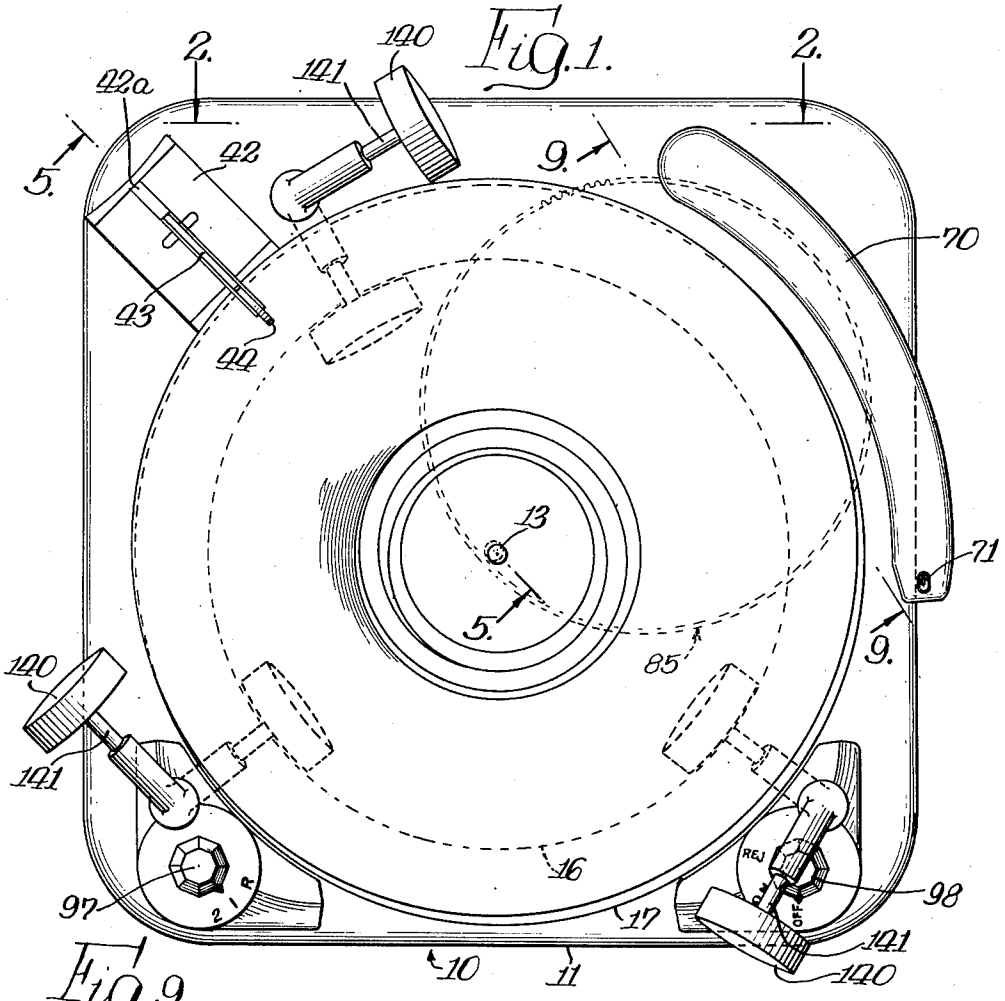


Fig. 9.

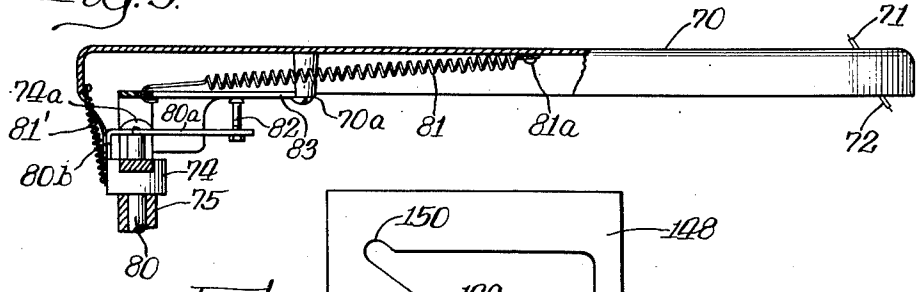
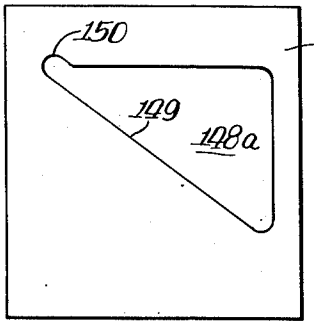


Fig. 10.



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AUTOMATIC PHONOGRAPH

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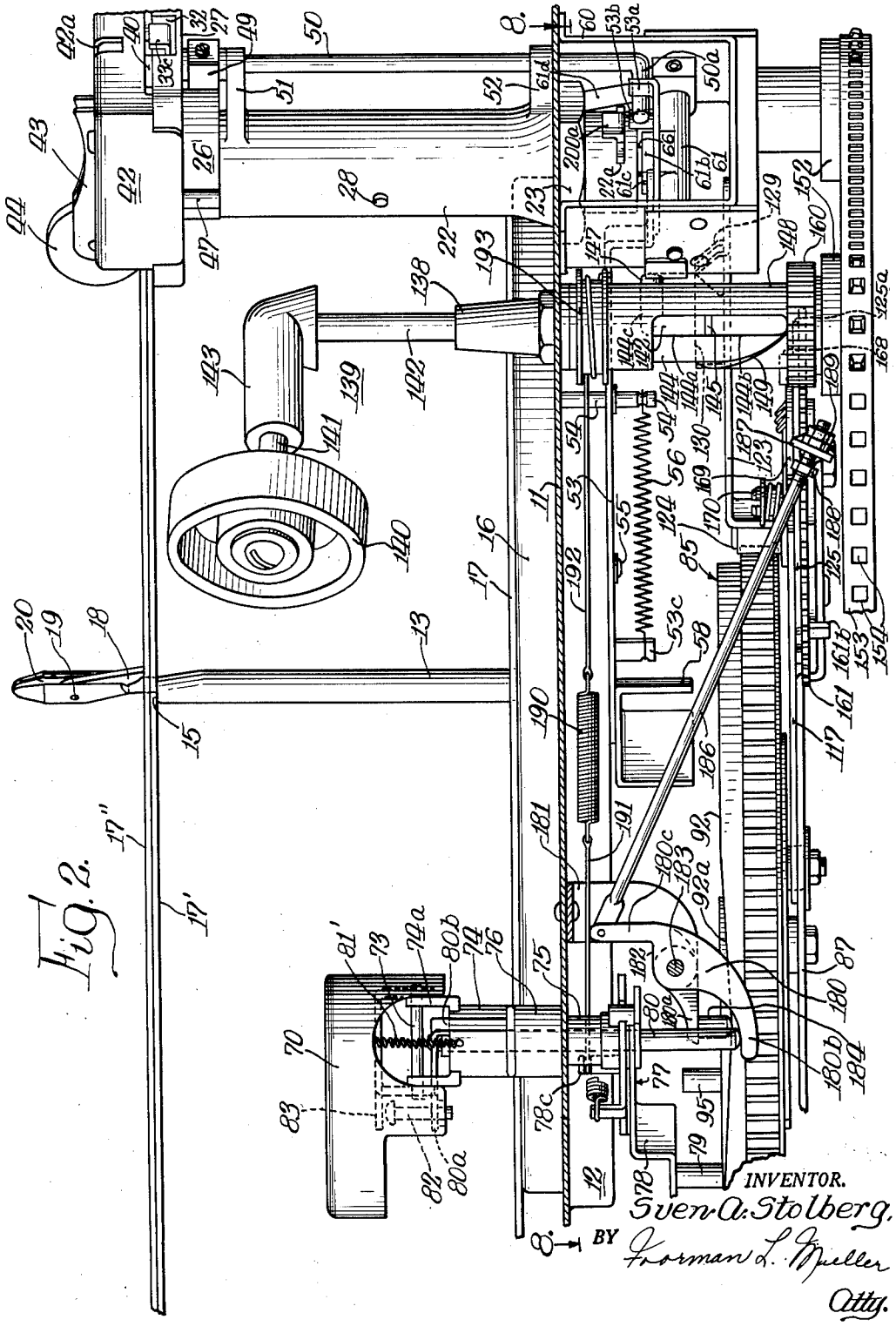


Fig. 2.

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AUTOMATIC PHONOGRAPH

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Fig. 3.

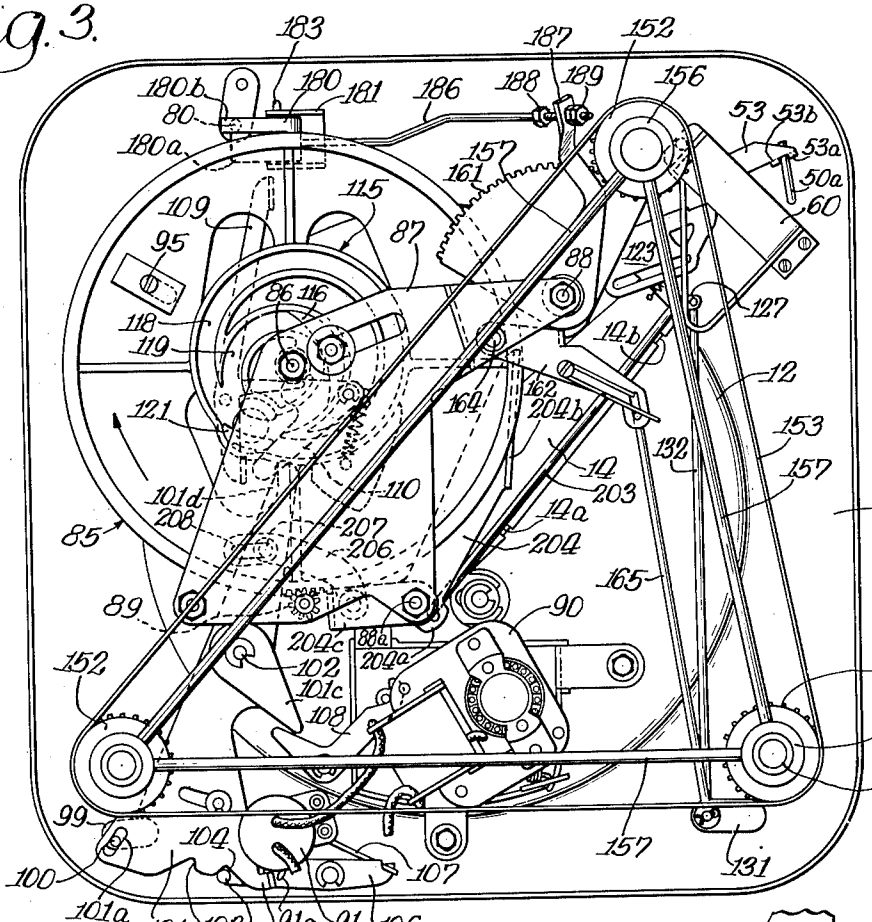
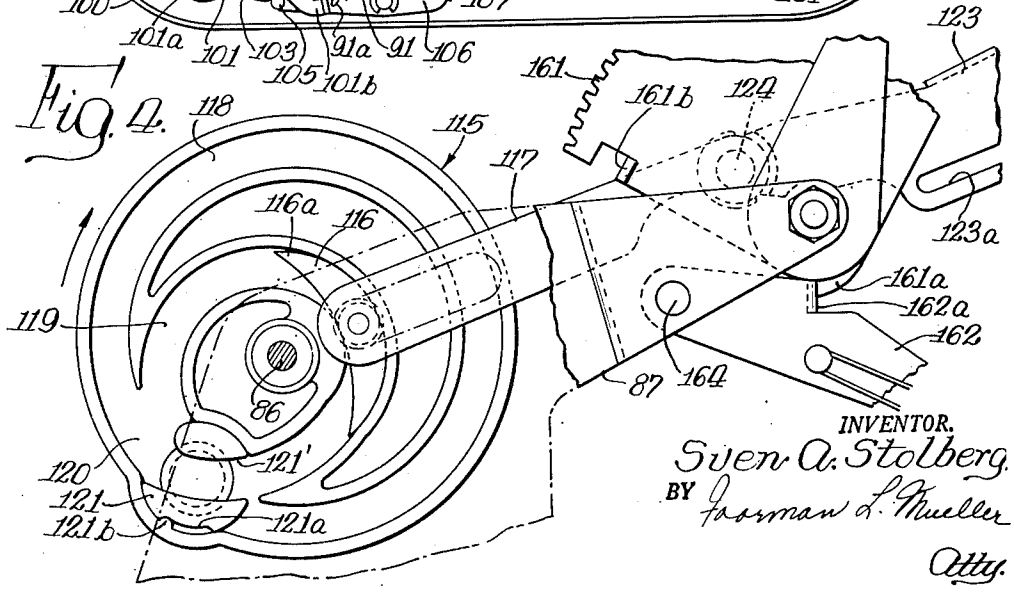


Fig. 4.

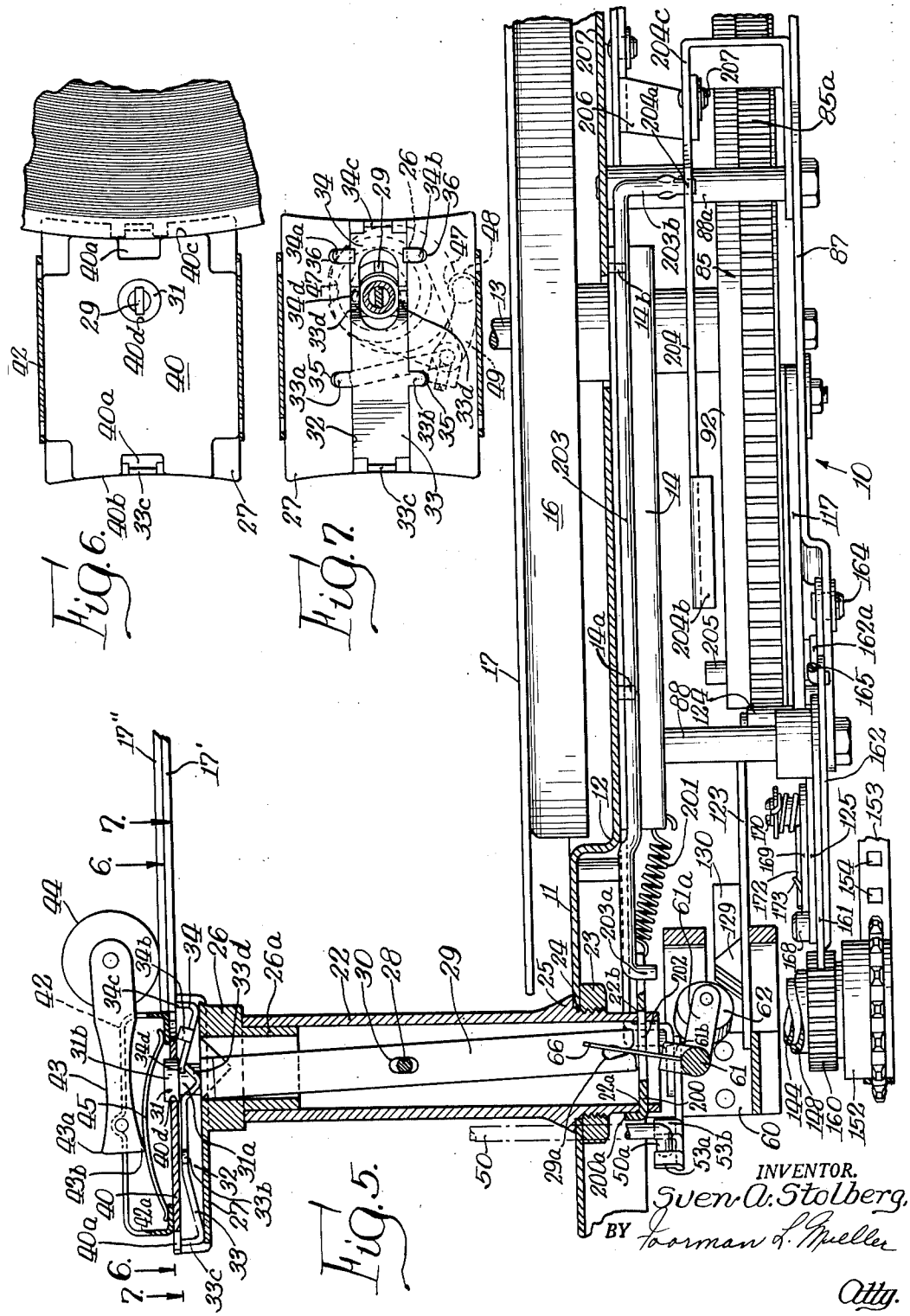


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AUTOMATIC PHONOGRAPH

Filed Aug. 6, 1947 6 Sheets-Sheet 4



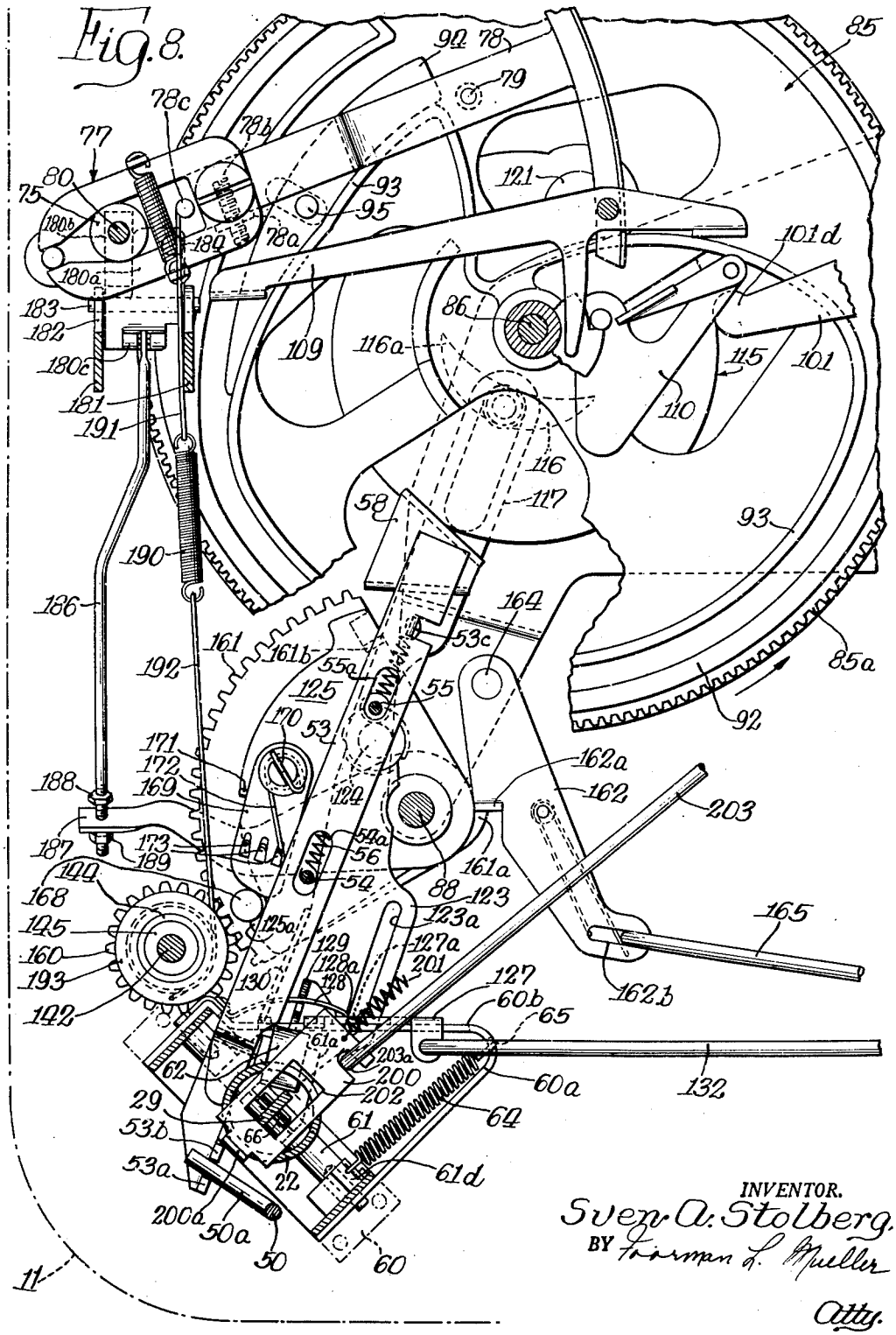
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May 5, 1953 S. A. STOLBERG 2,637,559

AUTOMATIC PHONOGRAPH

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Fig. 8.



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AUTOMATIC PHONOGRAPH

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Fig. 11.

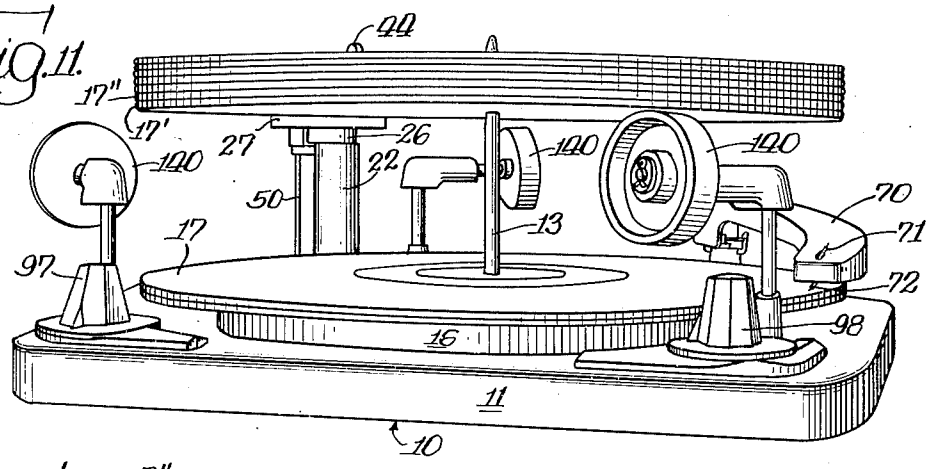


Fig. 12.

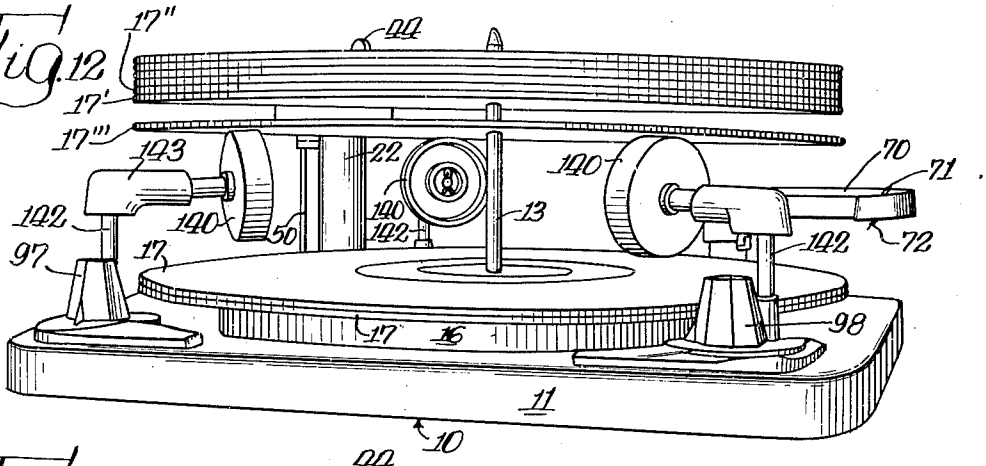
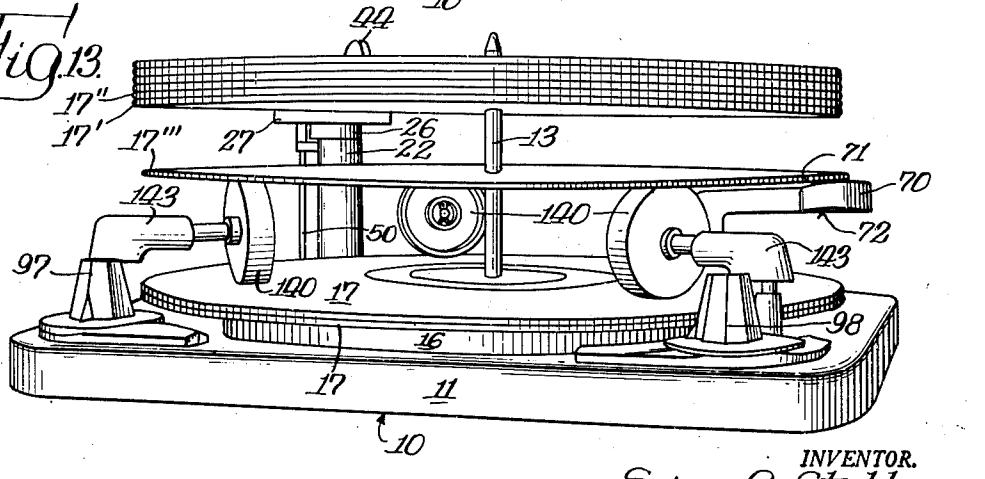


Fig. 13.



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Patented May 5, 1953

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UNITED STATES PATENT OFFICE

2,637,559

AUTOMATIC PHONOGRAPH

Sven A. Stolberg, Chicago, Ill., assignor, by mesne assignments, to Raytheon Manufacturing Company, Newton, Mass., a corporation of Delaware

Application August 6, 1947, Serial No. 766,717

14 Claims. (Cl. 274—10)

1

The present invention relates to automatic phonographs and more particularly to an automatic phonograph which is capable of playing a succession of records of the disk type on both faces thereof.

Automatic phonographs are in extensive use today, particularly combined with radio receiving devices in what is termed a radio-phonograph combination. One of the most common forms of automatic phonographs in extensive use today includes means for supporting a stack of unplayed records adjacent to and above the turntable from which stack records are fed one at a time onto the turntable. Such automatic phonographs are adapted to play these records on one side consecutively without requiring any control or assistance from the operator. To play the other side of these records, it is necessary to turn the entire stack of records around whereupon the other side of the records can be played successively, one record at a time.

There are on the market today various record changers which are capable of playing both sides of a record one after the other. However, these record changers are very complicated in that they require means for turning the record around so that the other side of the record may be played. Obviously such complicated mechanism greatly increases the cost of such record changers and consequently the cost of the radio-phonograph combination in which it is incorporated. It would be desirable to provide a record changer of the type in which the records are dropped from a record stack above the turntable one at a time onto the turntable for playing or reproduction thereof with means for playing both sides of the records without the provision of complicated means for turning these records around, whereby it would be possible to provide a record changer for playing both faces of the records consecutively at little additional cost over the relatively inexpensive one side record changer of the type referred to above employing the so-called center post drop.

Accordingly, it is an object of the present invention to provide a new and improved automatic phonograph.

It is another object of the present invention to provide an automatic phonograph which is capable of playing both faces of a disk record in succession without being much more complicated than the so-called center post drop record player which is capable of playing a succession of records from one side only and without requiring any additional cabinet space.

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It is another object of the present invention to provide a new and improved record changer which is extremely simple and sturdy in construction, which will stand up under conditions of severe and constant use without getting out of order or requiring repairs and which is inexpensive and simple from the manufacturing standpoint.

Still another object of the present invention is to provide an automatic record changer employing the same fundamental construction as the so-called center post drop record changer but which is capable of playing the disk-type records from both faces thereof with the addition of a minimum of parts to the heretofore used center post drop record changer.

It is a feature of the present invention to provide an improved record changer with control means whereby the records may be played only on one face thereof or on both faces together with means whereby the playing of any record or any face may be rejected or repetition of any record or of any face may be obtained with reference to the playing thereof.

It is a further object of the present invention to provide new and improved means for effecting the necessary reversal in rotation of the record when played from its opposite sides, such means also serving to support the record when played from one side and to transfer the record to its position for playing on the other side.

It is another object of the present invention to provide a new and improved record changer capable of playing both sides of a disk record without reversing of the record and while employing but a single tone arm.

Further objects and advantages of the present invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of the present invention, reference may be had to the accompanying drawings in which:

Fig. 1 is a top view of an automatic phonograph embodying the present invention with the tone arm indicated in a position free of the records, which position it would assume during a record changing cycle and with twelve inch records disposed in the record stack;

Fig. 2 is an enlarged sectional view of a portion of the phonograph shown in Fig. 1 taken on line 2—2 of Fig. 1;

Fig. 3 is a bottom view of the automatic record

changer shown in Fig. 1 of the drawings with the record changer shown in the "off" position;

Fig. 4 is an enlarged view of a portion of the auxiliary cam of Fig. 3 and the associated apparatus;

Fig. 5 is an enlarged sectional view taken on line 5—5 of Fig. 1 showing the details of the record feeding mechanism;

Fig. 6 is a sectional view taken on line 6—6 of Fig. 5;

Fig. 7 is a sectional view taken on line 7—7 of Fig. 5;

Fig. 8 is an enlarged view partly in section taken on line 8—8 of Fig. 2;

Fig. 9 is a side elevational view, partly in section of the tone arm of Fig. 1, looking in the direction of the arrow 9—9 in Fig. 1;

Fig. 10 is a development of a cam associated with each roller assembly of the present invention; and

Figs. 11, 12 and 13 are perspective views illustrating various operating positions of the automatic phonograph of the present invention while playing both sides of a succession of records stacked above the turntable thereof.

Referring now to the drawings, there is illustrated an automatic phonograph 10 having a base member 11 which serves as the support to which the various parts of the automatic phonograph are assembled. This base member 11 with the portions of the automatic phonograph assembled thereon is readily adaptable for mounting in a suitable cabinet, not shown, which cabinet may take any desirable form. The automatic phonograph 10 to be described hereinafter is capable of being mounted in any cabinet in which the heretofore center drop type of record changer capable of playing only one side of a record was mounted, since the base plate 11 to which all the parts of the automatic phonograph are assembled is preferably made of the same size as the bases in prior record changers. As illustrated, this base is preferably provided with a centrally located depression 12, from the center of which a suitable spindle or center post 13 extends in an upward direction. To ensure the desired rigidity and to permit mounting the center post 13 below the level of the recess 12 in the base 11, the base is provided with a channel-shaped supporting member 14, best shown in Figs. 3 and 5 of the drawings, which is suitably fastened as by welding or the like to the base member 11. The spindle or center post 13 is fastened to the channel-shaped member 14 in any desired manner.

RECORD SUPPORTING AND RECORD FEEDING MEANS

Preferably this center post 13 is of the form disclosed in my prior copending application, Serial No. 576,202, filed February 5, 1945, now Patent No. 2,517,050, and assigned to the same assignee as the present application and is illustrated as being provided with a shoulder 15 so as to support a stack of unplayed records thereon. In addition, the center post 13 is so formed that a slight lateral displacement of the lowermost record of the record stack supported on the shoulder 15 will cause release of this record so that the record may slide down center post 13 and onto a turntable 16 rotatable about suitable bearing means coaxially arranged with respect to the center post 13. Such a record indicated at 17 in Figs. 2 and 5 of the drawings is shown as having been moved into position on the turntable 16 whereupon the top face of this disk record 17 may be reproduced in a manner which will become apparent as the following description proceeds. A plurality of records, such as 17' and 17'', etc., is illustrated as being disposed in the record stack supported on the shoulder 15 of the center post 13 in a manner to be described more fully hereinafter. The upper end of the spindle or center post 12 is preferably provided with one or more movable members 18 for preventing any but the lowermost record of the record stack from being displaced laterally so as to be moved into playing position either onto the turntable 16 where the top face thereof can be played or to an intermediate position which will be described hereinafter where the bottom face thereof can be played. The movable member 18 is preferably pivotally mounted as indicated at 19 to the top of the center post 13 and is disposed in a suitable slot 20 formed in the post 13. It will be apparent that this pivotally mounted member 18 is arranged to permit removal of the records from the turntable 16 after all the records have been moved from the record stack onto the turntable without removing the center post 13 merely by raising the record stack from the turntable 16 whereupon the member 18 pivots about its support 19 so as not to interfere with the removal of the records. This arrangement forms no part of the present invention but is disclosed and claimed in the prior copending application referred to above.

For the purpose of further supporting the record stack comprising the records 17', 17'', etc. on the center post 13, there extends upwardly from the base 11, and in a manner so as to be clear of the turntable 16 and also the largest size record such as 17 which might be disposed on the turntable 16, a vertical, hollow post or stand 22 which houses the periphery engaging record ejecting mechanism. As illustrated, the hollow post or stand 22 is rigidly fastened to the base 11 as by means of a suitable nut 23 engaging a threaded portion 24 of the post 22 extending below the base 11. Preferably the post 22 is provided with an enlarged portion 25 for engaging the top surface of the base 11. The post 22 supports a rotatable eccentric 26 which has a sleeve portion 26a extending into the post 22 as is clearly shown in Fig. 5 of the drawings. Fastened to the eccentric 26 is a rectangular shelf or record supporting member 27 which is rotatable in either direction with the eccentric 26 through an angle of 360° so as to be adjustable for, and capable of, supporting either ten inch or twelve inch disk records such as 17', 17'', etc. With the record kickoff-head assembly such that it can be rotated 360°, and in either direction, there is no likelihood of breaking or jamming due to improper handling. Pivotally mounted about a horizontal pivot pin 28 within post or stand 22 is a rock arm or lever 29. This rock arm or lever 29 is provided with a slotted opening 30 engageable with the pivot pin 28 so as to be capable of limited movement in a direction generally along the axis of the post or stand 22.

The upper end of the lever or rock arm 29 has fastened thereto a suitable sleeve 31 having a portion of reduced cross-section 31a which is disposed about on the level with a longitudinal recess 32 defined in the shelf 27 as is best shown in Fig. 7 of the drawings. This longitudinal recess 32 is adapted to support a pair of automatic stop controlling or sensing members 33 and 34, respectively. The automatic stop controlling member 33 comprises two laterally extending members 33a

and 33b which are adapted to be disposed in cooperating recesses 35 formed in the shelf 27 and extending laterally from opposed edges of the recess 32. The end 33c of the stop controlling member 33 is disposed substantially at right angles to the main body portion of the member 33 as is best shown in Fig. 5 of the drawings. The other end of the member 33 is provided with a forked portion 33d which is adapted to extend on either side of the portion of reduced cross-section 31a of the sleeve 31 so as to support the head portion 31b of the sleeve 31 and consequently support the rock arm or lever 29. The member 34 is substantially identical with the member 33 except that it is much shorter, as is clearly apparent from Figs. 5 and 7 of the drawings. It is, however, provided with the laterally extending portions 34a and 34b which are adapted to pivotally support the member 34 in recesses 36 defined along the edges of the recess 32 in the member 27. Also the member 34 is provided with an upwardly extending portion 34c which is adapted to extend above the level of the shelf or ledge 27 so as to be engageable by the bottommost record such as 17' of the record stack. The member 34 is also provided with a forked end 34d for engaging the portion of reduced cross-section 31b of the sleeve 31 fastened to the rock arm 29. The end 33d of the member 33 is adapted to extend beneath the forked end 34d of the member 34.

It will be apparent that, whenever a record is resting on the edge of the ledge 27, such record will engage either the portion 34c of the member 34 or the portion 33c of the member 33, depending upon whether ten inch or twelve inch records are supported in the record stack, thereby moving the sleeve 31 and consequently the rock arm or lever 29 to an uppermost position, the purpose of which will be described in greater detail hereinafter in connection with the automatic stopping means for the phonograph. It is apparent that, when no record is resting on the ledge 27, the weight of the rock arm 29 causes it to bias the levers or members 33 and 34 about their pivotal supporting means disposed in the recesses 35 and 36, respectively, so as to permit the rock arm 29 to move to a lower position, which might be referred to as a functioning position. Although the ledge 27 is shown in Figs. 5 and 6 of the drawings as turned to the position for supporting twelve inch records, it will be understood that rotation of the eccentric 26 relative to the post 22 will cause the end of the ledge 27 adjacent the portion 33c of the member 33 to be in position to support the peripheral edges of ten inch records.

For the purpose of moving the lowermost record such as 17' laterally sufficiently to be free of the ledge 15, there is provided an ejector plate 40 disposed on the ledge 27 and reciprocally movable relative thereto. As illustrated in Fig. 6 of the drawings, the ejector plate 40 is provided with an opening through which the sleeve 31 extends. The ejector plate 40 is also provided with notches or cutaway portions such as 40a so as not to interfere with the portions 33c and 34c of the members 33 and 34, respectively. It will be apparent that pivotal movement of the rock arm 29 about the pivot 28 will cause reciprocal movement of the ejector plate 40. The ends of the ejector plate 40 are shaped so as to have a slightly concave form as indicated at 40b and 40c so as to engage the peripheral edge of either a ten inch or a twelve inch record, respectively, supported on the ledge 27 depending upon the particular position of the ledge 27. With the arrangement described, the assembly operation is very simple since the parts are merely laid in their various interrelated positions without the requirement of any fastening means or the like. For example, the members 33 and 34 are positioned in the recesses defined in the ledge 27 following the pivotal mounting of the rock arm 29 in the post 22. Subsequently, the ejector plate 40 is positioned on the ledge so that the sleeve 31 extends through the opening 40d defined therein.

For the purpose of holding the parts described above in position, a suitable cap 42 is provided which may be suitably supported from the ledge 27. Preferably, the cap 42 is provided with a slot 42a in which is pivotally mounted a member 43 having a roller 44 at the free end thereof for engaging the topmost record of the record stack to steady the same and, consequently, better support the record stack on the center post 13. The roller 44 is preferably formed of resilient material such as rubber or the like. A suitable leaf spring 45 disposed in the cap or casing 42 is adapted to engage with one of the edges 43a or 43b of the member 43, as best shown in Fig. 5 of the drawings, so as to cause the member 44 to be biased into firm engagement with the topmost record of the record stack.

In order to position the shelf 27 properly for supporting both ten inch and twelve inch records, the eccentric 26 is provided around its periphery with a pair of notches such as 47 which are engageable by a suitable roller 48 mounted on a lever 49. Suitable spring means are provided to bias the lever 49 and, consequently, the roller 48 into engagement with the surface of the eccentric 26 so as to maintain it in either its position for ten inch records or its position for twelve inch records. The lever 49 is fastened to a rod 50 which is rotatable in suitable bearings defined in ears 51 and 52 extending from the post 22 in a lateral direction, as is best shown in Fig. 2 of the drawings. The eccentric shape of the eccentric 26 causes a predetermined rotation of the member 50 depending upon whether ten inch or twelve inch records are positioned on the record stack. The lower end of the rod 50 is provided with a lateral extension 50a which is disposed between two upwardly extending arms 53a and 53b of a member 53 which is mounted for reciprocal movement to the underside of the base 11 as by means of pin and slot connections or the like indicated at 54—54a and 55—55a in Fig. 3 of the drawings. A suitable spring 56 is provided having one end connected to the reciprocal member 53, as, for example, to a downwardly extending portion 53c thereof, while the other end is connected to an extension of the pin 54 depending from the base 11. This pin 54 extends through the slot 54a to control the reciprocal movement of the member 53.

The end of the member 53 remote from the lever or rotatable shaft 50 is provided with a trough-shaped cam 58, the purpose of which will become apparent as the following description proceeds. From the above description, it will be apparent that, when the ledge or shelf 27 is rotated to support twelve inch records, the eccentric 26 causes the trough-shaped cam 58 to be moved to a position farthest away from the stand or post 22, while, when the shelf or ledge 27 is moved to the position to support ten inch records, the trough-shaped cam 58 is moved to a position closest to the post 22. As will become apparent from the following description the trough-shaped cam 58 is adapted to control the positioning of

the tone arm to be described hereinafter so as to engage the initial sound groove of either a ten inch or a twelve inch record depending upon the size of the records in the record stack on the center post 13 and consequently in dependence upon the position of the eccentric 26 associated with the record supporting ledge 27.

It will be understood that a record feeding operation occurs when the lever or rock arm 29 pivots about its pivotal support 28 in a clockwise direction, as viewed in Fig. 5 of the drawings, whereby the ejector plate 40, regardless of whether the ledge 27 is in a position for supporting ten or twelve inch records, is moved in a reciprocal manner to move the lowermost record in the record stack free of the shoulder 15. For the purpose of operating the rock arm or lever 29 in this manner to produce a record feeding operation, there is provided a U-shaped frame 60 depending from the base 11 for pivotally supporting a shaft or pivotal member 61 having a laterally extending portion 61*a* for supporting a roller 62. Extending upwardly from the pivotal member 61 is an extension 61*b* having a sawcut 61*c* therein. A suitable extension 61*d* of the pivotally mounted member 61 is connected by means of a spring 64 to a V-shaped extension 60*a* extending laterally from the U-shaped frame 60 as is shown at 65 in Fig. 8 of the drawings. This spring normally biases the pivotally mounted member 61 in a clockwise direction, as viewed in Fig. 5 of the drawings, so as to bias the roller 62 downwardly.

In accordance with the present invention the roller 62 is adapted to control the record feeding operation through movement of the rock arm 29. To relate the roller 62 with the rock arm 29 there is provided a leaf spring member 66 having a forked end engaging with a forked end 29*a* of the rock arm 29. The other end of the leaf spring 66 is inserted in the sawcut 61*c* of the extension 61*b* of the pivotal member 61 and fastened thereto in any suitable manner. With this arrangement, it is apparent that, if the roller 62 is moved upwardly as viewed in Fig. 5 of the drawings, force will be transmitted through the leaf spring 66 to the rock arm 29 to cause pivotal movement in a clockwise direction as viewed in Fig. 5 of the drawings. A record feeding operation will consequently be produced whenever the roller 62 is raised as viewed in Fig. 5 of the drawings. It is furthermore apparent that by virtue of the leaf spring 66 it is possible to block movement of the rock arm 29 to prevent a record feeding operation without damage to the mechanism even though the roller 62 were raised and movement of pivotal member 61 occurred against the bias of spring 64.

TONE ARM AND CONTROLS THEREFOR

Also extending above the base 11 of the automatic phonograph 10 of the present invention is a suitable tone arm 70 which is adapted to support one or more pickup units in the free end thereof for engaging the sound grooves provided in records such as 17, 17' and the like. In order that the automatic phonograph of the present invention is capable of playing both sides of the disk records associated therewith, the tone arm 70 is illustrated as being provided with an upwardly extending stylus 71 and a downwardly extending stylus 72. The upwardly extending stylus 71 is adapted to engage the underside of a suitable record for playing purposes, while the downwardly extending stylus, in a manner well understood by those in the art, is adapted to engage the sound groove in a record positioned on the turntable 16. It should be understood that each stylus 71 and 72 may be a part of a single pickup unit or a separate pickup unit may be associated with each stylus. The particular construction of the pickup units and styli forms no part of the present invention.

As is best shown in Figs. 2 and 9 of the drawings the tone arm 70 is pivoted for vertical movement about a horizontal pivot 73 extending through a pair of upwardly extending ears 74*a* of a collar 74 fastened to a vertically extending rotatable shaft 75. The rotatable shaft 75 is preferably a tubular shaft which is supported by the collar 74 rotating on a raised portion 76 which might comprise an integral portion of the base 11. The lower end of the tubular shaft 75 is effectively connected to a mechanism generally indicated at 77 in Figs. 2 and 8 of the drawings comprising a secondary tone arm 78 including an extension 78*a* and an adjustable trip actuating member 78*b*. The end of the secondary tone arm 78 includes a pin or cam follower 79. The mechanism 77 forms no part of the present invention but is disclosed and claimed in my prior copending application, Serial No. 699,961, filed September 28, 1946, now abandoned, and assigned to the same assignee as the present application.

Extending through the vertical tubular tone arm shaft 75 is a tone arm raise pin 80 which operates in the conventional manner to raise the tone arm 70 at a predetermined instant during the record changing cycle and subsequently to lower the tone arm onto the particular record in playing position on the turntable 16 or to raise the tone arm 70 into engagement with the underside of the particular record, the underside of which is being played as will be described in greater detail hereinafter. Fastened to the upper end of the raise pin 80 is a laterally extending member 80*a* having an adjustable means such as a screw 82 associated therewith. The upward end of the adjustable means 82 is adapted to engage with a lever 83, also pivotally mounted about the pivot 73 and biased by suitable spring means 81 to a predetermined downward position. The spring means 81 is connected from an intermediate point 81*a* of the tone arm 70 to the lever 83 as is best shown in Fig. 9 of the drawings. The end of the lever 83 is adapted to engage a stop 70*a* normally to limit the downward movement of the tone arm. The spring 81 is capable of producing the desired upward force for causing the stylus 71 to engage the sound groove on the underside of a record as will become apparent as the following description proceeds. If desired, an additional spring 81' may be provided connected between the collar 74 and the tone arm 70 to help support the weight thereof. The adjustable means 82 is adapted to engage the lever 83 to raise the tone arm 70 in any desired manner. The lever 83 and the resilient means 81 biasing the same in a downward direction against the stop 70*a* tend to cushion the tone arm in its upward movement when stylus 71 is effective while the spring 81' tends to cushion the downward movement of the tone arm 70 when the stylus 72 is effective.

It will be understood that the construction of the tone arm raise pin 80 per se forms no part of the present invention and any suitable means for accomplishing the purpose may be provided. Preferably, the laterally extending member 80*a* is

provided with a vertical extension 80b movable in a vertical groove in the collar 74 thereby properly relating the lever 80a with the shaft 75, while at the same time permitting reciprocal movement thereof in a vertical direction in response to movement of the tone arm raise pin 80.

MAIN CONTROL CAM

For the purpose of actuating the cam follower 79 of the secondary tone arm 78 and the tone arm raise pin 80, there is provided a main rotatable cam generally deisgnated at 85 which is substantially identical in every respect with the rotatable cam disclosed and claimed in copending application, Serial No. 616,879, Endo, filed December 17, 1945, now abandoned, and assigned to the same assignee as the present application. As illustrated, the cam 85 is mounted for rotation on a stationary vertical shaft generally designated at 86 which has one end thereof supported from the base 11. Preferably, the other end of the shaft 86 is supported from a suitable plate 87 disposed beneath the rotatable cam 85 and suitably supported from the base 11 by a series of depending pins or bolts designated at 88, 88a, etc.

The rotatable cam 85 is provided around its periphery with gear teeth 85a adapted to engage a rotatable pinion 89 which is driven at suitable times during a record changing cycle so as to cause rotation of the cam 85. Actually, the pinion 89 is adapted to be driven at a predetermined time during the operation of the automatic phonograph by an electric motor, indicated at 90 in Fig. 3 of the drawings, supported from the base 11. The particular construction of the motor 90 forms no part of the present invention but is preferably of the type disclosed and claimed in a copending application of Earle W. Ballentine, Serial No. 711,694, filed November 22, 1946, now Patent No. 2,492,207, and assigned to the same assignee as the present invention. This motor 90 also drives the turntable 16 by suitable friction wheels, not shown, one of which is adapted to engage the rim of the turntable 16. The mechanism for controlling the drive of the turntable 16 and the pinion 89 forms no part of the present invention but is disclosed and claimed in my copending application, Serial No. 535,218, filed jointly with Earle W. Ballentine on May 12, 1944, now Patent No. 2,480,623, and assigned to the same assignee as the present invention. The power supplied to the motor 90 from any suitable source of electrical energy, not shown, is preferably controlled by a suitable switch 91 supported from the underside of the base 11.

The rotatable cam 85 is provided with an edge or rim portion 92 which forms a horizontally disposed cam surface for controlling the tone arm raise pin 80 during the record changing cycle. The top surface of the rim 92 is provided with a portion of reduced height 92a defining a dwell portion for normally controlling the tone arm raise pin 80 during the operation of the automatic phonograph when the cam 85 remains stationary. The rotatable cam 85 also includes a cam track for the cam follower 79, a large portion of which is defined between a raised portion 93 on the upper surface of the cam 85 and the rim portion 92. A portion of the cam track for the cam follower 79 is also defined between a slidable member 94, best shown in Fig. 8 of the drawings, and either the rim 92 or the raised portion 93. The cam follower or pin 79 follows this cam track and, consequently, controls the position of the tone arm 70 so as to move it clear of the turntable or back into playing engagement with the records in playing position either on the turntable or in the position to be described hereinafter whereby the under surface of the record may be played. The slidable member or segment 94 controls the initial positioning of the tone arm relative to the record in playing position whether it be on the turntable or in the position assumed when the underside of the record is being played, but in either case in dependence upon whether a ten inch or twelve inch record is involved. The slidable member 94 is provided with an upwardly extending pin 95 which is adapted to be engaged by the trough-shaped cam 58 for moving the slidable member 94 either to the position shown in Fig. 8 of the drawings whereby the cam follower 79 moves the tone arm to the initial position for playing twelve inch records or to a position against the rim 91 so as to position the tone arm for playing ten inch records. In view of the detailed description included above with reference to the trough-shaped cam 58, it is apparent that, depending upon the size of the records supported on the record stack, the trough-shaped cam 58 is moved to a predetermined position so as properly to position the slidable member 94 during the record changing cycle whereby the tone arm 70 is subsequently positioned to engage the initial sound groove of the record in playing position whether the record be a ten inch or a twelve inch record.

MANUAL CONTROL MEANS

In addition to the elements described thus far, extending upwardly from the base 11 and consequently extending into the view of the operator, there are provided two manual control buttons 97 and 98, respectively. The manual control button 98 comprises the conventional control button heretofore employed in automatic phonographs of the type disclosed in the copending applications referred to above. This button 98 may be used to turn off the phonograph, to selectively pre-set the mechanism for manual or automatic operation when this button is moved to the "on" position or to cause rejection of any record that is moved into playing position whether it be moved to the playing position on the turntable or to the playing position for playing the underside of the record as will be brought out in greater detail hereinafter. The function of the control button 98 will be briefly described in connection with the mechanism which it actuates for the purpose of a complete disclosure, although it forms no part of the present invention.

Referring now to the underside of the base 11, as best shown in Fig. 3 of the drawings, it may be observed that the button 98 is connected to a crank 99 having a pin 100 engageable with a slot 101a in a manually actuatable lever 101, which lever is pivotally mounted to the base 11 as indicated at 102. This lever 101 is provided with a plurality of notches 103 and 104 engageable with a pin 105 which acts as a positioning means. The pin 105 is mounted on a lever 106 suitably biased by means of a spring 107 into engagement with the notched portions 103 and 104 of the lever 101. Lever 101 is also provided with a projection 101b which actuates the switch 91, which switch is provided with a suitable movable arm 91a engageable with the portion 101b of the lever

101 thereby cutting off the power supplied to the motor 90 from a suitable source, not shown, when the button 98 is moved to the "off" position shown in Fig. 1 of the drawings. Lever 101 also includes an extension 101c controlling a bell-crank 103 which when button 98 is moved to the "off" position moves the friction drive for the turntable 10 and the pinion 89 to an inoperative position.

When the button 98 is moved to the "on" position, the drive between the motor 90 and the pinion 89 is rendered effective dependent, however, upon suitable releasable or latching means forming no part of the present invention, which means control the initiation of the record changing cycle. This releasable means includes a trip lever 109 pivotally mounted to the base 11 and when this trip lever 109 is actuated it in turn moves a lever 110 to release the latching mechanism whereby the drive between the motor 90 and the cam 85 is rendered effective. When the button 98 is moved to the reject position, the end 101d of the lever 101 engages the trip lever 109 so as immediately to actuate or initiate the record changing cycle regardless of the position of the tone arm 70 relative to the record being played. When it is desired to play only a single record which is placed on the turntable, generally referred to as a manual operation of the automatic phonograph, the button 98 is turned to the "on" position and, as will become apparent from the following description, the phonograph will play this one record and stop with the tone arm 70 free of the record as shown in Fig. 1 of the drawings so a new record can be manually positioned on the turntable. It is apparent that, when the automatic phonograph of the present invention is operated for manual operation, it is unnecessary to employ the stylus 71 on the upper side of the tone arm 70 since the record can be positioned on the turntable with the proper face upwardly to play that side. It is only when the phonograph is arranged for automatic operation with a plurality of records on the record stack and it is desired to play the faces of the records in succession that the means to be described hereinafter for playing the underside of the records by means of the stylus 71 is employed.

AUXILIARY CONTROL CAM AND ASSOCIATED MECHANISM

In order that the ejector mechanism described in detail above may be actuated at the proper time during a record changing cycle to release a record from the record stack, either into the playing position where the underside thereof may be played to be described hereinafter or onto the turntable where the upper side thereof may be played, in synchronized relationship with the tone arm 70, there is provided a cam, generally designated in Fig. 4 of the drawings by the reference numeral 115, which might be designated as an auxiliary cam, the purpose of which is to provide an operating cycle which requires two revolutions of the main control cam 85. As illustrated, the cam 115, to be described in greater detail hereinafter, is fastened to the underside of the cam 85 so as also to be rotatable about the shaft 86. Like the main cam 85, the auxiliary cam 115 is always adapted to rotate in a clockwise direction as viewed in Figs. 3 and 4 of the drawings and indicated by the arrows thereon. The auxiliary cam 115 is provided with a crescent-shaped cam follower 116 connected to a link 117. As will become apparent from the following description, rotation of the cam 115 causes reciprocal movement of the link 117, a complete cycle of the link 117 being completed once for every two revolutions of the cam 115.

As is best shown in Fig. 4 of the drawings, the cam 115 comprises two curvilinear cam tracks 118 and 119. The cam track 119 has a larger diameter than the cam track 118 and substantially surrounds the latter except for a common or discontinuous portion 120 of these two cam tracks. In the common portion of these two cam tracks 118 and 119 there is provided a switch 121 having a cam track 121' defined therein. This switch 121 is mounted for limited pivotal movement, with the extreme counter-clockwise rotated position thereof being shown in Fig. 4 of the drawings. To limit the extreme positions, the switch 121 is provided with a notch or cutaway portion 121a, the ends of which engage with a pin 121b disposed in the auxiliary cam 115. It will be apparent that the switch 121 may rotate in a clockwise direction to a position whereby the right-hand end of the notch 121a engages the pin 121b.

Due to the counter-clockwise rotation of the cam 115, the left-hand end of the switch track 121' is always adapted to receive the leading tip 116a of the cam follower 116 when the cam follower 116 effectively moves from one cam track such as 119 to the other cam track 118 or vice versa. The leading portion 116a of the cam follower 116 is so shaped that upon entering the switch track 121' it causes it to pivot to its other position, thereby ensuring the effective transfer of the cam follower from one cam track to the other.

It will be apparent that with this arrangement the cam follower 116 causes the link 117 to reciprocate substantially along the axis of the link to complete a cycle of reciprocal movement once during every two revolutions of the cam 115. Assuming rotation of the cam 115 from the position shown in Fig. 4, it will be apparent that the switch track 121' will be moved so that the leading end 116a of the cam follower 116 will enter the track 121'. Continued rotation of the cam 115 will cause the switch track 121' to move into alignment with the end of the cam track 118 adjacent the right-hand end of the track 121'. Continued rotation of the cam 115 will cause the cam track 118 to control the cam follower 116 whereby the link 117 moves along its axis in a direction toward the right as viewed in Fig. 4 of the drawings. Upon the completion of another revolution of the cam 115, the leading end 116a of the cam follower 116 again effectively enters the cam track 121' which now is disposed in its other position from that shown in Fig. 4 of the drawings. Continued rotation of the cam 115 will move the switch 121 back to the position shown in Fig. 4 so that the second revolution of the cam 115 may be completed with the cam follower 116 effectively moving back into the cam track 119.

In accordance with the present invention, the reciprocal movement of the link 117 is adapted to control the record feeding operation as by causing reciprocal movement of the ejector plate 40 through pivotal movement of the rock arm or lever 29. Accordingly, the link 117 is connected to a link 123 as by means of a pin 124. The pin 124 is also connected to a segmental member 125 mounted for pivotal movement about a pivotal support which preferably comprises the pin 88 depending from the base 11. It

will be apparent that, by virtue of the pivotal movement of the segmental member 125, the junction point of the links 117 and 123 tends to move about the pin 88 in an arcuate manner. In order to guide the ends of the link 123 remote from the point of connection with the link 117, it is provided with an elongated slot 123a. A slidable plate 127 is adapted to be mounted for sliding movement along the angular portion 60b of the laterally disposed frame extension 60a. This slidable plate 127 has a downwardly projecting finger 127a which is adapted to be disposed within the longitudinal slot 123a in the link 123. A suitable spring finger 128 fastened to the frame 60 is provided with a suitable detent 128a for engaging with a plurality of openings formed in the slidable plate 127 whereby the slidable plate 127 may be selectively positioned in a plurality of positions.

Extending upwardly from the link 123 and preferably formed by integral upset portions thereof is a pair of cams 129 and 130, respectively. The cam 129 is in the form of a sawtooth having closely adjacent cam surfaces terminating substantially in a point. The cam 130, on the other hand, is provided with an angularly disposed cam surface portion at the end remote from the junction point between the links 117 and 123 connected to an elongated cam surface portion providing a substantially horizontal surface. These cams 129 and 130 are adapted to selectively engage the roller 62 so as to perform a record feeding operation. Sliding movement of the plate 127 is controlled through manipulation of the button 97 which is connected to the sliding plate 127 by means of a crank 131 and a rod 132 best shown in Figs. 3 and 8 of the drawings. When the button 97 is moved to the position marked "2" in Fig. 1 of the drawings, the cam 130 is rendered effective by being disposed beneath the roller 62. When the button 97 is moved to the position shown in Fig. 1 of the drawings marked "1", the sliding plate 127 is moved to the position shown in Fig. 8 of the drawings so that the cam 129 is disposed directly beneath the roller 62. When the button 97 is moved to the repeat position, the sliding plate 127 and consequently the link 123 is moved to the left, as viewed in Fig. 8 of the drawings, sufficiently so that both of the cams 129 and 130 are to the left of the roller 62 whereby they are both ineffective to cause a record feeding operation.

It will be apparent that reciprocal movement of the link 123 guided by the extension of the plate 127 movable in the elongated slot 123a will, when the cam 130 is effective, cause the roller 62 to be raised and consequently to move the ejector plate 40 to release the bottommost record from the record stack on the center post 13. Due to the fact that two revolutions of the main cam 85 are required to produce one cycle of the link 123, it will be apparent that during one cycle of the cam 85 a record is released from the record stack but during a second cycle of the cam 85 no record is released since the roller 62 remains in the raised position on the cam 130 and is not permitted to drop down to the position shown in Fig. 5 of the drawings until the end of the second cycle. It will be apparent that with this arrangement both sides of the record moved from the record stack will be played before another record is released and, consequently, the numeral "2" associated with the button 97 refers to the fact that both sides of the record are played.

When only one side of a record is to be played, the button 97 is removed to the position shown in Fig. 1 of the drawings whereupon the cam 129 is rendered effective. Due to the leading and trailing cam surfaces on the cam 129, it is apparent that the roller 62 is raised to release a record by operation of the ejector plate 40 when the link 130 is moved away from the center of the cams 85 and 115 and the trailing surface of this cam permits the roller 62 to move downwardly immediately following raising thereof. During the next cycle of the cam 85 when the link 123 moves toward the center of the cams 85 and 115 the process is repeated. In other words, a record is released from the record stack for every cycle of the cam 85 thereby causing playing on only one side of the disk records. When the button 97 is moved to the repeat position shown in Fig. 1 of the drawings, neither the cams 129 or 130 is operable to cause movement of the roller 62 and, consequently, no record is released. This means that the record moved into playing position on the turntable 16 will be replayed.

MECHANISM FOR SUPPORTING RECORDS SO THE UNDERSIDE THEREOF CAN BE PLAYED

In order that the bottom side of the disk record may be played by the upwardly extending stylus 71 of the tone arm 70, it is necessary that the record be supported for rotation in a first playing position above the tone arm 70. To this end, there is provided a plurality of substantially identical roller assemblies 139, each comprising a roller 140 which is rotatably mounted on stationary horizontal shaft 141. Each horizontal shaft 141 is connected to a rotatable and vertically movable vertical shaft 142 by means of a suitable connecting means 143. Preferably, the vertical shaft 142 extends into a suitable opening provided in the connecting member 143 and the horizontal shaft 141 acts as a set screw engaging suitable threads formed in the member 143 to clamp the vertical member 142 in position in the member 143 thereby providing a rigid, easily united assembly.

Each roller 140 is preferably formed of resilient material such as rubber or the like and is freely rotatable on its associated horizontal shaft 141. As illustrated in the drawings, the vertical shafts 142 are adapted to be mounted for rotation in suitable sleeve-like bearings 138 extending above the base 11 at spaced points around the periphery of the turntable 16. These sleeve-like bearings 138 are preferably adapted to extend through openings in the base 11 for threaded engagement with a plurality of stationary sleeves 144 each forming a part of one roller assembly 139 for controlling vertical movement of the associated vertical shaft 142. The lower end of each vertical shaft or rod 142 extends into its associated sleeve 144 beneath the base 11. In order to guide the lower end of the rod or shaft 142 in the sleeve 144, disk-like piston members 145 are fastened for reciprocal movement with the rods 142 within the sleeves 144. Each sleeve 144 is provided with an L-shaped slot 144a defined therein, which slot comprises a vertical portion 144b and a horizontal portion 144c connected with the upper end of the vertical portion 144b. A suitable pin 147 fastened to the vertically movable and rotatable rod or shaft 142 is adapted to be disposed within the slot 144a

of L-shaped configuration. It will be apparent that, if the pin 147 is moved upwardly in the vertical portion of the L-shaped slot 144a, the rollers 140 are raised a predetermined amount above the base 11. When the pin 147 reaches the top of the vertical portion of the L-shaped slot 144a, it may be moved along the horizontal portion 144c of this slot whereby the rollers 144 are adapted to be rotated from the position shown in solid lines in Fig. 1 of the drawings to the position shown in dotted lines in Fig. 1 of the drawings. With this arrangement, it is impossible for the rollers to pivot about the vertical shafts 142 from the solid positions of Fig. 1 to the dotted positions or vice versa unless the vertical shafts 142 are raised to their uppermost position to permit the pin 147 to move into the horizontal portion 144c of the L-shaped slot 144a.

For the purpose of causing vertical movement of the rollers 140 as well as pivotal movement of the vertical shafts 142, each of the roller assemblies 139 is provided with a rotatable sleeve 148 adapted to be concentrically positioned with reference to the sleeve 144 as is best shown in Fig. 2 of the drawings. The rotatable sleeve 148 is provided with an opening 149a, best shown in the developed view in Fig. 10 of the drawings, one boundary of which defines an inclined cam surface 149. Rotation of the external sleeve 148 will cause the associated pin 147 to move upwardly along the cam surface 149 so as to raise the shaft 142 until the pin 147 enters the horizontal portion 144c of the L-shaped slot 144a in the inner sleeve 144. Continued rotation of the outer sleeve 148 when the pin 147 has reached the upper end of the inclined cam surface 149 causes the pin to move into the horizontal slot 144c in the inner sleeve 144 to cause pivotal movement of the shaft 142. The upper end of the cam surface 149, best shown in Fig. 10 of the drawings, terminates in a notch 150 for receiving the pin 147. Rotation of the outer sleeve 148 in either direction while the pin 147 is disposed in the notch 150 will cause the pin 147 to move in either direction along the horizontal portion 144c of the L-shaped slot 144a.

From the above description, it will be apparent that a very simple mechanism is provided for causing vertical movement of the shafts 142 as well as pivotal movement thereof controlled entirely by movement of the rotatable outer sleeve 148.

It is apparent that the three rollers 140 of the roller assemblies 139 must be simultaneously rendered effective or ineffective to support a record above the turntable and to this end each of the sleeves 148 is provided at its lower end with a gear or sprocket 152. Preferably these sprockets 152 are suitably welded or otherwise fastened to the rotatable outer sleeves 148 and are interconnected by any suitable driving means as, for example, the metallic belt 153, provided with perforations 154 for engaging the teeth of the sprockets 152.

The outer sleeves 148 with the attached sprockets 152 are preferably maintained in rotatable position on the inner sleeves 144 by means of annular members 156 fastened to the sleeves 144 by suitable set screws or the like. To provide rigidity and additional support for the lower ends of the inner sleeves 144, the annular members 156 are preferably interconnected by suitable rods 157 which may be threaded into the annular members or fastened thereto in any suitable member. Preferably the annular members 156 are fastened to the rods 157 to form a unit which is then slipped onto the lower ends of the inner sleeves 144 and fastened thereto.

ROLLER ASSEMBLY OPERATING MECHANISM

It will be understood that only when it is desired to play both sides of a disk record is it necessary for the rollers 140 to be moved to a position for supporting a disk record in the manner indicated in Fig. 13 of the drawings. Consequently, it is only when the button 97 is moved to position "2" that the rollers 140 should be in other than the position indicated in solid lines in Fig. 1 of the drawings. To this end, the outer sleeve 144 of one of the three roller assemblies such, for example, as the outer sleeve 144 of the roller assembly adjacent the stand 22 is provided with a gear 160 integrally formed with the sleeve 144 adjacent the lower end thereof, which gear is adapted to be engaged with a segmental gear 161 pivotally mounted about the pin 88 depending from the base 11.

The segmental gear 161 is provided with an extension 161a which is adapted to be engaged with a shoulder 162a on a link 162 pivotally mounted as indicated at 164 to the plate 87 for supporting the rotatable cam 85 as described above. When the shoulder 162a of the link or lever 162 is in engagement with the extension 161a of the segmental gear 161, as indicated in Fig. 8 of the drawings, the segmental gear 161 is maintained in a stationary position. To control the position of the lever or link 162, it is connected by means of a rod 165 with the crank 131 fastened to the manual control buton 97. When the control button is moved to the "1" position, as shown in the drawings, the shoulder 162 is in engagement with the extension 161a of the segmental gear 161 whereby the segmental gear cannot operate and the rollers 140 are maintained in their solid line positions shown in Fig. 1 of the drawings. The end of the rod 165 extends into an elongated slot 162b in the link 162 so that, even when the button 97 is moved to the repeat position, the link 162 remains in the position shown in Figs. 3 and 8 of the drawings effectively locking the segmental gear 161 in the position shown. The slot 162b merely provides a lost motion connection to permit movement of the button 97 to the repeat position without changing the position of lever 162.

When the button 97 is moved to the "2" position, the rod 165 causes the link 162 to move so that it is free of the extension 161a of the segmental gear 161 whereupon pivotal movement of the segmental gear 161 about pivot pin 88 is possible. Under these conditions, the segmental gear 161 is adapted to be driven by the segment 125 by means of a pin 168 extending upwardly from the segmental gear 161. The segment 125 is provided with a spring biased dog 169 pivotally mounted thereto by means generally designated as 170. A suitable spring normally biases the dog 169 against a stop 171 which is preferably an upset portion of the segment 125. A plurality of ears 173 is provided on the dog 169 for selectively holding the end of the tension spring 172 and variably controlling the tension thereof. The end of the dog 169 is adapted to engage the pin 168 and if the gear segment 161 is free to pivot about pin 88 the dog 169 causes the segment 125 and the segmental gear 161 to move as a unit. When the shoulder 162a effectively locks the gear segment 161 in the position shown in Fig. 8 of the

drawings, the dog 169 is adapted to slip by the pin 168 during reciprocal movement of the links 117 and 123. The segment 125 is provided with an extension 125a which engages the pin 168 to return the gear segment 161 to its initial position, shown in Fig. 8 of the drawings, with the segment 125 when the gear segment 161 has pivoted to its maximum extent in a counterclockwise direction about the pin 88 as viewed in Fig. 8 of the drawings. The gear segment 161 is also provided with a downwardly depending stop or shoulder member 161b which may comprise a downwardly extending pin or an integral portion such as is illustrated in the drawings. This downwardly extending shoulder 161b is adapted to control the tone arm when the underside of a disk record is being played as will be described hereinafter.

It will be apparent that, when the underside of a record is to be played by the stylus 71 of the tone arm 70, a reverse rotation of the record must be provided as contrasted with the rotation of the record on the turntable when reproduction thereof is obtained by the stylus 72. The rollers 140 are adapted to engage the turntable 16 or any records disposed thereon whereby rotation of such rollers is obtained. If a record 17''' were disposed on the upper portions of the rollers 140 when they are in engagement with the turntable or any records disposed on the turntable 16 as indicated in Fig. 13, then it is obvious that such record 17''' will rotate in a direction opposite to the direction of rotation of the record 17 on the turntable.

TONE ARM CONTROL MEANS

From the above discussion, it is apparent that the tone arm 70 must effectively assume three positions solely with respect to the vertical during the operation of the record changer. First of all, when the stylus 72 is in engagement with the upper surface of a record disposed on the turntable 16, it is necessary for the tone arm to have what might be defined as a lowermost position indicated in Fig. 11 of the drawings. Also, the tone arm must have an intermediate position when it is out of engagement with the record on the turntable and also out of engagement with a record disposed on the rollers 140 as is shown in Figs. 1 and 12, for example. In addition, the tone arm must have a third position for engaging the underside of the disk record for reproduction thereof in the manner disclosed in Fig. 13 of the drawings. To accomplish this purpose, the tone arm raise pin 80 does not engage the rim 92 of the cam 85 as in the automatic phonographs disclosed in the copending applications referred to above. Instead, however, there is provided a pivotal assembly 180 which is pivotally mounted to a suitable U-shaped bracket 181 fastened to the underside of the base 11. The U-shaped bracket 181 has laterally extending portions 182 for supporting the pivot pin 183 for the pivotal assembly 180. The pivotal assembly 180 includes a finger 180a supporting a pin 184 adapted to ride on the rim 92 of the cam 85. In addition, the pivotal assembly 180 includes a finger 180b for supporting the bottom end of the tone arm raise pin 80. With the portion of the pivotal assembly described thus far, two of the three positions of the tone arm 70 are obtained. When the pin 184 is on the well portion 92a of the rim 92, then the pivotal assembly 80 is in its lowermost position, as shown in Fig. 2 of the drawings, and the tone arm 70 is permitted to move to its lowermost position shown in Fig. 11 so that the stylus 72 is free to engage the grooves defined in the upper surface of the record such as 17 on the turntable 16. When the cam 85 rotates so that the pin 184 moves onto the highest portion of the rim 92, then the tone-arm-raise-pin is moved so that the tone arm 70 assumes an intermediate position, such as is illustrated in Fig. 12 of the drawings, which is the position assumed by the tone arm at all times when it is not in engagement with either the upper surface or the undersurface of a record in one of the two playing positions. In this intermediate position of the tone arm 70 the adjustable means 82 is in engagement with the lever 83 and the weight of the tone arm is supported by the means 82. When the lever 83 is pivoted away from the stop 70a, then the spring 81 is tensioned and urges the tone arm upwardly to engage the stylus 71 and the underside of a record. The spring 81' is a counter-balance spring for the tone arm to adjust the playing pressure of the stylus or needle 72 so that the weight is proper when the tone arm comes down to the top surface of a record.

To control the tone arm in its uppermost position indicated in Fig. 13 of the drawings, the pivotal assembly 180 is provided with an upwardly extending portion 180c which is connected to a lever 187 through a rod 186 and a suitable lost motion connection which may comprise a pair of displaced nuts 188 and 189 disposed on the rod 186 on either side of an opening in the pivotally mounted lever 187 through which the rod 186 extends. The lever or link 187 is also pivoted about the pin 88 preferably beneath the segmental gear 161. The downwardly depending shoulder 161b of the segmental gear 161 is adapted to engage the pivotally mounted lever 187 just prior to the final inward and downward movement of the rollers 140 to the positions indicated in Fig. 13 of the drawings. This operation of the segmental gear 161 moving the link 187 in a counter-clockwise direction, as viewed in Fig. 8 of the drawings, causes a clockwise pivotal movement of the pivotal assembly 180, as viewed in Fig. 2, so that the finger 180b raises the tone arm raise pin 80 to its maximum extent causing the stylus 71 to engage the grooves defined in the underside of the record 17''' rotatable by the rollers 140 in a direction opposite to the direction of rotation of the turntable 16. The spring 81 ensures the desired upward force applied to the tone arm 70.

TONE ARM TENSION CONTROL

It is, of course, desirable that the effective engagement of the record by the stylus 71 is the same in every respect as the effective engagement of the record with the stylus 72 so that no variation in the reproduction is occasioned depending upon whatever the record is played on the turntable 16 or on the rollers 140. Since the records rotate in the reverse direction when played on the upper face than when played on the lower face while employing the same tone arm, it is apparent that the force applied to the tone arm by the sound groove in rotating with reference to the stylus 71 would tend to move the tone arm 70 outwardly, whereas with reference to the stylus 72 would tend to move the tone arm inwardly. To equalize this effect, it is desirable, when the tone arm is in its playing position indicated in Fig. 13 of the drawings, to apply a slight inward force thereto so as to approximate the condition when playing the upper

face of a record as indicated in Fig. 11 of the drawings. To this end, there is provided a tension applying means in the form of a tension spring 190 having one end thereof connected by a suitable means indicated at 191 to a projection 78c of the secondary tone arm 78. The other end of the tension spring 190 is adapted to be connected to a suitable cord or wire 192, which cord is adapted to be wrapped around a pulley 193 fastened to the upper end of one of the rotatable outer sleeves 148. When the vertical shafts 142 are rotated so the rollers 140 are in their inward position, as shown in Fig. 13 of the drawings, the cord 192 is wrapped around the pulley 193 so as to increase the tension of the spring 190 tending to pull the tone arm toward the center post 13. With this arrangement, the reproduction is substantially identical whether the record is played on the under face or the upper face thereof as indicated in Figs. 11 and 13, respectively.

AUTOMATIC STOP

It is desirable that, when the last record has been moved away from the shoulder 15 on the center post 13, the automatic phonograph is conditioned so that it stops upon the complete reproduction of this record. In accordance with the present invention, there is provided an automatic stop which in many respects is very similar to the automatic stop disclosed and claimed in my prior copending application, Serial No. 727,363, filed February 8, 1947, now Patent No. 2,529,474, and assigned to the same assignee as the present application. Where an automatic stop is associated with a record changer which plays both sides of the records without reversing the records manually, it is apparent that means must be provided to prevent stopping the phonograph until both sides of the last record have been reproduced.

As was described in connection with the record feeding mechanism, part of the automatic stop device of the present invention comprises the pivotally mounted members 33 and 34 mounted in recess 32 in the ledge or shelf 27. As was described above, the weight of the record whose peripheral edge rests on the shelf 27 biases the portion 33c or the portion 34c of the members 33 and 34, respectively, downwardly so as to raise the rock arm 29 to the position shown in Fig. 5 of the drawings, the slot 30 in the rock arm 29 permitting such movement. In accordance with the present invention, there is provided a sliding plate 200 mounted for sliding movement in a pair of opposed notches 22a and 22b defined in the lower end of the stand or post 22. One end of the slidable plate 200 is provided with an upturned portion 200a which limits the slidable movement thereof in one direction. The other end of the slidable plate 200 is connected by means of a tension spring 201 to the end of the channel member 14 welded or otherwise fastened to the undersurface of the base 11 to provide rigidity thereto. It is apparent that the spring 201 biases the slidable plate 200 to the position shown in Fig. 5 of the drawings whereby the upwardly extending portion 200a thereof is engaged with the exterior wall of the stand or post 22. The plate 200 is also provided with an opening of generally rectangular configuration, designated at 202 in Fig. 5 of the drawings, which opening is of sufficient size to permit the rock arm 29 to extend therethrough when it is permitted to move downwardly by the members 33 and 34 and the slot 30. When the rock arm 29 moves to its lowermost position limited by the upper edge of the slot 30, the lower end thereof extends into the opening 202 so that subsequent movement of the rock arm 29 by virtue of raising of the roller 62 will not only cause reciprocal movement of the ejector plate 40 but will also cause sliding or reciprocal movement of the plate 200 against the bias of the spring 201.

For the purpose of employing such sliding movement of the plate 200 for stopping the operation of the automatic phonograph there is provided a rod 203 having a laterally projecting portion 203a at one end thereof extending downwardly through an opening in the end of the plate 200. The rod 203 extends along the edge of the strengthening flange 14 and the other end thereof is also provided with a downwardly extending portion 203b which is adapted to be inserted in a suitable opening in a bell-crank 204 pivotally mounted, as best shown in Fig. 5 of the drawings, to one of the depending posts such as 88a from the base 11. This bell-crank 204 is provided with a short arm 204a which contains the opening for receiving the end 203b of the rod 203. The bell-crank 204 is also provided with a long arm having a right-angled flange 204b which extends over the upper surface of the rotatable cam 85 in fairly close relationship thereto as is best shown in Figs. 3 and 5 of the drawings. Normally, the tension spring 201 moves the bell-crank 204 to the position shown in Fig. 3 of the drawings so as to be entirely clear of an upwardly projecting pin 205 formed on the upper surface of the cam 85. With the flange 204b of the bell-crank 204 in the position shown in Fig. 3 of the drawings, the pin 205 moves behind the flange 204b, as viewed in Fig. 5 of the drawings, so as not to affect or move the bell-crank 204 in any manner. If, however, the slidable plate 200 is moved to the left, as viewed in Fig. 5 of the drawings, against the bias of spring 201, the rod 203 is moved so as to pivot the bell-crank 204 in a counterclockwise direction, as viewed in Fig. 3 of the drawings, into a position so as to be engaged by the pin 205 during rotation of the main cam 85, thereby causing further pivotal movement of the bell-crank 204 as the pin 205 moves along the flange 204b. As illustrated in Fig. 3 of the drawings, the bell-crank 204 is also provided with an arm 204c which is connected by means of a suitable link 206 with the lever 101. This connection between the link 206 and the lever 101 is illustrated as of the lost motion type comprising a pin and slot connection specifically designated at 207 and 208, respectively. With this arrangement, it is apparent that pivotal movement of the bell-crank 204 through engagement with the pin 205 causes pivotal movement of the lever 101 to operate the switch 91 to the "off" position thereby shutting off the motor 90 and stopping the automatic phonograph.

For the purpose of guiding the rod 203 in its reciprocal movement along the flange 14 there is preferably provided a plurality of downwardly projecting members 14a and 14b. These projections 14a and 14b are preferably cut-out portions of the flange 14, which is clearly apparent from Fig. 3 of the drawings. With the arrangement disclosed, it is clear that the assembly operation of the automatic stop mechanism is very simple since the rod 203 is merely inserted in the openings in the members 200 and 204 which it interconnects. The rod 203 cannot move out of posi-

tion due to its close proximity to the underside of the base 11 and also by virtue of the downwardly projecting members 14a and 14b.

When the automatic phonograph of the present invention is set to play only one side of the record, it is apparent that a record feeding operation causing reciprocal movement of ejector plate 40 occurs for every rotation of the cam 85 since the reciprocally movable cam 129 causes raising of the roller 62 twice during each cycle of the cam 115. When the last record of the record stack has moved onto the turntable under such conditions, the rock arm 29 moves downwardly into the opening 202 in the plate 200 so that a subsequent record feeding operation will cause movement of the rod 203 and the bell-crank 204 so that it can be actuated by the pin 205 to stop the automatic phonograph at an intermediate point during the record changing cycle. It will be understood that the pin 205 is so positioned on the upper surface of the cam 85 as to stop the phonograph when the tone arm 70 is swung to an outward position clear of the turntable 16 whereupon the records disposed on the turntable may be freely removed without interference by the tone arm 70.

When the record changer 10 is operated with the button 97 moved to position "2" for playing both sides of the records in succession, it is apparent that the cam 130 is rendered effective with respect to the roller 62. Under these conditions, when the last record from the record stack is released it of course is released to fall onto the upper surfaces of the rollers 140 which have moved inwardly in a manner described above. The rock arm 29 is pivoted into engagement with the right-hand edge, as viewed in Fig. 5, of the opening 40d defined in the ejector plate 40 and also the rock arm 29 is pivoted so the lower end moves to its extreme left-hand position as viewed in Fig. 5. In this position, the rock arm 29 is wedged so that it cannot move downwardly even though, when the last record is moved from the record stack, the members 33 and 34 will permit downward movement thereof. Also, the opening 202 is preferably constructed so that, when the lower end of the rock arm 29 is pivoted to its extreme left-hand position, as viewed in Fig. 5 of the drawings, it engages the edge of the opening 202 in the slidable plate 200 so that downward movement thereof is prevented. Consequently, even though the last record has moved away from the record stack and specifically off from the shoulder 15 of the record post 13, the rock arm 29 does not drop to its position effective to move sliding plate 200 upon subsequent operation thereof. Consequently, the underside of the last record from the record stack is played through engagement of the stylus 71 with the underside thereof and, upon completion of such playing, the record changer is cycled again causing the rock arm 29 to move back to its initial position, and the record which has been rotating in a reverse direction on the upper surfaces of the rollers 140 is permitted to drop down onto the records on the turntable 16. Following this operation, the rock arm 29 is permitted to move downwardly and upon completion of the playing of the upper surface of this record the automatic phonograph is stopped through operation of the stop mechanism described in detail above.

When the underside of a record is being played and there is no record resting on the members 33 or 34, it is noted that the leaf spring 66 acts on the rock arm 29 to prevent it from falling down. The spring 66 is maintained in tension for this purpose when the roller 62 is riding on the cam 130.

As was pointed out above the stop mechanism stops the automatic record changer at an intermediate point during the record changing cycle so that the tone arm is free of the turntable. It is of course desirable that the pivotally mounted roller assemblies 139 including the rollers 140 are also free of the turntable under these conditions so as to assume the solid line positions of Fig. 1 of the drawings. Under these conditions it may be desirable to provide means for ensuring that this takes place. This is not shown in the drawings but it will be understood that any suitable means for holding the segmental gear 161 in the position shown in Fig. 8 of the drawings under these conditions will ensure that the rollers 140 remain in the solid line positions shown in Fig. 1 of the drawings. It will be understood, therefore, that downward movement of the rock arm 29 may be employed to cause a suitable means to move into interfering position with the segmental gear 161.

OPERATION

In view of the detailed description included above, the operation of the automatic phonograph 10 of the present invention will be apparent to those skilled in the art. However, the operation of the automatic phonograph will be considered with respect to the three positions of the control button 97.

(a.) *Control button 97 moved to position "1" as shown in the drawings*

Under these conditions, the link or lever 162 has its shoulder 162a in engagement with the extension 161a of the segmental gear 161 thereby effectively locking segmental gear 161 against movement so that the roller assemblies including the rollers 140 are maintained in their solid line position shown in Fig. 1 of the drawings. This, of course, is desired when only the upper sides of the records are to be played. Also, this position of the button 97 renders the cam 129 effective with respect to the roller 62, During a record playing operation then, the automatic phonograph of the present invention is in the condition shown in Fig. 11 of the drawings and the pivotal assembly 180 is in the position shown in Fig. 2 of the drawings so that the tone arm 70 is in its lowermost position and the stylus 72 is effective to engage the grooves on the upper surface of the topmost record on the turntable 16. Upon completion of the playing of this side of the record, the tone arm 70 has moved inwardly toward the center post 13 to a sufficient extent so that the tripping mechanism, including the portion 78b of the secondary tone arm, causes pivotal movement of the lever 109 with consequent release of the latching means to render the pinion 89 effective to drive the cam 85. Each cycle of operation of the cam 85 by virtue of the cam 129 will cause the ejector plate 40 to release a record from the record stack which is played on only one side and, when the last record has dropped onto the turntable and is played, the automatic stop mechanism described above is rendered effective to stop the record changer by deenergizing the motor 90 as well as rendering the driving mechanism for the turntable 16 and the cam 85 ineffective.

(b.) *When the button 97 is moved to the "R" or repeat position*

Under these conditions the link 162 still has the shoulder 162*a* in engagement with the extension 161*a* of the segmental gear 161 so that the roller assemblies 139 comprising the rollers 140 are rendered ineffective and are maintained in the position shown in solid lines in Fig. 1 of the drawings. Consequently, repeat operation only occurs with respect to the record on the turntable 16. The repeat operation is caused solely by the fact that no cam means is effective to operate the roller 62 and, consequently, no record is moved from the record stack under these conditions. The operation of the mechanism otherwise is exactly the same as when the button 97 is moved to the "1" position, which is the position for playing one side only of the records.

(c.) *When the button 97 is moved to the "2" position for playing both sides of the records in succession*

Under these conditions the cam 130 is rendered effective to engage with the roller 62 and the link 162 is moved away from the segmental gear 161 so that the latter is free to pivot about its center of rotation 88. By virtue of the construction of the cam 130, the ejector plate 40 is effective to move a record from the record stack once during every cycle of the cam 115 but, since the cam 115 makes a complete operation only once during every two cycles of the cam 85, it is apparent that the ejector plate 40 is effective to move a record from the record stack only once during every two cycles of the cam 85. Under these conditions, operation of the record changing mechanism causes reciprocal movement of the link 123 and pivotal movement of the segment 125 which, by virtue of dog 169 and pin 168, causes pivotal movement of the segmental gear 161. Such operation causes the pivotal movement of the roller assemblies through rotation of the vertical shafts 142 from the position shown in Fig. 11 of the drawings to the position shown in Fig. 12 of the drawings where the rollers 140 are in their uppermost position by virtue of the fact that the pin 147 moves along the horizontal portion 144*c* of the L-shaped slot 144*a* in the inner sleeve 144. Simultaneously with the pivotal movement about the vertical shafts 142 of the roller assemblies, the record ejecting mechanism including the plate 40 causes a record to be moved free of the shoulder 15 of the center post 13 to drop onto the rollers 140 while in their inward but uppermost positions as is clearly shown in Fig. 12 of the drawings. Under these conditions, the tone arm 70 is still in its outward position clear of the turntable 16 and the records both in the record stack and on the turntable. Continued rotation of the cams 85 and 115 causes continued rotation of the outer sleeves 148 of the roller assemblies 139 so that the pins 147 enter the vertical portions 144*b* of the L-shaped slots 144*a* permitting the roller assemblies 139 and specifically the rollers 140 to move downwardly to the position shown in Fig. 13 of the drawings so as to drive the record 17''' on these rollers by engaging the rotating turntable or the records rotating with the turntable. It is apparent that, under these conditions, this record 17''' rotates in a reverse direction with respect to the rotation of the turntable or the records on the turntable. Since the rollers 140 are made of material such as rubber or the like, sufficient frictional engagement is assured to provide the desired driving operation thereof. The cam 85 causes the tone arm 70 to swing into playing position and, just before the cam 115 has reached the end of its cyclic operation and the segmental gear 161 has reached its extreme position following counter-clockwise rotation from the position shown in Fig. 8 of the drawings, the projection 161*b* thereof engages the end of the lever 187 to pivot it in a counter-clockwise direction, as viewed in Fig. 8, about the pin 98 so that the pivotal assembly 180 raises the tone arm raise pin 80 and consequently the tone arm 70 to the position shown in Fig. 13 of the drawings whereupon the stylus 71 engages the grooves on the underside of the record 17'''.

Upon completion of the playing of the underside of the record 17''', the record changing cycle is again initiated through operation of the lever 109 and, during the second half of the cyclic operation of the cam 115, the link 123 moves back to the original position shown in Fig. 5 of the drawings. No record, however, is released from the record stack. The segmental gear 161 returns to its original position through operation of the extension 125*a* of the segment 125 engaging the pin 168. Such movement of the segmental gear causes the roller assemblies to move in a vertical direction to the position shown in Fig. 12 of the drawings. The projection 161*b* of the segmental gear 161 also permits the pivotal assembly 180 to move to the intermediate position where the pin 184 is engageable with the rim 92 so that the tone arm is in its intermediate position, such as is shown in Fig. 12 of the drawings, whereupon the tone arm is free to swing outwardly from the center post 13. Continued rotation of the cam 115 causes the roller assemblies 139 to move to the solid line position shown in Fig. 1 of the drawings so that the record 17''' supported thereon drops onto the turntable 16 whereupon during the next cycle of operation the top surface of this record is played. It should be noted that, while the tone arm was in the position shown in Fig. 13, the tension control mechanism including the tension spring 190 provides increased tension on the tone arm tending to pull it in an inward direction to counteract the effect of the sound grooves tending to move the tone arm outwardly.

It will be apparent from the above description that there has been provided a new and improved automatic phonograph capable of playing both sides of disk records in succession if desired which is of a size no greater than that required for conventional center post drop automatic record changers now in extensive use. Furthermore, a very simple and foolproof mechanism is provided which permits any desired manual operation of the phonograph as well as automatic operation permitting rejection of any records, repeating of the records and playing of the records either on both sides or only on one side as desired. Automatic stop means are provided for stopping the phonograph when the last record in the record stack has been reproduced with the parts thereof in position so that free access to the turntable is provided.

Although a preferred embodiment of the present invention has been disclosed in complete detail so as to ensure a complete understanding of the present invention, it is contemplated that details of the disclosed structure are capable of modification and that other applications and features of the invention may occur to those skilled in the art. Hence, it is intended in the

appended claims to cover all such modifications and changes as fall within the true spirit and scope of the present invention.

What is desired to be secured by Letters Patent of the United States is:

1. In an automatic phonograph including a record changing mechanism, means for supporting a stack of unplayed records above said turntable in a record stack, a main rotatable cam, means for rotating said cam one revolution during each record changing cycle, means including a cam follower and auxiliary rotatable cam mounted on said cam capable of causing said cam follower to complete one cycle of movement thereof during each two revolutions of said main cam, and means including two reciprocating cams and means selectively to engage one or the other of said reciprocating cams with said auxiliary cam, each of said reciprocating cams being effective when so engaged for rendering said auxiliary cam effective to release one record from said record stack selectively either during every revolution of said main cam or for every two revolutions of said main cam.

2. In an automatic phonograph including a record changing mechanism, means for supporting a stack of unplayed records above said turntable in a record stack, a main rotatable cam, means for rotating said cam one revolution during each record changing cycle, an auxiliary rotatable cam mounted on said main cam, a cam follower for said auxiliary cam adapted to reciprocate in a single cycle of movement once during every two revolutions of said main cam, and means responsive to the reciprocal movement of said cam follower comprising a pair of reciprocally movable cams for releasing a record from said record stack, means for engaging one or the other of said reciprocally movable cams with said cam follower for selectively rendering one of said pair of cams effective to release a record from said record stack for every revolution of said main cam, or to release a record from said record stack for every two revolutions of said main cam.

3. In an automatic phonograph including a record changing mechanism, means for supporting a stack of unplayed records above said turntable in a record stack, a main rotatable cam, means for rotating said cam one revolution during each record changing cycle, an auxiliary rotatable cam mounted on said main cam, a cam follower for said auxiliary cam adapted to reciprocate in a single cycle of movement once during every two revolutions of said main cam, and means responsive to the reciprocal movement of said cam follower comprising a pair of reciprocally movable cams for releasing a record from said record stack, and means for engaging one or the other of said reciprocally movable cams with said cam follower for selectively rendering one of said pair of cams effective to release a record from said record stack, one of said reciprocally movable cams being constructed to operate the changing mechanism to release a record during every half cycle of movement thereof, while the other of said reciprocally movable cams is constructed to operate the changing mechanism to release one record during every cycle of movement thereof.

4. In a disk record player, means adapted to support a record for rotation in a horizontal plane, comprising a roller arranged to rotatably engage and support said record, means for rotating said roller to rotate a record supported thereon, a pickup unit adapted to cooperate with one face of a record while supported on said roller, means for raising and lowering said roller and for swinging said roller to and from a record supporting position comprising a vertical shaft connected to said roller, means for supporting said shaft, said supporting means including a sleeve surrounding said shaft in which said shaft can both rotate and slide, guide means restraining said shaft to vertical sliding motion except in a vertically extended position and additional guide means restraining said shaft to rotating motion in said vertically extended position, said guide means being arranged to permit vertical movement thereof only when swung out of said record supporting position and to permit pivotal movement thereof only when in its uppermost position, and a second rotatable sleeve surrounding said first-named sleeve and having means for causing such vertical and pivotal movement of said shaft.

5. In a disk record player, means adapted to support a record for rotation in a horizontal plane, comprising a roller disposed for rotation on a horizontal shaft and arranged to rotatably engage and support a disk record, means for rotating said roller on said shaft to rotate said record, a pickup unit adapted to cooperate with one face of a record supported on said roller, means for raising and lowering said horizontal shaft and for swinging said horizontal shaft to move said roller to and from a record supporting position comprising a vertical shaft supporting said horizontal shaft on the upper end thereof, means for supporting said vertical shaft, said supporting means including a sleeve surrounding said shaft in which said shaft can both rotate and slide, guide means restraining said shaft to vertical sliding motion except in a vertically extended position and additional guide means restraining said shaft to rotating motion in said vertically extended position, said guide means being arranged to permit vertical movement thereof only when pivoted so that said roller is out of said record supporting position and to permit pivotal movement thereof only when in its uppermost position, and a second rotatable sleeve surrounding said first-named sleeve and having means for causing such vertical and pivotal movement of said shaft.

6. In a disk record player, means adapted to support a record for rotation in a horizontal plane, comprising a plurality of rollers arranged to rotatably engage and support a record at spaced points thereon, a horizontal shaft for each of said rollers, means for rotating at least one of said rollers on its horizontal shaft to rotate a record supported thereon, a pickup unit adapted to cooperate with one face of a record while supported on said rollers, means for raising and lowering said rollers and for swinging said horizontal shafts and said rollers to and from record supporting positions comprising a vertical shaft connected to each horizontal shaft, means for supporting each of said vertical shafts, said supporting means including a sleeve surrounding said shaft in which said shaft can both rotate and slide, guide means restraining said shaft to vertical sliding motion except in a vertically extended position and additional guide means restraining said shaft to rotating motion in said vertically extended position, said guide means being arranged to permit vertical movement thereof only when swung to their non-record supporting positions and to permit pivotal movement thereof only when in their uppermost posi-

tions, a second rotatable sleeve surrounding said first-named sleeve and having means for each of said vertical shafts for causing such vertical and pivotal movements thereof, and means for causing simultaneous movement of each of said second rotatable sleeves.

7. In a disk record player, means adapted to support a record for rotation in a horizontal plane, comprising a plurality of rollers arranged to rotatably engage and support a record at spaced points thereon, a horizontal shaft for each of said rollers, means for rotating at least one of said rollers on its horizontal shaft to rotate a record supported thereon, a pickup unit adapted to cooperate with one face of a record while supported on said rollers, means for raising and lowering said rollers and for swinging said horizontal shaft and said rollers to and from record supporting positions comprising a vertical shaft connected to each horizontal shaft, means for supporting each of said vertical shafts, said supporting means including a sleeve surrounding said shaft in which said shaft can both rotate and slide, guide means restraining said shaft to vertical sliding motion except in a vertically extended position and additional guide means restraining said shaft to rotating motion in said vertically extended position, said guide means being arranged to permit vertical movement theerof only when swung to their non-record supporting positions and to permit pivotal movement thereof only when in their uppermost positions, a second rotatable sleeve surrounding said first-named sleeve and having means for each of said vertical shafts for causing such vertical and pivotal movements thereof, and means for causing simultaneous movement of each of said second rotatable sleeves comprising a sprocket on each of said second rotatable sleeves and a flexible driving member interconnecting said sprockets.

8. In a disk record player, means adapted to support a record for rotation in a horizontal plane, comprising a roller disposed for rotation on a horizontal shaft and arranged to rotatably engage and support a disk record, means for rotating said roller on said shaft to rotate said record, a pickup unit adapted to cooperate with one face of a record supported on said roller, means for raising and lowering said horizontal shaft and for swinging said horizontal shaft to move said roller to and from a record supporting position comprising a vertical shaft supporting said horizontal shaft at the upper end thereof, a pin extending laterally from the lower end of said vertical shaft, means comprising a stationary sleeve having an inverted L-shaped slot therein for receiving said pin to support said vertical shaft only for vertical movement thereof when said pin is in the vertical leg of said slot, and to support said vertical shaft only for pivotal movement when said pin is in the horizontal leg of said slot, and a rotatable sleeve disposed around said stationary sleeve having an opening one edge of which defines an inclined plane engageable with said pin to cause vertical movement of said vertical shaft in response to rotation of said rotatable sleeve at one end of said plane, and a notch in said rotatable sleeve for receiving said pin when said pin is in the horizontal leg of said slot to cause pivotal movement of said vertical shaft, and means for rotating said rotatable sleeve.

9. In a disk record player, means adapted to support a record for rotation in a horizontal plane, comprising a plurality of rollers arranged to rotatably engage and support a record, a horizontal shaft for each of said rollers, means for rotating at least one of said rollers on said shaft to rotate a record supported thereon, a pickup unit adapted to cooperate with one face of a record while supported on said rollers, means for raising and lowering said rollers and for swinging said horizontal shaft and said rollers to and from record supporting positions comprising a vertical shaft connected to each horizontal shaft, a pin extending laterally from the lower end of each vertical shaft, means for supporting each of said vertical shafts to permit vertical movement thereof only when swung to their non-record supporting positions and to permit pivotal movement thereof only when in their uppermost positions each comprising a stationary sleeve having an inverted L-shaped slot therein for receiving said pin to support said vertical shaft only for vertical movement thereof when said pin is in the vertical leg of said slot, and to support said vertical shaft only for pivotal movement when said pin is in the horizontal leg of said slot, a plurality of rotatable sleeves one disposed around each of said stationary sleeves and each having a cam surface thereon which is arranged to be engageable with its associated pin for moving said vertical shafts in a vertical and pivotal manner, means for rotating one of said rotatable sleeves, and means drivingly interconnecting all of said rotatable sleeves.

10. In a disk record player, means adapted to support a record for rotation in a horizontal plane, comprising a plurality of rollers arranged to rotatably engage and support a record, a horizontal shaft for each of said rollers, means for rotating at least one of said rollers on said shaft to rotate a record supported thereon, a pickup unit adapted to cooperate with one face of a record while supported on said rollers, means for raising and lowering said rollers and for swinging said horizontal shaft and said rollers to and from record supporting positions comprising a vertical shaft connected to each horizontal shaft, a pin extending laterally from the lower end of each vertical shaft, means for supporting each of said vertical shafts to permit vertical movement thereof only when swung to their non-record supporting positions and to permit pivotal movement thereof only when in their uppermost positions each comprising a stationary sleeve having an inverted L-shaped slot therein for receiving said pin to support said vertical shaft only for vertical movement thereof when said pin is in the vertical leg of said slot, and to support said vertical shaft only for pivotal movement when said pin is in the horizontal leg of said slot, a plurality of rotatable sleeves one disposed around each of said stationary sleeves and each having a cam surface thereon which is arranged to be engageable with its associated pin for moving said vertical shafts in a vertical and pivotal manner, means comprising a gear fastened to one of said rotatable sleeves for rotating the same, and means comprising a sprocket associated with each rotatable sleeve and flexible means interconnecting said sprockets for drivingly interconnecting all of said rotatable sleeves to ensure simultaneous movement of said plurality of rollers.

11. In a disk record player, means adapted to support a record for rotation in a horizontal plane, comprising a roller disposed for rotation on a horizontal shaft and arranged to rotatably

engage and support such record, means for rotating said roller on said shaft to rotate said record, a pickup unit adapted to cooperate with one face of said record while supported on said roller, means for raising and lowering said horizontal shaft and for swinging said horizontal shaft to move said roller to and from a record supporting position comprising a vertical shaft supporting said horizontal shaft on the upper end thereof, means for supporting said vertical shaft, said supporting means including a sleeve surrounding said shaft in which said shaft can both rotate and slide, guide means restraining said shaft to vertical sliding motion except in a vertically extended position and additional guide means restraining said shaft to rotating motion in said vertically extended position, said guide means being arranged to permit vertical movement thereof only when pivoted so that said roller is out of said record supporting position and to permit pivotal movement thereof only when in its uppermost position, a second rotatable sleeve surrounding said vertical shaft and having a pin-engaging cam surface thereon, said sleeve having a first gear fastened thereto adapted to cause rotation of said sleeve for causing such vertical and pivotal movement of said shaft, a segmental gear drivingly engaged with said first gear, and means for selectively causing pivotal movement of said segmental gear.

12. In an automatic phonograph of the type capable of playing both sides of disk records without reversal of the records but while the records are disposed in two different playing positions, comprising means for supporting a stack of unplayed records above said playing positions thereby providing a record stack, means comprising a cam follower for releasing a record from said record stack to move into one of said playing positions, a tone arm including stylus means for effectively engaging a record in either of said playing positions, a rotatable cam capable upon one revolution thereof of moving said tone arm free of a record in either of said playing positions to permit a record changing operation and for causing return of said tone arm for engagement with a record in one of said playing positions, and a pair of cams reciprocally movable so as to complete a cycle for every two revolutions of said rotatable cam and means for selectively engaging one of the other of said pair with said cam follower, one of said pair of cams being so constructed and arranged to cause the release of a record from said record stack for every revolution of said cam whereby only one face of the records is reproduced, the other of said pair of cams being so constructed and arranged to cause the release of a record from said record stack every time said rotatable cam completes two revolutions whereby both faces of the records are successively reproduced.

13. In an automatic phonograph of the type capable of playing both sides of disk records without reversal of the records but while the records are disposed in two different playing positions, comprising means for supporting a stack of unplayed records above said playing positions thereby providing a record stack, means comprising a cam follower in the form of a roller for releasing a record from said record stack to move into one of said playing positions, a tone arm including stylus means for effectively engaging a record in either of said playing positions, a rotatable cam capable upon one revolution thereof of moving said tone arm free of a record in either of said playing positions to permit a record changing operation and for causing return of said tone arm for engagement with a record in one of said playing positions, a pair of cams reciprocally movable so as to complete a cycle for every two revolutions of said rotatable cam and means for selectively engaging one or the other of said pair with said cam follower, the first of said pair of cams being so constructed and arranged to cause the release of a record from said record stack for every revolution of said cam whereby only one face of the records is reproduced, the second of said pair of cams being so constructed and arranged to cause the release of a record from said record stack every time said rotatable cam completes two revolutions whereby both faces of the records are successively reproduced, means rendered effective when said second cam is engageable with said cam follower for causing each record released from said record stack to be alternately disposed in two different playing positions, and means for rendering said last-mentional means ineffective when said first cam is engageable with said cam follower and for causing successive records released from said record stack to be disposed in only one playing position.

14. In an automatic phonograph of the type capable of playing both sides of disk records without reversal of the records but while the records are disposed in two different playing positions, comprising means for supporting a stack of unplayed records above said playing positions thereby providing a record stack, means comprising a cam follower in the form of a roller for releasing a record from said record stack to move into one of said playing positions, a tone arm including stylus means for effectively engaging a record in either of said playing positions, a rotatable cam capable upon one revolution thereof of moving said tone arm free of a record in either of said playing positions to permit a record changing operation and for causing return of said tone arm for engagement with a record in one of said playing positions, a pair of cams reciprocally movable so as to complete a cycle for every two revolutions of said rotatable cam and means for selectively engaging one or the other of said pair with said cam follower, the first of said pair of cams being so constructed and arranged to cause the release of a record from said record stack for every revolution of said cam whereby only one face of the records is reproduced, the second of said pair of cams being so constructed and arranged to cause the release of a record from said record stack every time said rotatable cam completes two revolutions whereby both faces of the records are successively reproduced, means comprising a pair of pivotally movable members rendered effective to move as a unit when said second cam is engageable with said cam follower for causing each record released from said record stack to be alternately disposed in two different playing positions, and means for rendering one of said pivotally movable members ineffective to move with said other member when said first cam is engageable with said cam follower whereby successive records released from said record stack are disposed in only one playing position.

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(References on following page)

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,832,665	Spaine	Nov. 17, 1931
1,979,195	Govare et al.	Oct. 30, 1934
1,980,527	Hewton	Nov. 13, 1934
2,295,092	Offen	Sept. 8, 1942
2,313,262	Pressley	Mar. 9, 1943
2,318,654	Wissner	May 11, 1943
2,378,676	Ambruster	June 19, 1945
2,486,898	Wennerbo et al.	Nov. 1, 1949
2,506,926	Johnson	May 9, 1950
2,515,283	Wissner	July 18, 1950
2,555,895	Lynch	June 5, 1951

FOREIGN PATENTS

Number	Country	Date
822,026	France	Dec. 18, 1937
541,156	Great Britain	Nov. 14, 1941
111,950	Sweden	Sept. 26, 1944