

Nov. 16, 1943.

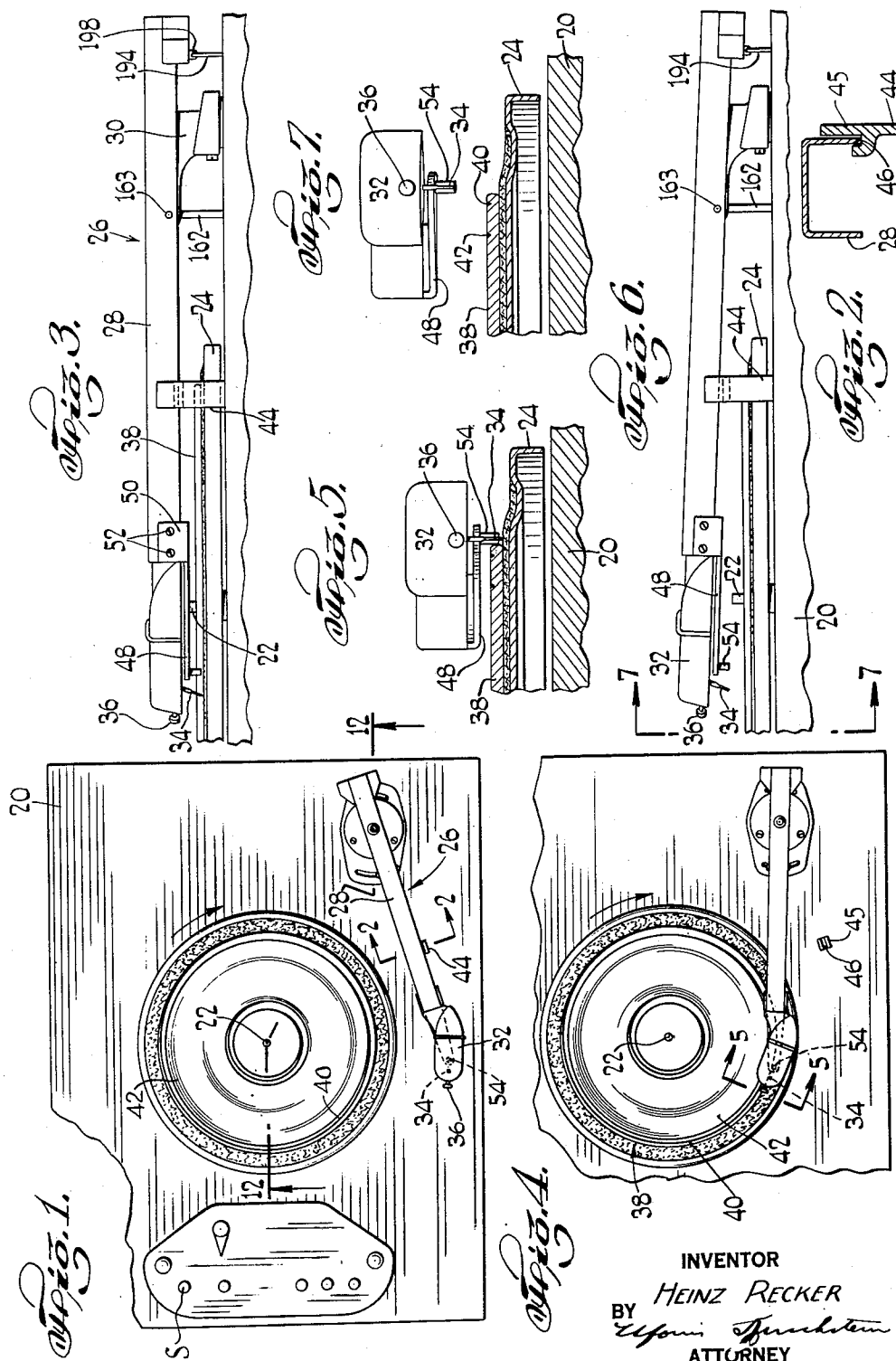
H. RECKER

2,334,649

PHONOGRAPH

Filed May 10, 1941

3 Sheets-Sheet 1



Nov. 16, 1943.

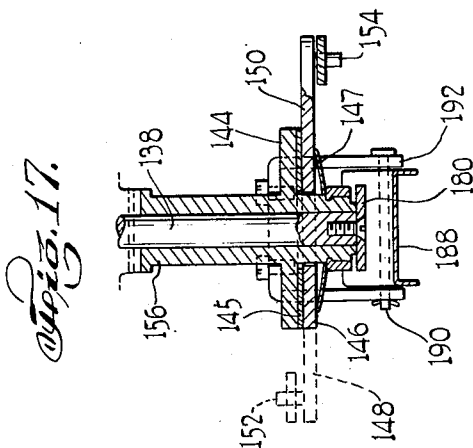
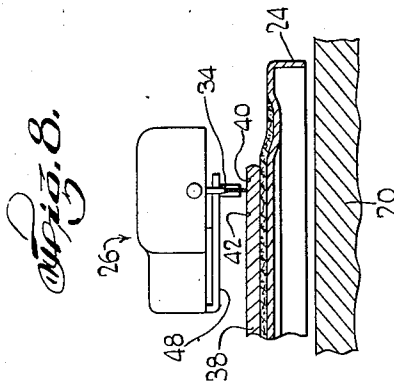
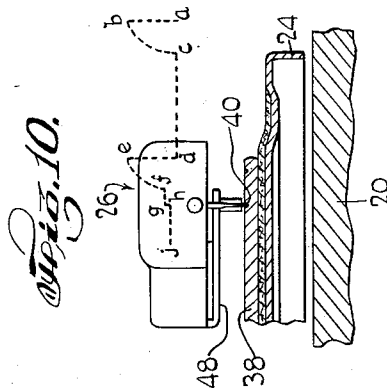
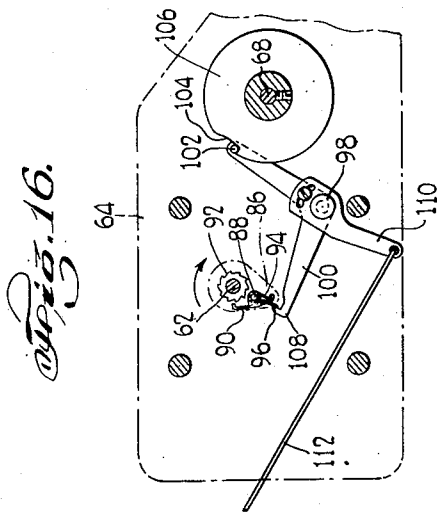
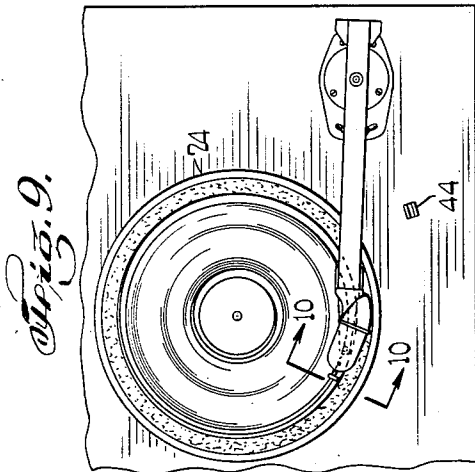
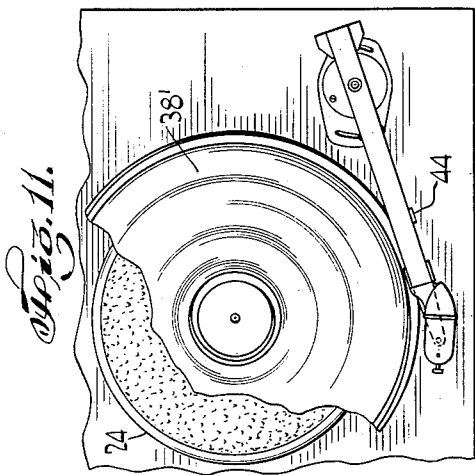
H. RECKER

2,334,649

PHONOGRAPH

Filed May 10, 1941

3 Sheets-Sheet 2



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ATTORNEY

Nov. 16, 1943.

H. RECKER

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PHONOGRAPH

Filed May 10, 1941

3 Sheets-Sheet 3

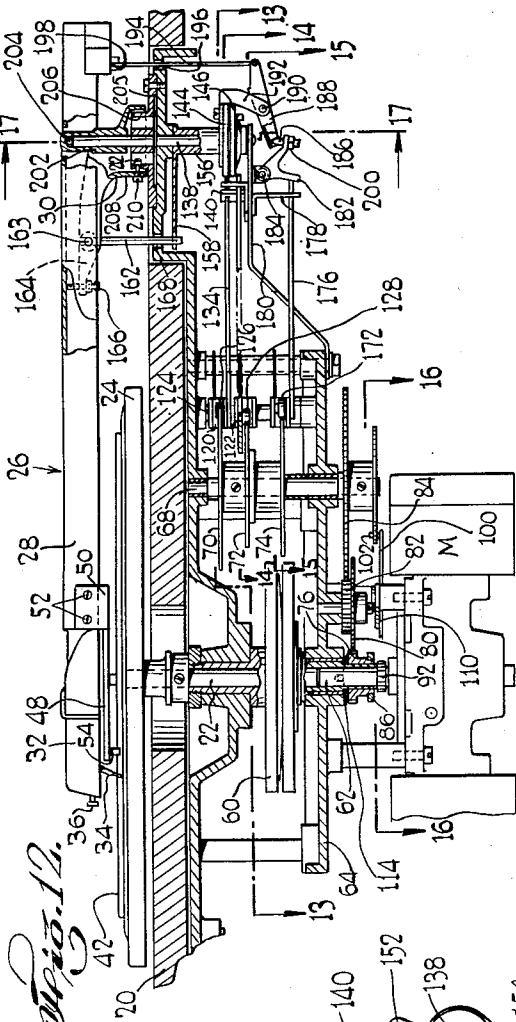


Fig. 12.

Fig. 14.

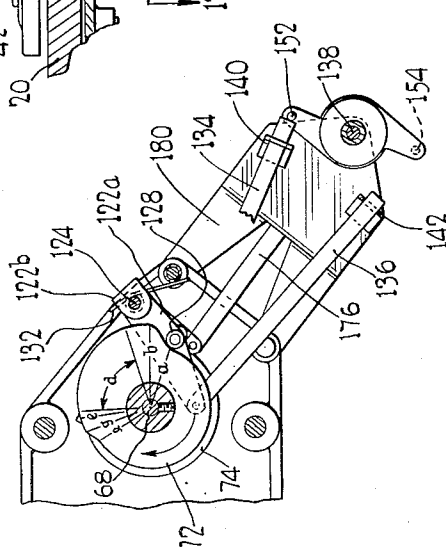


Fig. 13.

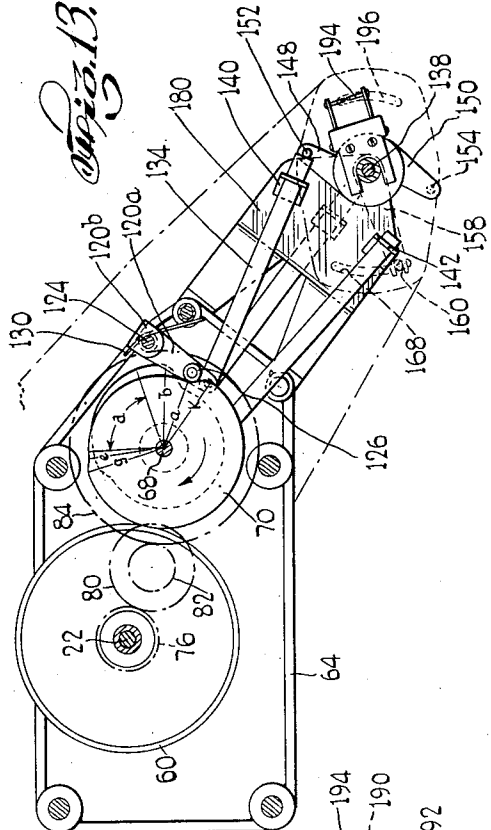


Fig. 15.

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UNITED STATES PATENT OFFICE

2,334,649

PHONOGRAPH

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Application May 10, 1941, Serial No. 392,825

20 Claims. (Cl. 274—1)

This invention relates to phonographs. More particularly my invention is directed to a novel method and means for positioning a phonograph tone arm.

The principal object of my invention is to provide a method and means of the character described which will automatically place the tone arm in such position that the phonograph needle is disposed in the starting groove of a record to be played, regardless of the size of the record.

Another object of my invention is to provide a method and means of the character described wherein the operation of placing a phonograph needle in the starting groove of a record is controlled by the size of the record to be played.

A further object of my invention is to provide a device which by coaction with the edge of a record to be played, during the movement of the tone arm from resting position towards the center of the record, causes the phonograph needle to automatically find the starting groove.

An additional object of my invention is to provide an automatic positioning device for holding the tone arm under positive control during the stage of its movement immediately preceding the disposition of the phonograph needle in the starting groove and for subsequently releasing the tone arm for limited free pivotal movement during the period of sound reproduction.

A supplementary object of my invention is to provide in connection with a method and device of the character described a rest for maintaining the tone arm in inoperative position during an idle period after a playing cycle has been completed and in which period the positioning means permits limited free pivotal movement of the tone arm.

A further supplementary object of my invention is to provide a method and device of the character described which at the start of each playing cycle will automatically free the tone arm from the rest.

Yet another object of my invention is to provide a tone arm positioning mechanism of the character described which shall comprise relatively few and simple parts, which shall be inexpensive to manufacture, rugged in structure, and efficient in operation to a high degree.

Other objects of this invention will in part be obvious and in part hereinafter pointed out.

Certain features of the apparatus herein shown or described but not claimed are shown, described and claimed in Patent No. 2,310,985, granted February 16, 1943.

The invention accordingly consists in the fea-

tures of construction, combinations of elements, and arrangement of parts which will be exemplified in the construction hereinafter described, and of which the scope of application will be indicated in the claims.

In the accompanying drawings, in which is shown one of the various possible embodiments of this invention

Fig. 1 is a top plan view of a phonograph having a tone arm positioning device embodying my invention, the tone arm being disposed in this view at its outermost position;

Fig. 2 is a cross-sectional view taken substantially along the line 2—2 of Fig. 1 and shows the rest employed to maintain the tone arm in fixed position when not in use;

Fig. 3 is an enlarged fragmentary side elevational view of the phonograph shown in Fig. 1;

Fig. 4 is a top plan view of the phonograph at a stage of the operative cycle wherein a portion of the positioning device is abutting against the edge of a phonograph record;

Fig. 5 is a sectional view taken substantially along the line 5—5 of Fig. 4;

Fig. 6 is a view similar to Fig. 3 but showing a subsequent stage of the operative cycle wherein the tone arm is raised;

Fig. 7 is a sectional view taken substantially along the line 7—7 of Fig. 6;

Fig. 8 is a view similar to Fig. 7 but showing the succeeding stage of the operative cycle wherein the tone arm is resting on the record;

Figs. 9 and 10 are views similar to Figs. 4 and 5, showing still a later stage of the operative cycle wherein the phonograph needle is disposed in the record starting groove;

Fig. 11 is a view similar to Fig. 1, showing the use of my device with a larger record;

Fig. 12 is a side elevational view in partial section taken substantially along the line 12—12 of Fig. 1 but with the tone arm disposed on the other side of the turntable shaft to facilitate illustration;

Figs. 13, 14 and 15 are sectional views taken substantially along the lines 13—13, 14—14, and 15—15 of Fig. 12 and explanatory respectively of the horizontal positioning cam, the check and restoring cam, and the vertical positioning cam;

Fig. 16 is a sectional view taken substantially along the line 16—16 of Fig. 12 and showing the one revolution clutch which drives the cams; and

Fig. 17 is a sectional view taken substantially along the line 17—17 of Fig. 12 and illustrating the friction slip drive.

Referring now to the drawings, and more par-

ticularly to Figs. 1 through 10, the phonograph comprises a housing 20 through whose top wall projects a rotatable shaft 22 to which is affixed the usual felt-covered turntable 24. The tone arm 26 includes a U-shaped channel member 28 swiveled at its rear end on a tone arm mount 30, and carrying at its forward end a sound reproducing head of any type known to the art, as for example a crystal pick-up head 32. A phonograph needle 34 is conventionally removably secured in a concealed needle holder by a manually manipulatable screw 36.

Disposed on the turntable 24 is a flat disc phonograph record 38 of standard manufacture having a large-pitch one-turn spiral starting groove 40 and a small-pitch multi-turn spiral reproducing groove 42.

The tone arm 26 is maintained in fixed position when idle by a rest 44 having a stopping finger 45 adjacent a slot 46 which is adapted to receive one leg of the channel member 28.

In accordance with my invention I provide means, preferably (but not necessarily) associated with and mounted on the tone arm 26, to gauge the size of record 38 positioned on the turntable 24. Such means may comprise a plate 48 having a pair of integral upwardly projecting flanges 50 which are permanently affixed as by rivets 52 to the channel member 28 behind the pick-up 32. Depending from the end of the plate 48, adjacent the phonograph needle 34, is a gauging finger or feeler 54. Said finger must be so disposed and actuated (in a manner soon to be described) that its path of travel crosses an edge of the record 38. The finger 54 is also positioned in predetermined relationship to the needle 34 at the time said finger strikes the phonograph record so that upon or shortly after contact between the finger and the record, the needle 34 may be caused to move through a predetermined path of travel which will deposit same in proper position upon the record.

In the embodiment of my invention herein disclosed said finger 54 is positioned immediately in back of the needle 34, its lower surface being spaced above the tip of the needle a distance somewhat greater than the depth to which the point of the needle enters the grooves in the record 38. The finger 54 is also disposed slightly closer to the shaft 22 than the needle so that when the tone arm is moved inwardly towards the said shaft while the needle and finger lie in the plane of the record 38, the finger will first strike the record and protect the needle 34 from impact thereagainst.

One method of moving the tone arm 26 with its associated feeler 54 and needle 34 will now be described. At the start of an operating cycle the channel member 28 is disposed in its extreme outward position with one leg thereof in the groove 46 of the rest 44. Upon actuation of the starting button S the phonograph shaft 22 begins to turn. At the same time the tone arm is rotated in a clockwise direction (viewed from Fig. 3) about the swivel mount 30 until the channel member 28 is raised above the groove 46. After the tone arm has come to the end of its upward angular movement it is caused to rotate in a clockwise direction (viewed from Fig. 4) to clear the rest 44 and move the needle 34 and finger 54 towards the record 38. Also, as the rest is cleared the tone arm is lowered to position the needle and feeler in the plane of the record. The tone arm then continues to rotate inwardly about

its mount 30 until the feeler 54 abuts against the record 38, as shown in Fig. 5.

In this position the needle 34 is disposed in predetermined relationship with respect to the starting groove 40. In the drawings the needle at such time lies below and outside the starting groove. Now the tone arm need merely be moved along a predetermined path to gently place the needle 34 in the region of the starting groove 40. Such movement may be started immediately upon abutment of the feeler 54 against the edge of the record 38 or may be caused to occur a short time thereafter, the time elapsing between the abutment and the start of the predetermined movement of the tone arm being a function of the size of the record; that is, the larger the record the longer will be the lapse of time between abutment and initiation of the tone arm movement along a predetermined path.

The tone arm is next rotated in a clockwise direction (viewed from Fig. 3) so that both the feeler 54 and needle 34 will move vertically upward to clear the edge of the record 38. At this time the various parts will have the relative positions shown in Figs. 6 and 7.

The tone arm 26 is then caused to rotate in a counterclockwise direction (viewed from Fig. 3) and a clockwise direction (viewed from Fig. 4) to thereby bring the needle 34 down to the surface of the record in the region of the starting groove 40 (see Fig. 8).

Finally, the tone arm is rotated in a clockwise direction (viewed from Fig. 4) towards the beginning of the reproducing groove 42. During this movement it will strike a portion of the starting groove 40 and drop thereinto. This final position of the elements is shown in Figs. 11 and 12. After this all control of the movement of the tone arm is removed and same is left free within limits to swivel about the mount 30 during the full period of reproduction of the record 38. If no starting groove is present in the record the tone arm will be moved beyond such region to a point slightly beyond the start of the sound track at a rate substantially the same as the rate the sound track spirals inwardly.

The dotted lines in Fig. 10 represent schematically the path of movement of the tone arm 26 from its starting point in the rest 44 to the end of sound reproduction.

In the period from *a* to *b* the phonograph tone arm 26 is raised vertically to clear the rest 44. From *b* to *c* the tone arm moves inwardly towards the shaft 22 and at the same time moves downwardly to position the feeler 54 in the plane of the record 38. From *c* to *d* the tone arm is moved towards the record until the finger 54 strikes the edge of the record, and at *d* the tone arm marks time while being constantly urged towards the shaft until the next set of operations are performed. From *d* to *e* the tone arm moves vertically upwardly to clear the finger 54 of the edge of the record. From *e* to *f* the arm moves simultaneously downwardly and inwardly until the point of the needle rests upon the top surface of the record 38 in the region of the starting groove 40. From *f* to *g* the tone arm is moved towards the shaft 22 until the needle 34 finds the groove 40, and finally from *g* to *h* the needle drops into the said starting groove. From *h* to *j* sound is reproduced.

In Fig. 11 I have shown a larger record 38' disposed upon the turntable 24. The operative cycle of the tone arm when employed with a record of this size will be generally similar to

that above described with reference to the record 38. The only variation in operation will be in the shortening of the distance cd and in a longer waiting period at d before the balance of the cycle from d to h is completed.

In Figs. 12 through 17 I have shown a preferred form of apparatus for causing the tone arm 26 to move through the operative cycle above described. The shaft 22 is driven through a clutch 60, more fully described in the said aforementioned patent for Sound picture projector, No. 2,310,985. This clutch is in turn actuated by a motor M driving through a shaft 62. Said shaft 62 and motor M are journaled in a skeleton supporting structure 64 suitably secured to the casing 20. Also journaled in the support 64 is a cam shaft 68 on which are mounted a plurality of cams 70, 72, 74 hereinafter referred to as the horizontal positioning cam, the check cam and the vertical positioning cam, respectively.

The cam shaft 68 is driven from the shaft 62 through a chain of reducing gears 76, 80, 82, 84, the last of which is mounted on the cam shaft.

I have found it desirable in order to avoid manual resetting of the various elements actuating the tone arm 26 and to provide a simple structure which permits the said tone arm 26 to swivel freely on its mount 30 during the reproducing period, to employ a one-revolution clutch to actuate the gear train 76—84, said clutch being so designed that the cam shaft 68 will, after operation of the phonograph is started, revolve once and then stop; whereupon the various cams are in position to start another cycle when desired. To this end I provide the following mechanism:

The gear 76 is mounted to revolve with respect to the shaft 62. Said gear carries an arm 86 (Figs. 12 and 16) on whose lower surface there is pivotally mounted at 88 a pawl 90, said pawl being urged by a spring 94 towards a ratchet 92 affixed to and rotating with the shaft 62. The rear end of the pawl 90 extends beyond the pivot point 88 and terminates in a release finger 96. Pivoted at 98 to the support 64 is a bell-crank lever 100 having on one end thereof an upwardly projecting pin 102 which is adapted to lie in the notch 104 of cam 106 or to be disposed in abutment with the periphery of said cam. The cam 106 is mounted for rotation with the cam shaft 68 and controls the operation of the one-revolution clutch. The other arm of the bell-crank lever 100 has its end formed into a finger 108 which, according to the positioning of the elements of the clutch, is either disposed in the circular path of travel of the release finger 96 about the shaft 62 or is clear of said path.

In order to oscillate the bell-crank lever 100 out of its normal position in which the clutch is inoperative I provide on said lever a third arm 110 rigidly attached to said bell-crank lever and actuable by means of a long rod 112 pivotally connected to the extreme end of the arm 110, said rod 112 being movable in turn upon depression of the starting button S. In order to cause the gear 76 to tend to rotate with the shaft there is provided a spiral spring 114, said spring being disposed between the gear 76 and the supporting structure 64 and pressing the said gear 76 against the upper surface of the ratchet 92.

Prior to the operation of the one-revolution clutch the parts are in the position indicated in Fig. 16 with the release end 96 of the pawl 90 pressed against the finger 108 with such force that the operative end of said pawl is clear of

the ratchet 92. At this time the gear 76 will be floating on the shaft 62 and rotation of said shaft will not cause a corresponding rotation of the cam shaft 68. When the starting button S is depressed it will raise the pin 102 out of the notch 104. At the same time finger 108 will move away from release end 96 of the pawl 90 permitting said pawl to engage one of the teeth of the ratchet 92. This will tie together the ratchet 92 and gear 76, causing them both to rotate in a clockwise direction (viewed from Fig. 16). Thereupon, the gear train 76—84 will be actuated and cause the cam shaft 68 to begin to rotate. After a short period of time the notch 104 will have moved away from the pin 102 and upon releasing the starting button S, which normally causes retraction of the rod 112 under the influence of a spring (not shown), the bell-crank lever 100 will not oscillate back to stopping position. However, when the arm 106 has completed one revolution the pin 102 will drop back into the said notch, causing the finger 108 to be placed in the path of the release end 96 of the pawl 90. When said end of the pawl then encounters the finger 108 the pawl will rotate about pivot point 88 and its operative end will become disengaged from the teeth of the ratchet 92, thus removing power from the gear 76 and stopping the cam shaft 68. The pawl will be maintained in this position by the torque of the gear 76 imparted by the spring 114. It should be noted that if, as shown, the ratio between the rates of rotation of the shafts 62 and 68 is substantially a whole number the finger 96 will be in position for immediate tripping at the end of one revolution of the cam 106.

The cams 70 and 72 are employed to control the movements of the tone arm 26 in horizontal position in accordance with a predetermined scheme of operation. The cam 70 (shown in Fig. 13) is in inoperative position at the beginning of a cycle. The portion of the cam 70 is employed to move the tone arm through a linkage system, hereafter to be described, from its starting position on the rest 44 to the position shown in Figs. 9 and 10, wherein the reproducing portion of the record has almost been reached. From a to b a dwell is provided to render the cam 70 inoperative while the tone arm is being lifted to clear the rest 44; and from b to d the cam moves the tone arm inwardly. From d to e a dwell holds the tone arm stationary while it clears the edge of the record, and from e to g the tone arm is moved a short distance further inwardly. From g to k there is provided a dwell or rest period which nullifies the cam 70 while the record is playing, and from k to a the linkage system associated with cam 70 is reset to prepare for another operative cycle.

On the cam 72 the portion b — g controls or checks the movement of the tone arm in conjunction with the portion b — g on the cam 70 from the point of said arm's travel after it is raised out of the rest until it has found the starting groove 40. From g to l the cam backs away rapidly to permit a limited free pivotal movement of the tone arm about its swivel mount 30 during sound reproduction. If desired the backing away portion g — l may be slightly advanced to f so as to remove checking control from the tone arm as soon as the needle touches the record. From l to a is a dwell during which cam 72 has no function, and from a to b , while the elevation positioning cam 74 is moving the tone arm out of its rest 44, the check cam 72 resets the position of

an element of a friction slip drive, hereinafter described, and presses the tone arm against the stop 45.

To transmit motion from the cams 70 and 72 to the tone arm 26 I provide the following apparatus:

Each of the cams 70 and 72 has associated therewith a cam-following lever 120 and 122, respectively. Said levers are in the form of a J with a long lower leg 120a and 122a, and a short upper leg 120b and 122b which are pivotally mounted on a cam lever shaft 124, said shaft being vertically held in the support 64. Each of the said levers 120, 122 is provided with roller pins 126 and 128 which are constantly maintained in engagement with the periphery of the cams 70 and 72, respectively, under the influence of springs 130 and 132. The free end of each of the longer legs 120a and 122a has pivotally attached thereto a flat bar 134 and 136. One of these bars 134 lies to one side of the tone arm shaft 138 and the other bar 136 to the other side thereof. In order to maintain the bars substantially in this position they are slidably received in apertures in a pair of angle brackets 140 and 142, one disposed on either side of the shaft 138.

Revolvably mounted at the lower end of the shaft 138 is a friction slip drive comprising a pair of plates 144 and 146 (Figs. 12 and 17) which are resiliently urged by a spring 147 towards each other and opposite sides of a rough-faced washer 145. The lower of these plates 146 has a pair of oppositely extending arms 148 and 150 at each end of which is mounted a roller pin 152 and 154, said pins being in alignment respectively with the axes of the flat bars 134 and 136.

It will thus be seen that when the cam shaft 68 rotates and turns the cams 70 and 72, the bars 134 and 136 will be reciprocated to oscillate the lower plate 146 in accordance with a predetermined scheme of operation.

The motion of the upper plate 144 is transmitted to the tone arm 26 by the following mechanism:

Integral with the upper plate 144 and journaled on the shaft 138 is a sleeve 156 which has at its upper end an integral arm 158 (Figs. 12 and 13). The end of the arm 158 is slotted at 160 to receive a vertically disposed rod 162 whose upper end is pivoted at 163 to an extension member 164 integral with the swivel mount 30. It is thus apparent that rotation of the upper plate 144 will cause a corresponding rotation of the tone arm 26 towards or away from the phonograph turntable shaft 22.

If desired, a screw 166 may be threadably received in the extension 164 to adjust the height of the tone arm 26 during the period c—d. To permit rotation of the pin 162 relative to the shaft 138 I provide a slot 168 in the top surface of the supporting structure 64 adjacent the swivel mount 30.

It will be seen that when the feeler finger 54 abuts against the edge of the record 38 the friction slip drive, comprising the plates 144 and 146, will cause the finger 54 to be pressed against the record 38 during the period d until said finger starts to be lifted clear of the record by the node e of cam 74.

During the period d, when the finger 54 is abutting against the edge of the record 38, the plate 146 will slip past the plate 144 and the plates must be restored to their initial relative angular relationship at the start of each cycle. To this end the restoring portion a—b on the cam 72 is

provided. It is desirable to have the tone arm 26 free within limits of the position controlling mechanism during its reproducing period and same is accomplished by means of a drop g—l in the cam 72 which causes the free end of the bar 136 to be moved away from the pin 154 during the playing period.

The following mechanism is provided to cause the tone arm 26 to be lifted out of the rest 44 and above the edge of the record 38 at the proper stages of its operative cycle.

The vertical positioning cam 74 has two operative nodes with peaks at b and e for causing the tone arm to be raised at the time it is lifted out of the rest 44 and at the time the feeler 54 clears the edge of the record 38, said nodes being positioned in proper synchronous relationship with respect to the portions a—b and d—e of the cams 70 and 72. Cooperating with the cam 74 is a linkage mechanism similar to that associated with the cams 70 and 72, said mechanism comprising a J-shaped lever 170 pivotally mounted on the lever shaft 124 and having a cam roller pin 172 constantly urged against the peripheral surface of the cam 74 by means of a spring 174 encircling the shaft 124. The long end of the lever 170 pivotally carries a flat bar 176 which is slidably supported at its end adjacent the shaft 138 in a slotted bracket 178 mounted on the plate 180 which depends from the lower end of the shaft 138. The free end of the bar 176 rests against one leg 182 of a bell-crank lever which is pivoted to the plate 180 at 184. The other end of the lever threadably carries a screw 186 having a pointed end which is disposed substantially concentrically with the shaft 138. This pointed end bears against a plate 188 which is pivoted on the shaft 190 carried between a pair of arms 192 mounted on and depending from the upper plate 144 of the friction slip drive. The end of the plate disposed on the opposite side of the pivot 190 from the screw 186 has pivotally connected thereto a link 194 which passes through a slot 196 in the top surface of the support 64 and is pivotally connected at 198 to the rear end of the tone arm 26.

It will thus be seen that when the peaks b or e of the cam 74 engage the pin 172 and cause the lever 170 to rotate about the shaft 124, this motion will be transmitted through the bar 176, bell-crank levers 182, 186, flat plate 188 and link 194 to the rear end of the tone arm 26 causing the same to pivot about the point 163 and to be raised at the desired stages of the operative cycle to either clear the rest or the edge of the record.

Any slack in this last linkage train may be taken up by adjustment of the screw 186 which is then locked in position by means of a lock nut 200.

When the tone arm 26 is in reproducing position the major portion of the weight of said arm is carried on the swivel mount 30 which has a cap portion 202 encircling the shaft 138, a ball 204 being disposed between the upper end of the shaft and the cap to reduce friction.

To aid in maintaining the swivel mount 30 in proper position with respect to the support 64, a plate 205 may be mounted on the top surface of the said support, said plate being provided with an annular ledge 206 concentric with the shaft 138. Telescoped over said annular ledge is an annular lip 208 depending from the swivel mount 30. A pin 210 extends inwardly from the lip 208 and rides in a groove 212 in the ledge 206 in order to provide inner and outer stops for the tone arm

26 and prevent abutment of either the rod 162 or link 194 against the ends of their associated slots 168 and 196.

It should be noted that the portion *e-g* on the cams 70 and 72 covers an arc of such size that in all cases the phonograph needle 34 after being disposed adjacent the edge of a record 38 will be moved by the cam 70 a sufficient distance to place the said needle in the region of the starting groove 40. In this manner it will be seen that I am able to position the phonograph needle in proper starting position on any record regardless of the diameter thereof.

It will thus be seen that there is provided a method and means in which the several objects of this invention are achieved, and which is well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiments above set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Since it is apparent from the foregoing description that my apparatus will work with equal facility on records which either do or do not have a steep-pitched initial groove, the expression "starting groove" in the appended claims is to be understood to connote the first spiral in a record.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. In a mechanism for automatically positioning a phonograph tone arm with the needle thereof in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured phonograph record supported on said turntable in a predetermined horizontal plane during the operation of the positioning mechanism, means having an operative element movable in said predetermined plane in a direction having a component radial to said spindle for gauging the size of said record while said record is lying in said plane, and means associated with said gauging means for disposing said tone arm with the needle thereof in the region of said starting groove.

2. In a mechanism for automatically positioning a phonograph tone arm with the needle thereof in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured phonograph record supported on said turntable in a predetermined horizontal plane during the operation of the positioning mechanism, means having an operative element movable in said predetermined plane in a direction having a component radial to said spindle for gauging the size of said record while said record is lying in said plane, and means controlled by said gauging means for disposing said tone arm with the needle thereof in the region of said starting groove.

3. In a mechanism for automatically positioning a phonograph tone arm with the needle thereof in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured phonograph record supported on said turntable in a predetermined horizontal plane during the operation of the positioning mechanism, means having an operative element movable in said predetermined plane in

a direction having a component radial to said spindle for gauging the size of said record while said record is lying in said plane, means for placing said tone arm with the needle thereof in predetermined position relative to said starting groove at the time of gauging, and means associated with said gauging means to move said tone arm along a predetermined path from its place when the needle was in said position until said needle is in the region of said starting groove.

4. In a mechanism for automatically positioning a needle in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured phonograph record supported on said turntable in a predetermined horizontal plane during the operation of the positioning mechanism, feeler means having an operative element movable in said predetermined horizontal plane for gauging the size of said record while said record is lying in said plane, means for moving said operative element relative to the edge of said record until the same is disposed in predetermined position relative to said edge, means whereby said needle is maintained in predetermined position relative to said operative element at the time of gauging, and means associated with said feeler means to move said needle along a predetermined path from its position at the time of gauging to a position where said needle is in the region of said starting groove.

5. In a mechanism for automatically positioning a needle in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured phonograph record supported on said turntable in a predetermined horizontal plane during the operation of the positioning mechanism, a tone arm, means to vary the vertical position of said tone arm, means to vary the horizontal position of said tone arm, means having an operative element movable in said predetermined plane in a direction having a component radial to said spindle to gauge the size of said record while said record is lying in said plane, means to actuate said positioning means to place said tone arm with the needle thereof in predetermined position relative to said starting groove, means associated with said gauging means to actuate said positioning means to move said arm from its first named position to a position wherein said needle is disposed in the region of said starting groove, and means to motivate said actuating means in properly timed relationship.

6. In a mechanism for automatically positioning a needle in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured phonograph record supported on said turntable in a predetermined horizontal plane during the operation of the positioning mechanism, means having an operative element movable in said predetermined horizontal plane to gauge the size of said record while said record is lying in said plane, and means to move said gauging means in a path which intersects the edge of said record.

7. In a mechanism for automatically positioning a needle in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured

phonograph record supported on said turntable in a predetermined horizontal plane during the operation of the positioning mechanism, means to gauge the size of said record while said record is lying in said plane, said means comprising a feeler having an operative element movable in said predetermined horizontal plane, and means to move said feeler in a path which intersects the edge of said record, said moving means including a friction slip drive mechanism.

8. In a mechanism for automatically positioning a phonograph tone arm with the needle thereof in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured phonograph record supported on said turntable in a predetermined horizontal plane during the operation of the positioning mechanism, a tone arm, a needle supported on said tone arm, and a feeler gauge supported on said tone arm, said feeler gauge being maintained in fixed spaced relationship relative to said needle, said feeler gauge including an operative element movable in said predetermined horizontal plane and in a direction having a component radial to said spindle while said record is lying in said plane.

9. In a mechanism for automatically positioning a phonograph tone arm with the needle thereof in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured phonograph record supported on said turntable in a predetermined horizontal plane during the operation of the positioning mechanism, a tone arm, a record side-edge feeler member associated with said tone arm and including an operative element movable in said predetermined horizontal plane, and means to move said feeler member towards said record while said record is lying in said plane, said means being so constructed and arranged that the path of movement of said feeler member intersects the edge of said record.

10. In a mechanism for automatically positioning a phonograph tone arm with the needle thereof in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured phonograph record supported on said turntable in a predetermined horizontal plane during the operation of the positioning mechanism, a tone arm, means, including an operative element movable in said predetermined horizontal plane, associated with said tone arm to gauge the size of said record while said record is lying in said plane, means to move said tone arm towards said record during gauging, a phonograph needle supported on said tone arm, said needle being disposed in predetermined relationship relative to the starting groove of said record at the time of gauging, and means to move said needle through a predetermined path, said means being actuable subsequent to said gauging.

11. In a mechanism for automatically positioning a phonograph tone arm with the needle thereof in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured phonograph record supported on said turntable in a predetermined horizontal plane during the operation of the positioning mechanism, a tone arm, a record side-

edge feeler member, including an operative element movable in said predetermined horizontal plane, associated with said tone arm for gauging the size of said record while said record is lying in said plane, a phonograph needle supported on said tone arm, means to cause said member to abut an edge of said record, said needle being disposed in predetermined relationship relative to the said member at the time of said abutment, and means to move said needle through a predetermined path from the position of said needle at the time of said abutment, said means being actuable subsequent to abutment of said member.

12. In a mechanism for automatically positioning a phonograph tone arm with the needle thereof in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured phonograph record supported on said turntable in a predetermined horizontal plane during the operation of the positioning mechanism, a tone arm, a feeler member carried by said tone arm, said member including an operative element movable in said predetermined horizontal plane, a needle supported on said tone arm in predetermined relationship to said feeler member, means to move said tone arm toward said record from a position wherein said operative element is spaced away from said record and until said operative element abuts against a side edge of said record, means to raise said tone arm for causing said operative element to clear said edge, and means to lower said tone arm and move same over said record.

13. In a mechanism for automatically positioning a phonograph tone arm with the needle thereof in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured phonograph record supported on said turntable in a predetermined horizontal plane during the operation of the positioning mechanism, a phonograph tone arm, and means to move said tone arm towards said record from a position away from said record, said means including a friction slip drive.

14. In a mechanism for automatically positioning a phonograph tone arm with the needle thereof in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured record supported on said turntable in a predetermined horizontal plane during operation of the positioning mechanism, means for gauging the size of said record, said gauging means comprising an abutment member having a portion disposed during gauging in the plane of said record, means to urge said abutment member toward a position in which it would engage the periphery of a phonograph record of the smallest diameter desired to be played, said tone arm being disposed in predetermined relationship to said abutment member while said abutment member is being urged towards said record, means to disengage said abutment member and said record, means to move said tone arm a predetermined distance toward the center of said record, the operation of said tone arm moving means, said abutment member disengaging means, and said abutment member urging means being so timed that said tone arm moving means and said abutment member dis-

engaging means will not operate until after said abutment member urging means has ceased operating.

15. A combination as set forth in claim 14 wherein the means for urging said abutment member into engagement with the periphery of said record includes a slip drive.

16. In a mechanism for automatically positioning a phonograph tone arm with the needle thereof in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured record supported on said turntable in a predetermined horizontal plane during operation of the positioning mechanism, means for gauging the size of said record, said gauging means comprising an abutment member having a portion disposed during gauging in the plane of said record, means to urge said abutment member toward a position in which it would engage the periphery of a phonograph record of the smallest diameter desired to be played, said tone arm being disposed in predetermined relationship to said abutment member while said abutment member is being urged towards said record, means to disengage said abutment member and said record, means to move said tone arm along a predetermined path from its position at the time of gauging to a position where said needle is in the region of said starting groove, the operation of said tone arm moving means, said abutment member disengaging means, and said abutment member urging means being so timed that said tone arm moving means and said abutment member disengaging means will not operate until after said abutment member urging means has ceased operating.

17. In a method for automatically positioning a phonograph tone arm with the needle thereof in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured record supported on said turntable in a predetermined horizontal plane during operation of the positioning mechanism, means for gauging the size of said record, said gauging means including an abutment member mounted on said tone arm, means to urge said tone arm to a position wherein said abutment member will engage the periphery of a record of

the smallest diameter desired to be played, means to disengage said abutment member and said record, and means to move said tone arm centrally of said record along a predetermined path until said needle is in the region of said starting groove, said tone arm moving means, the operation of said abutment member disengaging means, said tone arm moving means, and said tone arm urging means being so timed that said tone arm urging means will cease its operation before said tone arm moving means and said abutment member disengaging means begin their operation.

18. In a method for automatically positioning a phonograph tone arm with the needle thereof in the starting groove of an apertured phonograph record, regardless of the record's diameter, the combination of a turntable having a spindle for receiving an apertured record supported on said turntable in a predetermined horizontal plane during operation of the positioning mechanism, means for gauging the size of said record, said gauging means including an abutment member mounted on said tone arm, means to urge said tone arm to a position wherein said abutment member will engage the periphery of a record of the smallest diameter desired to be played, means to disengage said abutment member and said record, and means to move said tone arm centrally of said record along a predetermined path until said needle is in the region of said starting groove, the operation of said tone arm urging means and said tone arm moving means being so timed that said tone arm urging means will cease its operation before said tone arm moving means begins its operation.

19. A combination as set forth in claim 18 wherein the tone arm urging means includes a cam having a check cam associated therewith, wherein said tone arm urging means also includes a friction slip drive and wherein the tone arm moving means includes a cam having a check cam associated therewith.

20. A combination as set forth in claim 18 wherein the lower end of said abutment member is higher than the operative portion of said needle and wherein the means for disengaging said abutment member includes means for vertically raising said tone arm.

HEINZ RECKER.