

Oct. 30, 1945.

A. L. KNOX ET AL

2,387,916

PICKUP ARM CONTROL

Original Filed Dec. 31, 1940

2 Sheets-Sheet 1

FIG. 1

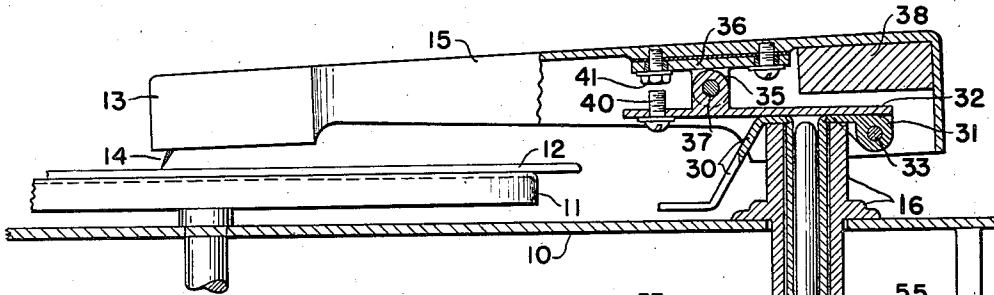


FIG. 3

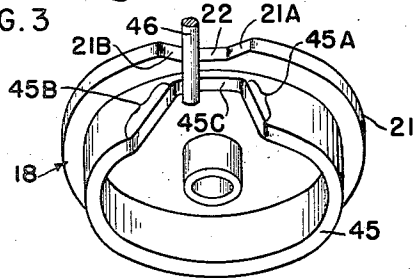
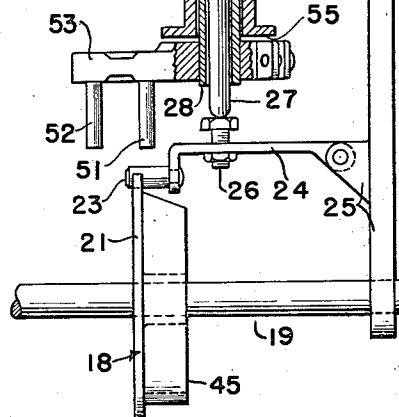


FIG. 5

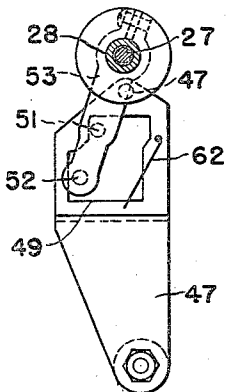


FIG. 4

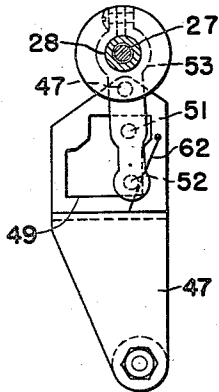
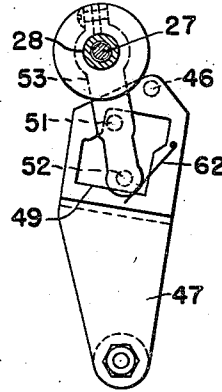


FIG. 6



INVENTORS

ARTHUR L. KNOX
FRITZ KAHL

BY

Charles E. Hartman
ATTORNEY

Oct. 30, 1945.

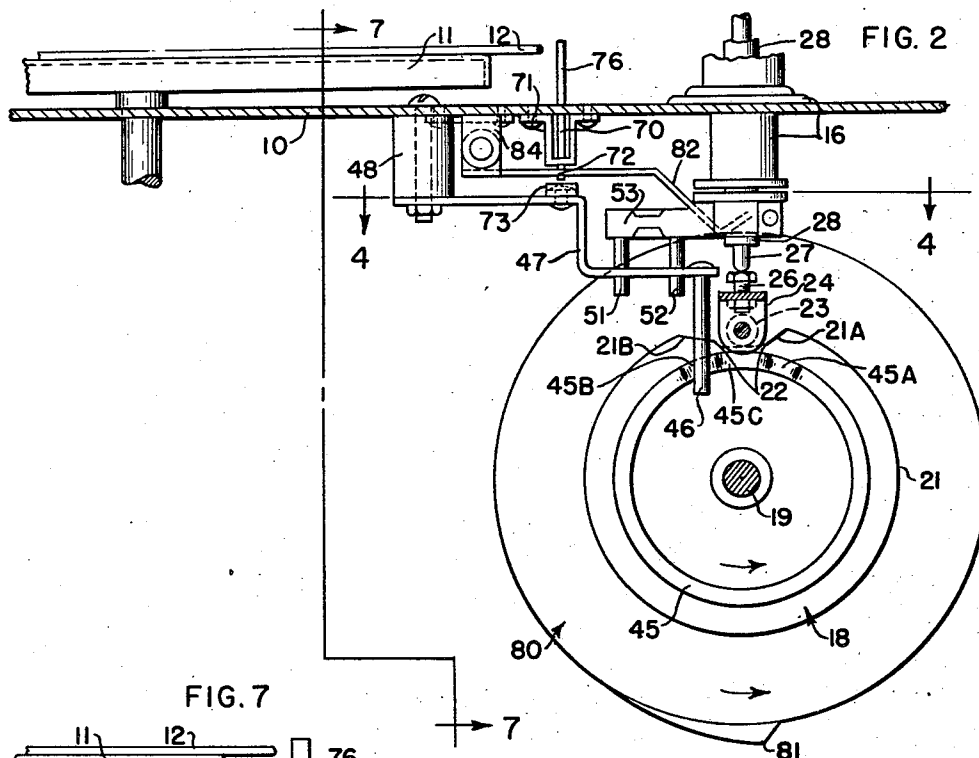
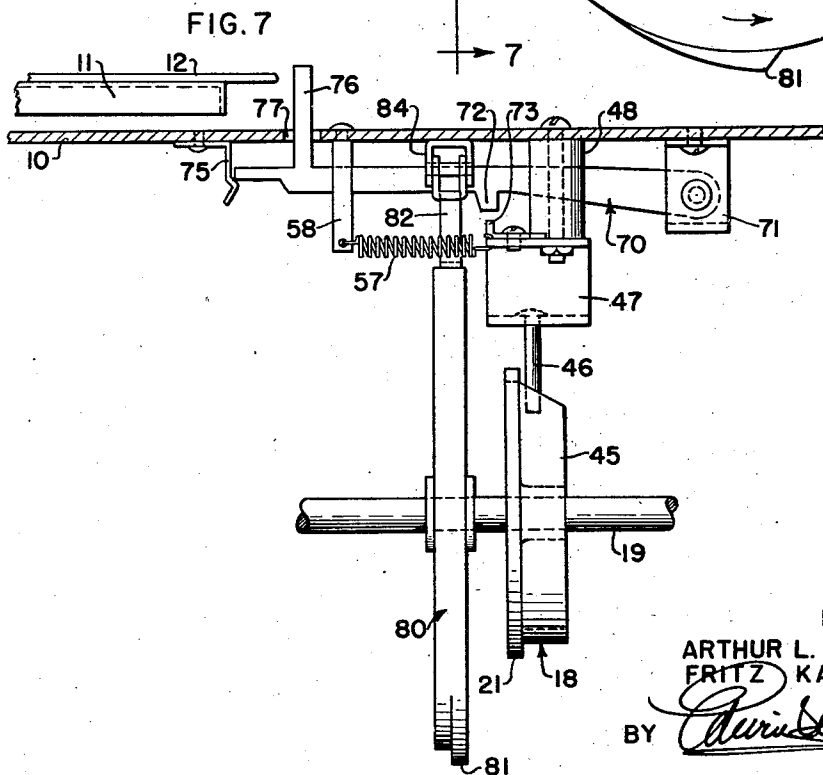
A. L. KNOX ET AL

2,387,916

PICKUP ARM CONTROL

Original Filed Dec. 31, 1940

2 Sheets-Sheet 2



INVENTORS
ARTHUR L. KNOX
FRITZ KAHL
BY *Arthur L. Knox*
ATTORNEY

UNITED STATES PATENT OFFICE

2,387,916

PICKUP ARM CONTROL

Arthur L. Knox and Fritz Kahl, Fort Wayne, Ind.,
assignors to Farnsworth Television and Radio
Corporation, a corporation of Delaware

Original application December 31, 1940, Serial No.
372,681. Divided and this application May 1,
1943, Serial No. 485,266

8 Claims. (Cl. 274—15)

This invention relates to an automatic phonograph and more particularly to new and useful improvements in pickup arm control mechanism. This application is a division of our copending application, Serial No. 372,681, filed December 31, 1940 now Patent No. 2,332,650, granted October 26, 1943.

An object of the present invention is to provide an improved mechanism for controlling the movement of the pickup arm used with record-changing apparatus.

In accordance with the present invention, there is provided for use in an automatic record-changing apparatus a turntable, a pickup arm for cooperating with a record on the turntable and a cam means for moving the pickup arm. A swinging means, which is associated with the pickup arm and the cam means, imparts to the pickup arm a relatively fast outward movement and a relatively slow inward movement.

In accordance with a further feature of the present invention, there is provided for use in an automatic record-changing apparatus a turntable, a pickup arm for cooperating with a record on the turntable, and a cam means for moving the pickup arm. A first means is associated with the cam means and the pickup arm for imparting a raising and lowering movement to the pickup arm. A second means is associated with the cam means and the pickup arm for imparting to the pickup arm an outward and an inward movement. A spring means is associated with the second means for moving a stylus of the pickup arm into the outer groove of a record on the turntable after the stylus of the pickup arm is brought into engagement with a record on the turntable.

For a better understanding of the invention, together with other and further objects thereof, reference is made to the following description taken in connection with the accompanying drawings, and its steps will be pointed out in the appended claims.

In the accompanying drawings:

Fig. 1 is a fragmentary side elevation view partly in section of the pickup arm support, and the mechanism for elevating the pickup arm;

Fig. 2 is a fragmentary side elevation view showing the mechanism for moving the pickup arm horizontally;

Fig. 3 is a perspective view of the pickup arm cam wheel, showing the contour of the cam surface for controlling the horizontal movement of the pickup arm;

Figs. 4, 5 and 6 are fragmentary views taken on line 4—4 of Fig. 2, showing various positions of the

members for controlling the horizontal movement of the pickup arm when the stylus of the pickup arm is at the beginning of a record, when the stylus moves into the trip groove at the end of a record and when the pickup arm has been moved to its outwardmost position; and

Fig. 7 is a fragmentary view taken on line 7—7 of Fig. 2 showing the mechanism for controlling the inward movement of the pickup arm to position the stylus over the initial playing groove of a twelve-inch record.

Referring now particularly to Fig. 1 of the drawings, the invention here illustrated shows a record-playing apparatus which includes a base plate 10. Disposed above the base plate 10 is a horizontally rotatable turntable 11 for supporting a record 12 to be played. The turntable 11 may be rotated by a mechanism shown and fully described in the above-mentioned application.

Means for playing the record 12 comprises a reproducer 13 with a stylus 14 (Fig. 1) which cooperates with the record on the turntable 11. The reproducer 13 is supported at the free end of a pickup arm 15, the other end of which is pivotally mounted on a pedestal 16 to permit the reproducer 13 and the pickup arm 15 to move in a horizontal and vertical plane.

When the stylus of the pickup arm 15 reaches the inner groove of a record, the pickup arm is elevated and then swung outwardly in a horizontal plane to a position where it will not interfere with a record-changing cycle.

The means for elevating the pickup arm includes a cam wheel 18 (Figs. 1 and 2) fixed to the shaft 19. The cam 18 and shaft 19 may be driven by a mechanism disclosed in our copending application. The cam wheel 18 has a cam surface 21 with a notched portion 22. A roller 23, which is fixed to one end of a lever 24, is adapted to engage the cam surface 21. The other end of the lever 24 is connected to a bracket 25 which is suspended from the base plate 10 (Fig. 1) so that the lever 24 may pivot in a vertical plane. An adjustable screw 26 is supported by the lever 24 intermediate its ends. The screw 26 supports a rod 27 which extends upwardly in a hollow shaft 28. The shaft 28 is rotatable within the pedestal 16 and is adapted to be moved vertically therein. The shaft 28 has an irregular-shaped plate 30 fixed to the top thereof. The plate 30 is adapted to move freely over the top of the pedestal 16. One end of the plate 30 is provided with a bearing 31 which pivotally supports a plate 32 by means of a pin 33. Intermediate the ends of the plate 32 there is pro-

vided a bearing 36 which pivotally supports a bracket 36 by means of a pin 37. The pickup arm 15 is affixed to the bracket 36 so as to pivot on the bearing pin 37 when the stylus of the reproducer 13 is in engagement with a record on the turntable. A suitable weight 38 is provided in the pivoted end of the pickup arm 15 as shown in Fig. 1 to maintain a predetermined stylus pressure on the record on the turntable. An adjustable screw 40 is provided on the left-hand end of the plate 32 (Fig. 2) to come into contact with a surface such as 41 just before the stylus is brought out of engagement with the record as the pickup arm is being elevated. When the cam wheel 18 begins to rotate to elevate the pickup arm out of engagement with a record on the turntable, the roller 23 is in the notch 22. The rotation of the cam wheel 18 moves portion 21A of the cam surface 21 under the roller 23. The raising of the roller 23 and therewith the lever 24 moves the adjustable screw 26 which raises the rod 27. The raising of the rod 27 moves upwardly the plate 32 which is fixed to the plate 30. When the lever 32 is moved by the upward movement of the pin 27, the plate 30 is moved upwardly and therewith the hollow shaft 28. As the lever 32 moves upwardly the adjustable screw 40 engages the surface 41 and the pickup arm 15 is elevated by pivotal movement about the axis of the pin 33 to lift the stylus out of engagement with the record.

In order to swing the pickup arm outwardly in a horizontal plane, the cam wheel 18 is provided with a cam surface 45, which is adapted to engage a pin 46. The pin 46 is affixed to one end of a plate 47 which is pivoted as at 48 to the base plate 10 (Fig. 2). The plate 47 is provided with an aperture 49 (Figs. 4-6) through which pins 51 and 52 extend. These pins 51 and 52 are affixed near one end of a lever 53, the other end of which is fixed to the shaft 28 to move therewith. The outward movement of the pickup arm begins when cam portion 45A (Fig. 3) of the cam surface 45 moves into engagement with the pin 46. This moves the plate 47 in a clockwise direction (Figs. 4-6). When the stylus of the pickup arm is in the tripping groove of a record on the turntable, the pins 51 and 52 are in the position shown in Fig. 5. The clockwise movement of the plate 47 (Fig. 5) engages the left side of the aperture 49 with the pin 51 to move the pin 51 and the lever 53 attached thereto in a counterclockwise direction (Fig. 5). It is to be noted that any movement of the lever 53 while the pickup arm is out of engagement with a record on the turntable is against friction created by the engagement of the lever 53 with the base of the pedestal 16 as at 55 (Fig. 1). The frictional engagement between the lever 53 and the pedestal 16 occurs when the shaft 28, to which the lever 53 is affixed, is raised, as has been previously described. The raising of the shaft 28 brings the upper surface of the annular end of the lever 53 into frictional engagement with the bottom surface of the pedestal 16. The clockwise movement of the plate 47 is against the biasing action of a spring 57 which has one end anchored to the plate 47 and the other end anchored to a pin 59 depending from the underside of the base plate 10 (Fig. 7). When the pins 51 and 52 and the plate 47 have reached the position shown in Fig. 6, the pickup arm 15 has been swung to its outwardmost position.

As the cam wheel 18 continues to rotate the cam portion 45B (Fig. 3) of the cam surface 45

moves into engagement with the pin 46. The tension of the spring 57, which is sufficient to overcome the frictional resistance of the lever 53 created by its engagement with the base of the pedestal 16 (Fig. 1) thereupon starts to swing the plate 47 in a counterclockwise direction (Fig. 6) causing the righthand side of the aperture 49 to engage the pin 52 (Fig. 6) and moves the pin 52 and therewith the arm 53 in a clockwise direction (Fig. 6). During this latter movement of the plate 47 and the arm 53, the pickup arm is swung inwardly. When the cam wheel 18 and the pin 46 are in the position shown in Fig. 3, where the pin 46 engages the flat portion 45C of the cam surface 45, the plate 47 is in the position shown in Fig. 4 and the pickup arm 15 is approximately over the outer groove of a record on the turntable.

It is to be noted that the inward movement of the pickup arm 15 is slower than its outward movement. This allows for the more accurate positioning of the pickup arm over the outer groove of a record on the turntable. The slower inward movement of the pickup arm is achieved by the shape of the cam 45 which includes the steep portion 45A which acts during the outward movement of the pickup arm and the gradual portion 45B which acts during the inward movement of the pickup arm. The speed of the inward and outward movement of the pickup arm is also due to the action of the plate 47 on the pins 51 and 52 at different times. When the pickup arm is being swung outwardly, the left side of the aperture 49 of the plate 47 (Fig. 5) acts on the pin 51. However, when the pickup arm is being swung inwardly, the right side of the aperture 49 of the plate 47 is acting on the pin 52 (Fig. 6). Since pin 52 is further from the axis of rotation of lever 53 than pin 51, it is obvious that pin 52 moves slower than pin 51 around the axis of rotation of the lever 53.

When the pickup arm 15 is in a position approximately over the outer groove of a record on the turntable the pins 51 and 52 and lever 53 are in the position shown in Fig. 4. Thereupon, the portion 21B of the cam surface 21 moves under the roller 23. As the cam wheel 18 continues to rotate, the notch 22 gradually comes into engagement with the roller 23 which allows the lever 24 and the rod 27 to lower the pickup arm and therewith the stylus into engagement with the outer groove of a record on the turntable. With the lowering of the pickup arm, the lever 53 is brought out of frictional engagement with the pedestal 16.

Due to the fact that the outer grooves of disc records are not at exactly the same distance from their outer edges, the stylus does not always drop exactly into the outer groove of a record. Means are provided for moving the stylus into the outer groove of a record when the record is not provided with a feed-in groove. This means includes a tension spring 62 which is provided on the plate 47 as shown in Figs. 4-6.

When the pickup arm 15 is swung inwardly by the movement of the plate 47 (Figs. 4 and 6) as previously described, the pin 52 engages and forces the spring 62 outwardly thereby creating a tension on this spring. The tension created is not sufficient to overcome the frictional resistance of the lever 53 created by its movement against the base of the pedestal 16, but it is sufficient to swing the lever 53 when it is free of the pedestal 16. When the pickup arm 15 is swung inwardly by the plate 47, and is lowered into

engagement with the record, as heretofore described, and the stylus has not engaged the outer groove of the record, the tension spring 62, which is exerting a force upon the pin 52 (Fig. 4), thereupon moves the lever 53 and therewith the pickup arm 15 inwardly sufficiently far to move the stylus of the reproducer into engagement with the outer groove of the record.

Means are provided for limiting the inward movement of the pickup arm 15 so that the stylus may be positioned over the outer margin of a twelve-inch record. This means includes a lever 70 which is pivotally supported by a bracket 71 depending from the underside of the base plate 10, (Figs. 2 and 7). Disposed intermediate the ends of the lever 70 is a depending ear 72 which is held out of the path of movement of a lug 73 provided on the plate 47, by means of a flat spring 75 depending from the base plate 10 and engaging the free end of the lever 70, as shown in Fig. 7. Near its free end, the lever 70 is provided with a finger 76 which extends upwardly through an aperture 77 provided in the base plate 10 (Fig. 7) and extends above the turntable 11 a suitable distance as indicated in Fig. 7. The location of the finger 76 in relation to the turntable, is such, as to lie in the path of a twelve-inch record, when said record is moved into playing position upon the turntable 11. The mechanism shown and fully described in our copending application may be used for moving a record into playing position upon the turntable 11.

When a ten-inch record is placed upon the turntable, the periphery of the ten-inch record will not engage the finger 76 to release the lever 70. Thus, the plate 47 will swing into its normal position to move the pickup arm over the outer groove of a ten-inch record, as previously described. When a twelve-inch record is placed into playing position upon the turntable, the periphery of the twelve-inch record engages the finger 76 (Figs. 2 and 7), and moves the finger 76 and therewith the lever 70 downwardly out of engagement with the spring catch 75. The lever 70 is released by the spring 75 after the plate 47 has moved the pickup arm 15 to its outermost position as heretofore described. When the plate 47 acts to swing the pickup arm 15 inwardly as previously described, the lug 73 engages the ear 72, which was released while the twelve-inch record was placed upon the turntable. The engagement of the lug 73 with the ear 72 takes place when the pickup arm 15 has been moved inwardly sufficiently far to position the stylus over the outer groove of the twelve-inch record. The engagement of the elements 72 and 73 takes place before the flat portion 45C of the cam surface 45 engages the pin 47. However, continued movement of the cam wheel 18 acts to lower the stylus 14 into engagement with the outer groove of the twelve-inch record.

When the twelve-inch record is played and the tripping mechanism, previously mentioned, is actuated, the shaft 19 and therewith the cam wheel 18 and a large cam wheel 30 affixed to the shaft 19 are rotated. As the cam wheel 30 continues to rotate, a cam 31 engages a pivoted lever 32 (Figs. 2 and 7) and lifts the lever 32 in a vertical plane. The lever 32 is pivotally supported by a bracket 34 depending from the bottom of the base plate 10 (Fig. 2), and is arranged to engage the lower edge of the lever 70 (Fig. 7). Thus, as the lever 32 is raised, it engages and lifts the lever 70 to its normal position in engagement with the spring 75, as shown in Fig. 7. When a new record

is moved into playing position upon the turntable (if it is a ten-inch record), the mechanism will remain in its normal position to play the ten-inch record. However, if the new record is a twelve-inch record, the mechanism will again be set automatically to position the pickup arm over the beginning of the twelve-inch record as heretofore described.

Mode of operation

The general mode of operation will now be described. In this mode of operation it will be assumed that the pickup arm 15 has been positioned to place the stylus 14 in the initial playing groove of a record on the turntable 11, as shown in Fig. 1. As the turntable 11 is rotated by a mechanism (not shown) and the record is played, the pickup arm 15 moves inwardly toward the center of the record, as the stylus 14 follows the playing groove of the record. As the pickup arm 15 moves inwardly, the lever 53 is likewise moved inwardly by means of the tubular shaft 28, from the position shown in Fig. 4, to the position shown in Fig. 5.

After the record on the turntable 11 is reproduced and the stylus 14 of the pickup arm 15 moves into the tripping groove of the record, a tripping mechanism (not shown) is initiated to start the rotation of the shaft 19. The rotation of the cam wheels 18 and 30 with the shaft 19 is so timed that the first operation which occurs after the shaft 19 begins to rotate, is to lift the stylus 14 of the pickup arm 15 out of engagement with the record on the turntable 11. This operation is brought about by the cam portion 21A of the cam surface 21 (Figs. 2 and 3) moving into engagement with the roller 23 on the lever 24 to raise the lever 24 and the adjustable screw 26 from the position shown in Fig. 2. This movement of the lever 24 raises the rod 27 vertically within the tubular shaft 28 (Fig. 1). As the rod 27 moves upwardly the upper end of the rod engages the plate 32 and pivots the plate 32 in a clockwise direction (Fig. 1) on the pivot pin 33. The plate 32 in moving in a clockwise direction, moves the screw 40 into engagement with the surface 41. Thereafter the continued upward movement of the pin 27 raises the pickup arm 15 and therewith the stylus 14 out of engagement with the record on the turntable 11.

After the pickup arm 15 is raised, the cam portion 45A of the cam wheel 18 (Figs. 2 and 3) engages the pin 46 and moves it, and therewith the plate 47 in a clockwise direction against the biasing action of the spring 57 from the position shown in Fig. 5. The clockwise movement of the plate 47 moves the left-hand side of the aperture 49, of the plate 47, into engagement with the pin 51 to move the pin 51 and therewith the lever 53 in a counterclockwise direction. The counterclockwise movement of the lever 53 also moves the tubular shaft 28 and the pickup arm 15 in a corresponding direction until the pickup arm 15 is in its outwardmost position. When the pickup arm 15 has been moved to its outwardmost position, the lever 53 and plate 47 are in the position shown in Fig. 6.

After a new record is placed upon the turntable 11, in the manner fully described in our copending application, the cam portion 45B (Fig. 3) engages the pin 46. As the cam wheel 18 continues to rotate, the tension of the spring 57 starts to swing the plate 47 in a counterclockwise direction from the position shown in Fig. 6. The

plate 47 in moving, moves the right-hand side of the aperture 49 (Fig. 6) into engagement with the pin 52, and moves the pin 52 and therewith the lever 53 in a clockwise direction. The clockwise movement of the lever 53 also moves the tubular shaft 22 and the pickup arm 15 in a corresponding direction. When the pin 46 reaches the end of the cam portion 48B of the cam wheel 18 (Fig. 3), the plate 47 and lever 53 are moved to the position shown in Fig. 4, and the pickup arm 15 is approximately over the outer groove of the record on the turntable 11.

Continued rotation of the cam wheel 18 moves the flat portion 31B of the cam wheel 18 (Fig. 2) into engagement with the roller 23. As the cam wheel 18 continues to rotate, the roller 23 and the lever 24 gradually lower the rod 27 and the pickup arm 15. When the notch 22 (Fig. 1) moves under the roller 23, the pickup arm 15 and therewith the stylus 16 are lowered into engagement with the record on the turntable 11. Immediately thereafter, the driving mechanism (not shown) for the shaft 13 is shut off and reproduction of the record takes place.

The next and following cycles of automatic operation of the mechanism are initiated by an automatic tripping mechanism (not shown) which is actuated each time the stylus 16 moves into a tripping groove of a record.

While there has been described what is at present considered the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. An automatic record-changer apparatus comprising a turntable, a pickup arm for cooperating with a record on said turntable, a movable cam means for moving said pickup arm, and a means operatively associated with said cam means and said pickup arm and movable by said cam means for imparting to said pickup arm a relatively fast outward movement and a relatively slow inward movement.

2. An automatic record-changer apparatus comprising a turntable, a pickup arm for cooperating with a record on said turntable, a movable cam means for moving said pickup arm, a first means associated with said cam means and said pickup arm for imparting to said pickup arm a raising and lowering movement, and a second means operatively associated with said cam means and said pickup arm and movable by said cam means for imparting to said pickup arm a relatively fast outward movement and a relatively slow inward movement.

3. An automatic record-changing apparatus comprising a turntable, a shaft, a pickup arm mounted to pivot on said shaft for cooperating with a record on said turntable, a movable cam means for moving said pickup arm, a swinging member connected to said shaft to rotate therewith having first and second members, said first member being a relatively long distance from said shaft, said second member being a relatively short distance from said shaft, and means operatively associated with said cam means and said first and second members for imparting to said pickup arm a relatively fast outward movement and a relatively slow inward movement.

4. An automatic record-changing apparatus comprising a turntable, a shaft, a pickup arm mounted to pivot on said shaft for cooperating with a record on said turntable, a movable cam means for moving said pickup arm, a first means associated with said pickup arm for imparting to said pickup arm a raising and lowering movement, a swinging member connected to said shaft to rotate therewith having first and second members, said first member being a relatively long distance from said shaft, and said second member being a relatively short distance from said shaft, and a second means operatively associated with said cam means and said first and second members for imparting to said pickup arm a relatively fast outward movement and a relatively slower inward movement.

5. An automatic record-changing apparatus comprising a turntable, a shaft, a pickup arm mounted to pivot on said shaft for cooperating with a record on said turntable, a movable cam means, a swinging member connected to said shaft to rotate therewith and having first and second members, said first member being a relatively long distance from said shaft, and said second member being a relatively short distance from said shaft, means operatively associated with said cam means and said first and second members for engaging said first and second members at different times, said means being adapted to impart a relatively fast movement to said pickup arm when said means is in engagement with said second member and a relatively slow movement to said pickup arm when said means is in engagement with said first member.

6. An automatic record-changing apparatus comprising a turntable, a pickup arm for cooperating with a record on said turntable, a movable cam means for moving said pickup arm, a first means associated with said cam means and said pickup arm for raising and lowering said pickup arm, a second means associated with said cam means and said pickup arm for moving said pickup arm outwardly and inwardly, and a spring means associated with said second means for moving a stylus of said pickup arm into the outer groove of a record on said turntable after the stylus of said pickup arm is brought into engagement with the record.

7. An automatic record-changing apparatus comprising a turntable, a pickup arm for cooperating with a record on said turntable, a movable cam means for moving said pickup arm, a first means operatively associated with said cam means for imparting to said pickup arm a raising and lowering movement, and a second means operatively associated with said cam means and said pickup arm and movable by said cam means for imparting to said pickup arm a relatively fast outward movement and relatively slow inward movement, and a spring means associated with said second means for moving the stylus of said pickup arm into the outer groove of a record on said turntable after the stylus of said pickup arm is brought into engagement with the record.

8. An automatic record-changing apparatus comprising a turntable, a shaft, a pickup arm mounted to pivot on said shaft for cooperating with a record on said turntable, a movable cam means, a first means operatively associated with said cam means for raising and lowering said pickup arm, a swinging member connected to said shaft to rotate therewith having first and second members, said first member being a relatively

long distance from said shaft and said second member being a relatively short distance from said shaft, a second means operatively associated with said cam means and at different times with said first and second members for imparting to said pickup arm a relatively fast outward movement and a relatively slow inward movement, and a spring means associated with said second means

and adapted to engage said first member for moving the stylus of said pickup arm into the outer groove of a record on said turntable after the stylus of said pickup arm is brought into engagement with the record.

ARTHUR L. KNOX.
FRITZ KAHL.