United States Patent

Rabinow

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[54] **ELECTRICAL LOWERING AND LIFTING MECHANISM FOR PHONOGRAPH TONE ARMS**

[72] Inventor: **Jacob Rabinow,** Bethesda, Md.

[73] Assignee: **Max L. Libman,** Reston, Va. ; a part interest

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[52] **U.S. Cl.** .....**274/23 A**

[51] **Int. Cl.** **G11b 3/10**

[58] **Field of Search** .....274/23 R, 23.1, 13–15

[56] **References Cited**

UNITED STATES PATENTS

2,915,315 1/1959 Rabinow .....274/23 A

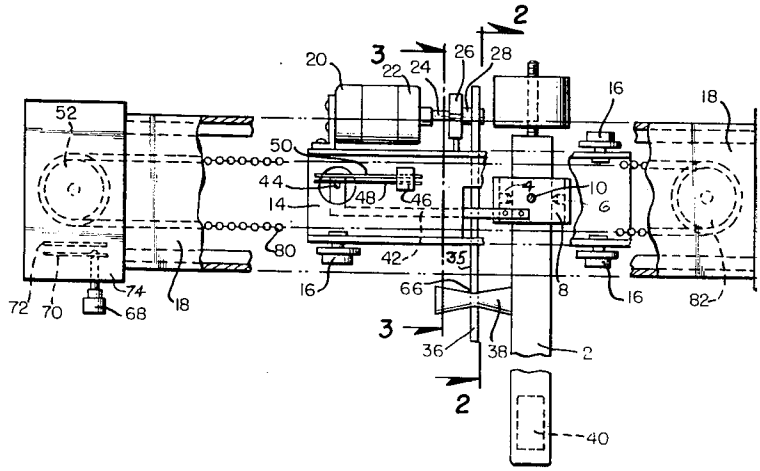
Primary Examiner—Harry N. Haroian

Attorney—Max L. Libman

[57] **ABSTRACT**

A unidirectional electric motor is used to lift and lower a phonograph arm by means of an eccentric or a cam mounted on a suitable gear train. The eccentric can stop in one of two positions corresponding to the upper and lower positions of the arm. This stopping is controlled by a switch controlled by the same shaft on which the eccentric is mounted. The switch that opens the circuit of the motor can be over-ridden either by the automatic trip switch of the arm or by a manual push-button. Thus, the initiation of the arm lift cycle can be achieved either automatically or manually while the lowering cycle can be initiated manually.

7 Claims, 5 Drawing Figures



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SHEET 1 OF 2

FIG. 1.

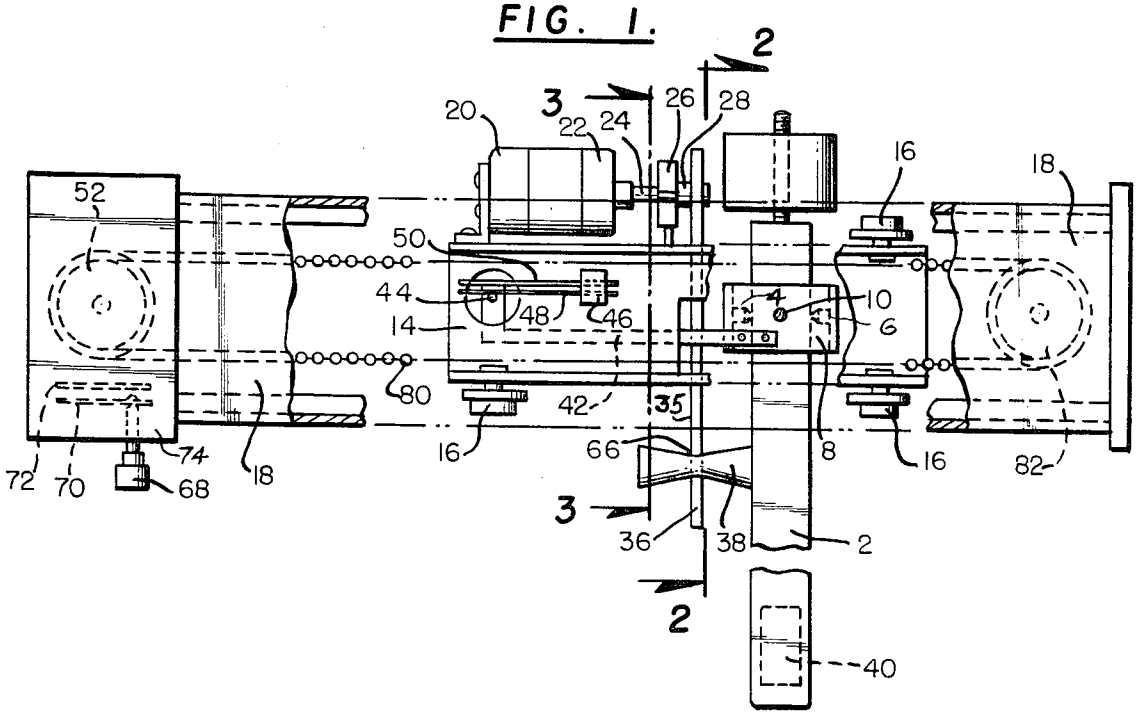
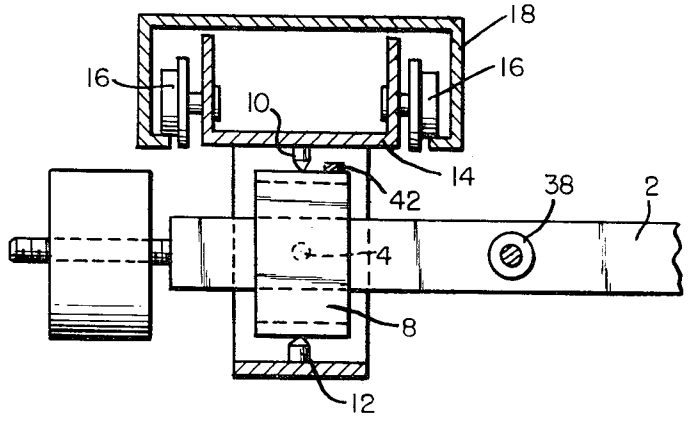


FIG. 2.



INVENTOR

Jacob Rabinow

BY Max L. Libman

ATTORNEY

FIG. 3.

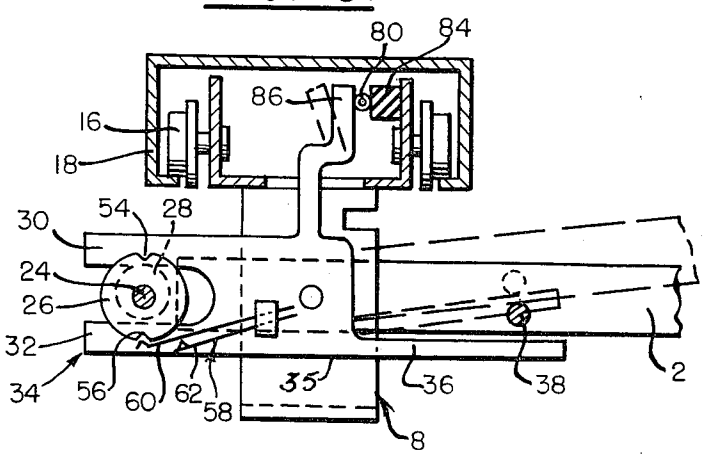
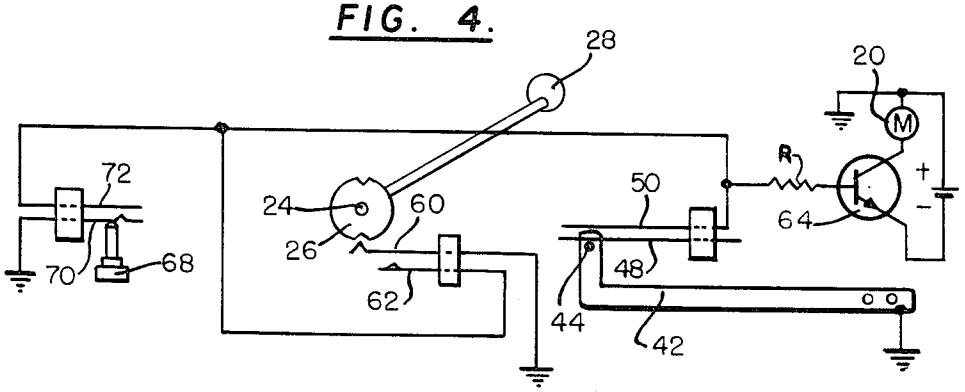


FIG. 4.



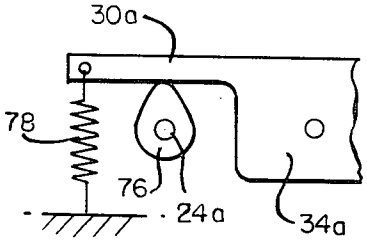


FIG. 5.

INVENTOR

Jacob Rabinow

BY Max L. Libman

ATTORNEY

ELECTRICAL LOWERING AND LIFTING MECHANISM FOR PHONOGRAPH TONE ARMS

DESCRIPTION OF THE INVENTION

While the following description is particularly useful with servo-driven phonograph arms such as described in my U.S. Pat. No. 2,915,315, it is suitable also for other types of arms as well. Automatic arm lifting and lowering mechanisms are, of course, old and are used universally in record players. Most of such devices are totally mechanical and occasionally use a dash pot to control the up or down motion of the arm so as to provide a gentle lowering or gentle lifting. Because of the fact that my servo-driven arms (based on the above patent) which are manufactured today have electrical servo mechanisms, it appears most useful to provide an electrical lift and lowering mechanism so that its actuation can be controlled by suitable electrical switches. The main object of the invention is to provide a simple and reliable arm lifting and lowering mechanism, which is operated by a unidirectional motor, and which is particularly suited for being started and stopped by means of an electrical switch action. The switch action can be initiated either by automatic means at the end of the record playing cycle, or at any time by means of a manual switch or pushbutton.

The specific nature of the invention, as well as other objects and advantages thereof, will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings, in which:

FIG. 1 shows a partial cutaway schematic view of a commercially available servo arm covered by the patent cited above, provided with the lifter of the present invention;

FIG. 2 shows a section view taken along line 2—2 of FIG. 1 showing the arm gimbals in which the arm is mounted and a sectional view of the carriage and track on which the whole system rides;

FIG. 3 shows a partial view of the lifting mechanism showing the eccentric driven by a motor shaft and the yoke which lifts and lowers the arm, taken along line 3—3 of FIG. 1;

FIG. 4 shows the electric circuit for lifting and lowering the arm, showing how the various switches are connected in the circuit; and

FIG. 5 shows a variation of the lifting and lowering mechanism.

In FIG. 1 the straight arm 2 is held by two cone pivots 4 and 6 in a square gimbal 8. This gimbal is pivoted at points 10 and 12 (See also FIG. 2.) to the carriage 14. This carriage is provided with four wheels 16 which ride in the track 18. For clarity, only three wheels 16 are shown in FIG. 1. Mounted on the carriage 14 is a motor 20 and a suitable gear train 22. On the output shaft 24 of the gear train 22 there is mounted flange 26 to which is fixed an eccentric 28.

In FIG. 3 I show the eccentric 28 located between the two tines 30 and 32 of a fork member 34. The forward end 36 of this member 34 acts to lift the arm 2 by acting under the pin 38 mounted on the arm 2 (See also FIG. 1.). It should be understood that a phono pickup cartridge 40, shown by dotted lines, is mounted in arm 2 and is used to play a phonograph record (not shown). The gimbal 8 pivots horizontally with arm 2 and has rigidly connected to it an L-shaped member 42 which extends to the left of the gimbal (FIG. 1). This member 42 carries a vertical pin or contact member 44. In practice this contact is made of gold alloy wire.

Mounted in the carriage 14 on a suitable insulating block 46 are two thin wire contacts 48 and 50. The forward wire 48 is used to control the servo motor 52 for moving the carriage 14. This motor is shown by dotted lines in FIG. 1 since it forms no part of the present invention. In passing, it should be said that when the arm 2 deviates from its correct 90° angle with the track 18, the gold wire 44 contacts the first contact wire 48 and serves to actuate the servo motor 52 so as to make the angle return to approximately 90°. This action is explained in U.S. Pat. No. 2,915,315 and is not part of the present invention.

Mounted immediately behind contact wire 48 is a second contact wire 50 which is important to this invention because it is the trip contact used to lift the arm 2 from the record at the end of play. This is accomplished as follows: As long as the servo system operates fast enough to move the carriage 14 to the left (as seen in FIG. 1), keeping the arm angle at 90°, the second wire 50 is not contacted by the vertical contact 44. If, however, the carriage reaches the run-out groove of the record, the servo is no longer capable of following the groove (because the servo system is limited in speed) and the arm 2 continues to move to the left rather rapidly, reducing the angle to much less than 90° between itself and the track 18. When this happens, the vertical contact 44 touches the wire 50 starting the cycle that will lift the arm 2.

Referring now to FIG. 3, I show the detail of flange 26 and the two notches 54 and 56 in it which operate the switch 58 consisting of the two contacts 60 and 62. The contacts 44, 48, and 50, carried by the carriage 14 in FIG. 1 and the contacts 60 and 62 of FIG. 3 are also shown in FIG. 4.

The motor 20 normally rests in such a position that the flange 26 is as shown in FIG. 3. The flange is seen with the switch contacts 60 and 62 open. The eccentric 28 is now at the upper dead center so that the fork member 34 is rotated to the maximum clockwise position. Thus, the extension 36 is below the pin 38 and the arm 2 is resting on the record. When the record reaches the run-off groove, as explained above, contacts 44 and 50 in FIGS. 1 and 4 engage. This sends current into the transistor 64 through the limiting resistor R and the transistor 64 amplifies this current and sends current through the motor 20. This motor starts rotating, and the tines 30 and 32 of the fork 34 begin to move downward. At the same time the flange 26 actuates the switch contacts 60 and 62 and closes them. Thus, even though the arm 2 now returns to its 90° position when it is lifted from the record, because of the camming action of the pin 38 (See FIG. 1), the motor 20 continues to run since contacts 44 and 50 are by-passed by contacts 60 and 62, actuated by the flange 26.

The motor 20 continues to run until the second notch 54 meshes with the switch 58, whereupon this switch opens. The current through the resistor R is interrupted (See FIG. 4) and the motor 20 stops. In this position the fork 34 is as shown by dotted lines in FIG. 3, with the arm 2 up.

As stated earlier, to make sure the arm 2 when in the raised position does not actuate the contacts 44 and 50, the lifting pin 38 attached to the arm 2 has a deep notch or reduced portion 66 cut into it. This notch 66 engages and meshes with the member 36 in such a way that the arm is held at an angle slightly larger than 90° so that neither contact wire 48 or 50 (in FIG. 1) contacts the pin 44 when the arm 2 is in the upper position.

In order to lower the arm 2 to start playing a record, manual pushbutton 68 with switch contacts 70 and 72 is provided, preferably mounted on the supporting structure 74 to which the track 18 is attached. When it is desired to lower the arm 2, pushbutton 68 is depressed, closing contacts 70 and 72 (See FIGS. 1 and 4). This sends current again through transistor 64, as before, the motor 20 starts and, again, the flange 26 closes switch 60 and 62. Thus, even if the manual button 68 is released, the motor 20 will continue to run, lowering the arm 2 onto the playing surface of the record and again stopping in the position shown in FIG. 3.

If it is desired to lift the arm 2 at this moment because it may not be where the user wants to start playing the record, the manual pushbutton 68 is again pressed. This again starts the cycle and the motor output shaft 24 and flange 26 continue to rotate for another 180°, lifting the arm 2 and again shutting itself off in the upper position.

Thus, the arm can be lowered or raised at will by merely pushing the button 68. If the button is held down, the motor 20 will continue to run, lowering and raising the arm continuously. This is normally not a desirable operation, but it is stated just to explain the action.

In normal use, the up motion would normally be initiated by the automatic contacts **44** and **50** at the end of the record, while the lowering would be actuated by the pushbutton **68** at the beginning of play.

It should be recognized that the motor **20** can be of any type, either D.C. motor operated by a battery, or an A.C. "-clock" type, or any other. Because the motor is required to run in only one direction, I believe I have achieved a very simple mechanism.

Instead of the eccentric **28**, a cam **76** shown in FIG. **5** may be employed, with the member **30***a* pressed against the cam **70** by spring **78**. The action would be identical to that explained above except that the up- and-down motion can be modified as desired, for example it can be made to have a very gentle lowering and a more rapid lifting. In other words, a cam can be designed for a wider variety of velocity-time curves than those produced by simple eccentrics. Still other linkages can also be used in place of the simple fork and eccentric shown, but this is well understood in the art.

The details of the carriage-moving servo mechanism are not shown because they are not part of the present invention, but the arm as preferably constructed uses a beaded chain **80** driven by servo motor **52** shown in dotted lines in FIG. **1**. The beaded chain **80** goes through the carriage **14**, around a pulley **82** shown by dotted lines in FIG. **1**. When the phonograph arm **2** is in the downward position (shown by solid lines in FIG. **3**), the beaded cable **80** is clamped to a rubber block **84**, by the vertical extension **86** of the fork member **34**. When the arm **2** is in the upper position, this extension **86** is shown by dotted lines to the left of the cable **80** and the cable is disengaged from rubber block **84**, thus permitting the carriage **14** to move left and right freely as desired by the operator.

The electrical circuit which drives the carriage **14** may be similar to that which is used to operate the motor **20** for lowering and raising the arm **2**, but is not shown because it forms no part of the present invention.

It will be understood that the invention is not limited to the exact embodiment shown and that various modifications can be made in construction and arrangement within the scope of the invention.

I claim:

1. a. In combination with a phonograph tone arm mounted on a carriage and having drive means for translatory movement of the carriage to transport the tone arm across a record disc being played and including sensing means controlling said drive means to maintain said tone arm tangent to the record groove as the record is played,

b. a tone arm lifting lever mounted on said carriage and normally disengaged from said tone arm,

c. electric motor means mounted on said carriage to move said lever into engagement with said tone arm to lift same off the disc record being played,

d. first switch means responsive only to an abnormally large and rapid lateral excursion of the tone arm, such as caused by the run-off groove of a record being played, to initiate actuation of said electric motor means,

e. holding switch means in parallel with said first switch means and normally open in the record playing position of the tone arm,

f. holding switch actuating means driven by said drive means concurrently with said lifting lever to close said holding switch means once said lifting lever has started to lift the tone arm, to continue actuation of said drive means after its initiation by said first switch means, said last actuating means including further means for opening said holding means when the tone arm is in the fully raised position.

2. The invention according to claim **1**, and tone arm positioning means actuated by said lifting lever to restore the tone arm from its large lateral excursion back into its normal record playing orientation.

3. The invention according to claim **1**,

h. said lifting means being effective on further rotation of the electric motor means in the same direction to lower said tone arm into record playing position,

i. manual switch means in parallel with said first and said holding switch means to initiate said further rotation of the electric drive means,

j. further holding switch actuating means driven by said drive means, once said lifting means has started to drive said lever to lower the tone arm, to continue actuation of said drive means until the tone arm is in fully lowered position again, in which position the tone arm lifting lever is disengaged and the holding switch means is again open.

4. The invention according to claim **1**, said lifting means being driven by said motor means through a shaft, said holding switch actuating means being on said same shaft.

5. The invention according to claim **1**, said lifting lever being pivoted intermediate its ends, one end of said lever being bifurcated so as to terminate in two tines, the lifting means being an eccentric lying between said tines so that as the eccentric rotates, the other end of the lever is alternately raised and lowered.

6. The invention according to claim **5**, said tone arm having a projection lying in the path of said other end of the lever and positioned to be disengaged therefrom in the lower position of the lever but engaged therewith in the raised position of the lever to raise the tone arm from the disc playing surface.

7. The invention according to claim **6**, said projection having a notched cam surface therein, said lever engaging said notched surface so as to align the tone arm laterally from its position of large lateral excurions back into normal lateral playing alignment.

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