United States Patent [19]

Tourtellot

[11] **3,762,723**

[45] **Oct. 2, 1973**

[54] **AUTOMATIC RECORD CHANGER**

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[73] Assignee: **RCA Corporation,** New York, N.Y.

[22] Filed: **May 11, 1970**

[21] Appl. No.: **36,224**

[52] **U.S. Cl.** ..... **274/10 R**

[51] **Int. Cl.** **G11b 17/12,** G11b 17/16

[58] **Field of Search** ..... 274/10 R

[56] **References Cited**

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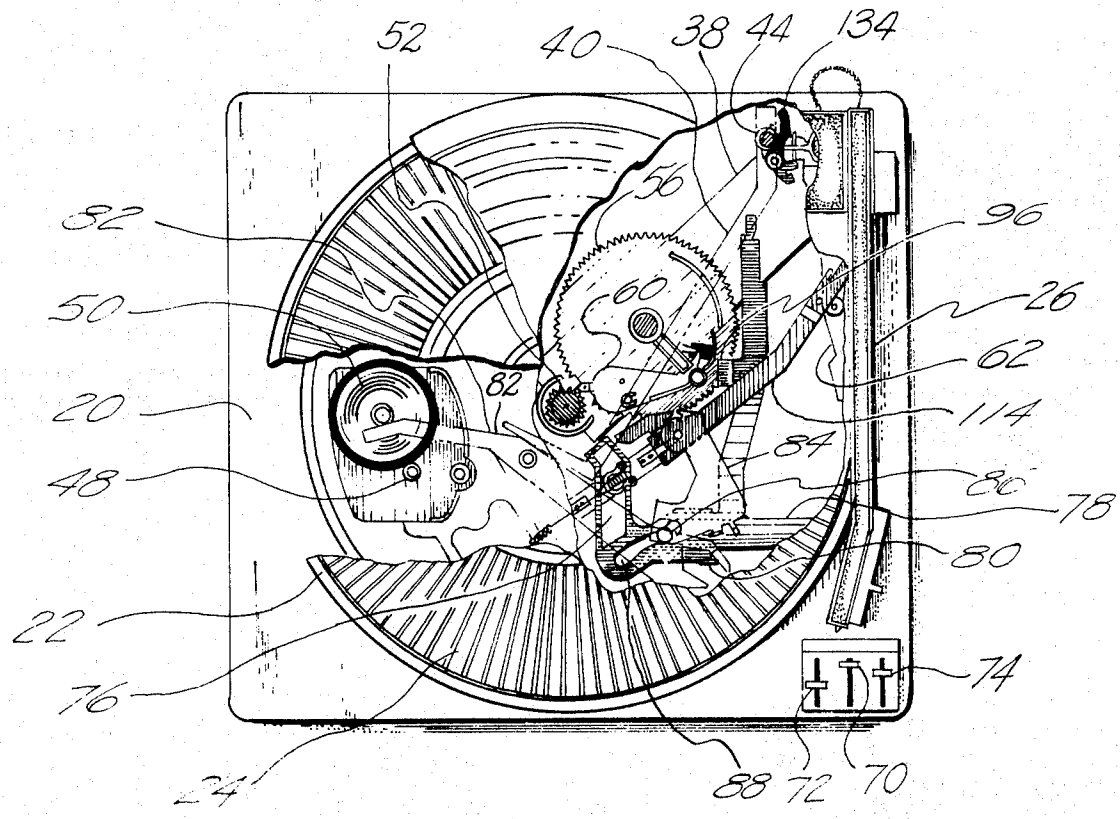
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Assistant Examiner—Steven L. Stephan
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[57] **ABSTRACT**

A simplified phonograph record changer mechanism is provided wherein after the last record has been played, a shut-off stud on the cycling gear contacts a shut-off lever. This imparts a movement to the shut-off lever and causes it to coact with other parts of the changer mechanism effective to move the changer motor power switch to its OFF position. The shut-off lever is positioned to interfere with the shut-off stud's path of travel only after the last record has been played which is determined by the position of the stabilizer arm stab shaft. At all other times, the shut-off lever is positioned so that the shut-off stud will not contact the lever.

3 Claims, 7 Drawing Figures



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SHEET 1 OF 5

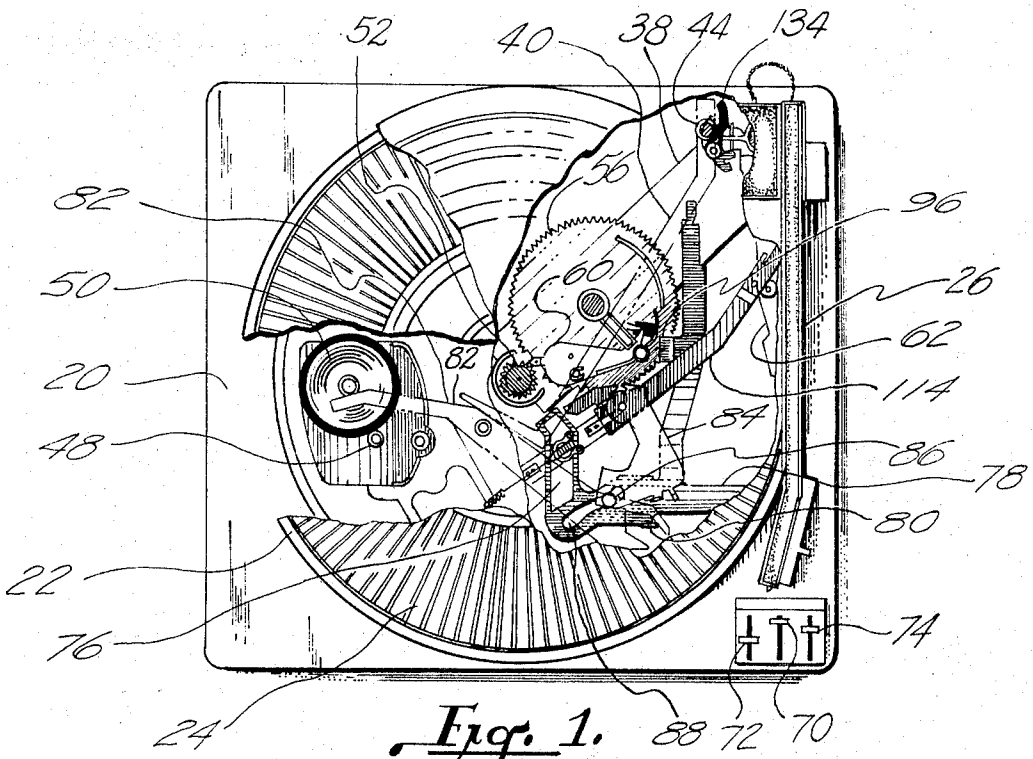


Fig. 1.

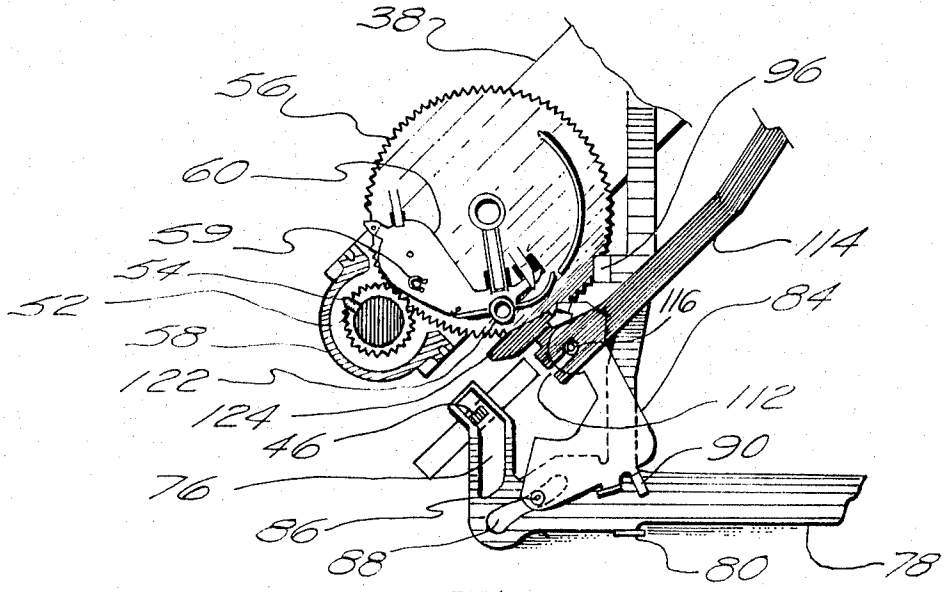


Fig. 2.

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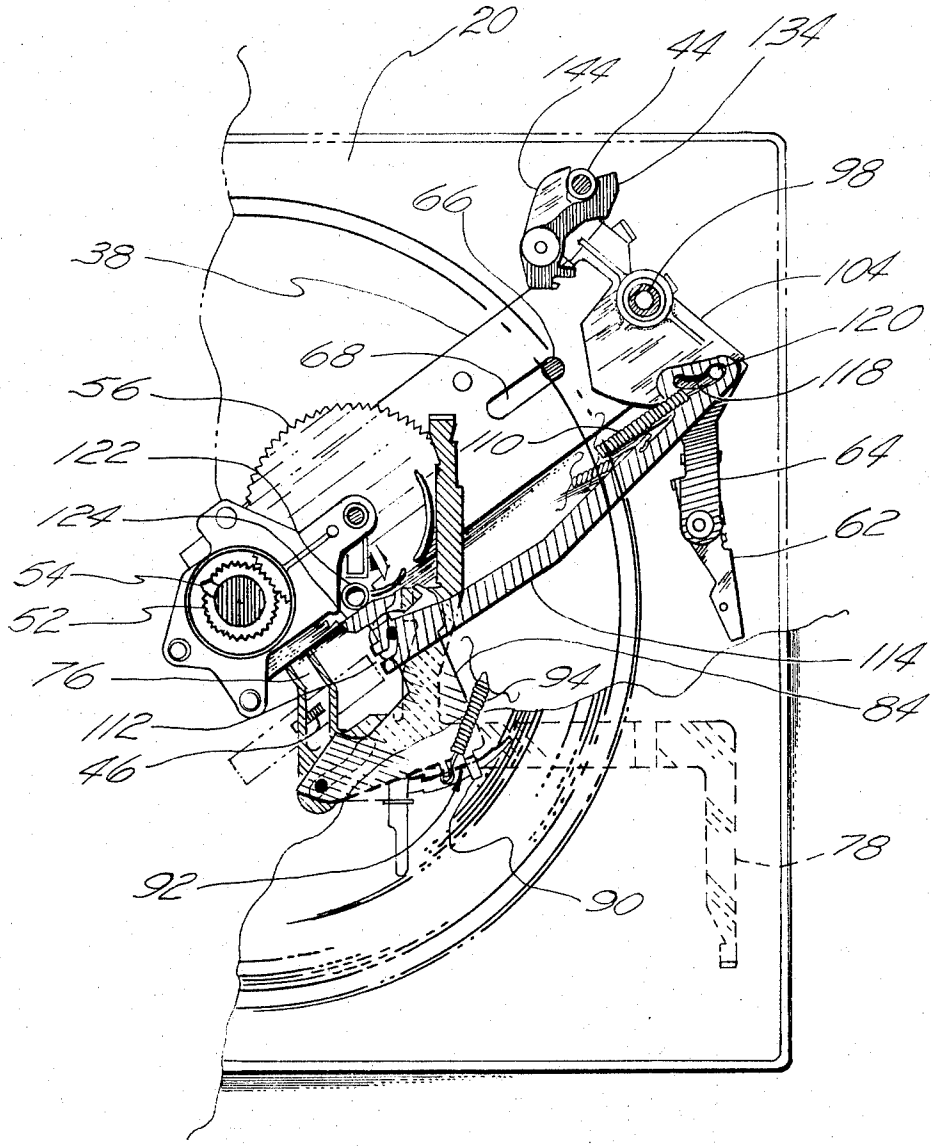


Fig. 3.

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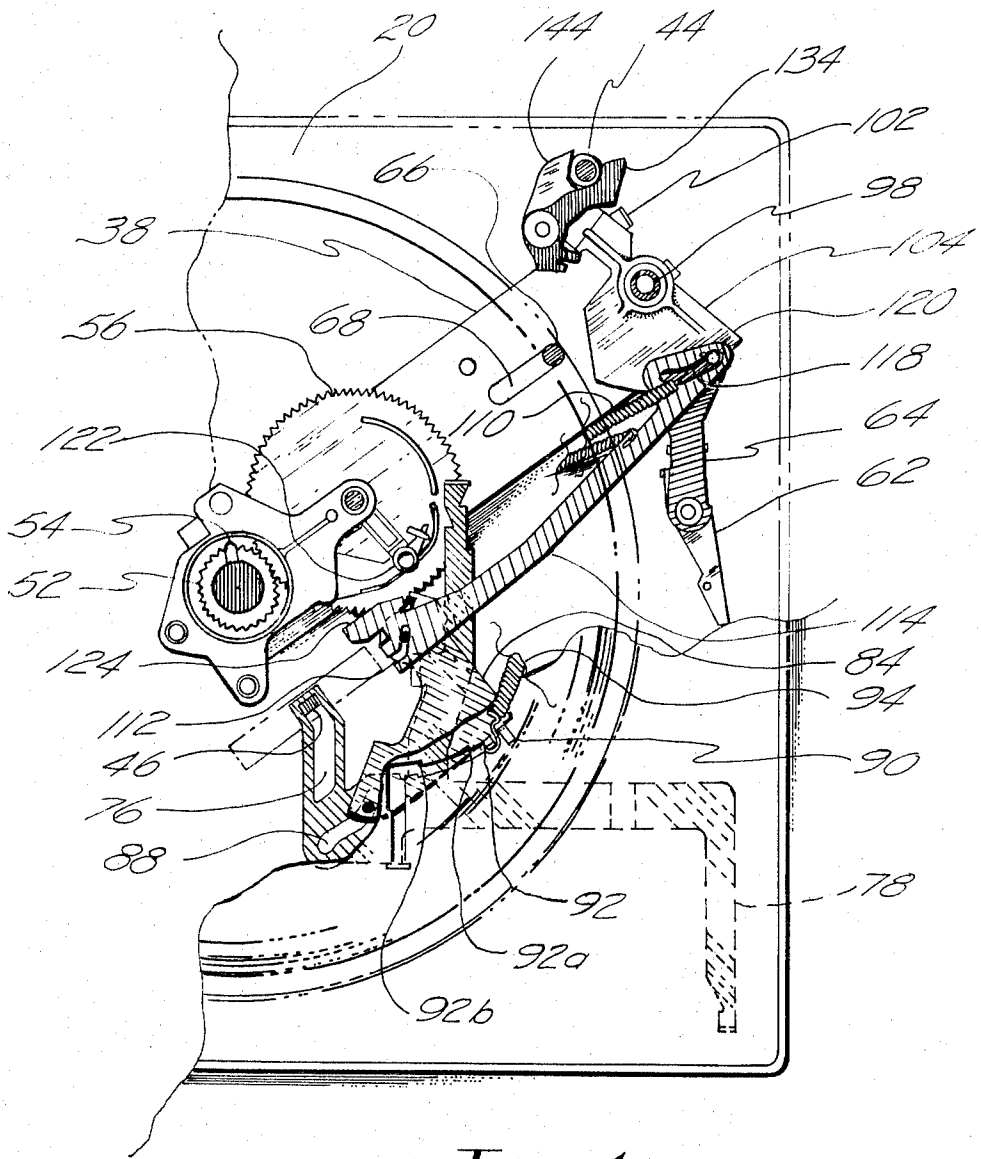


Fig. 4.

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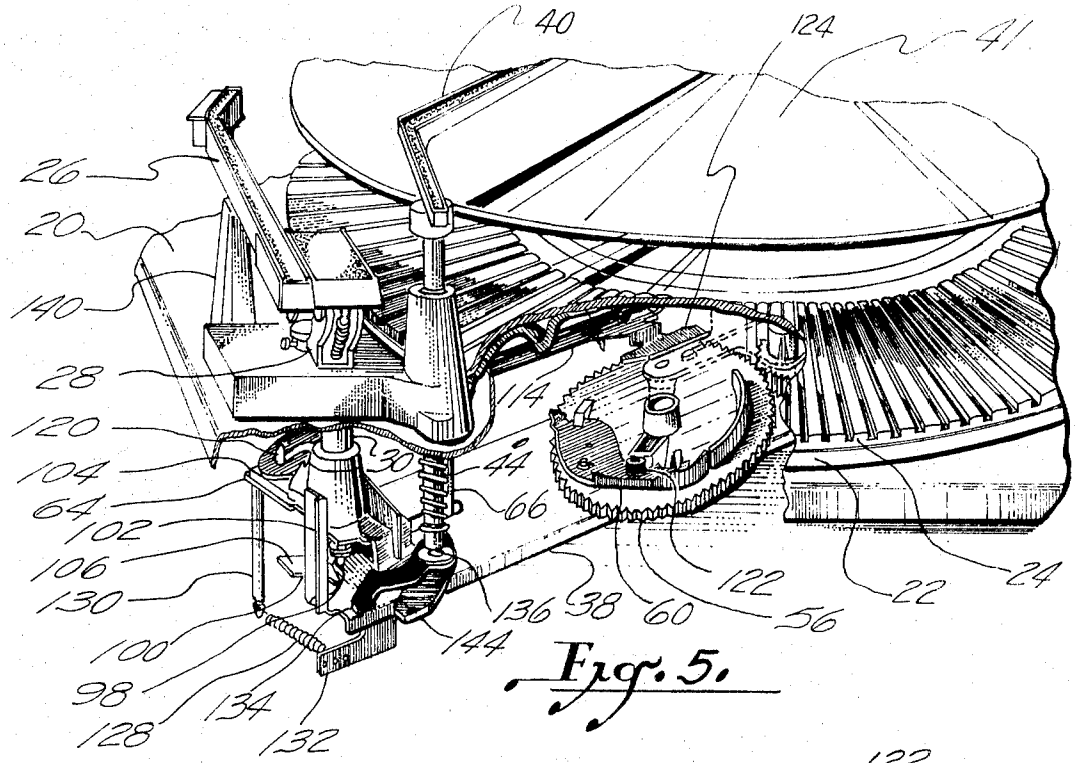


Fig. 5.

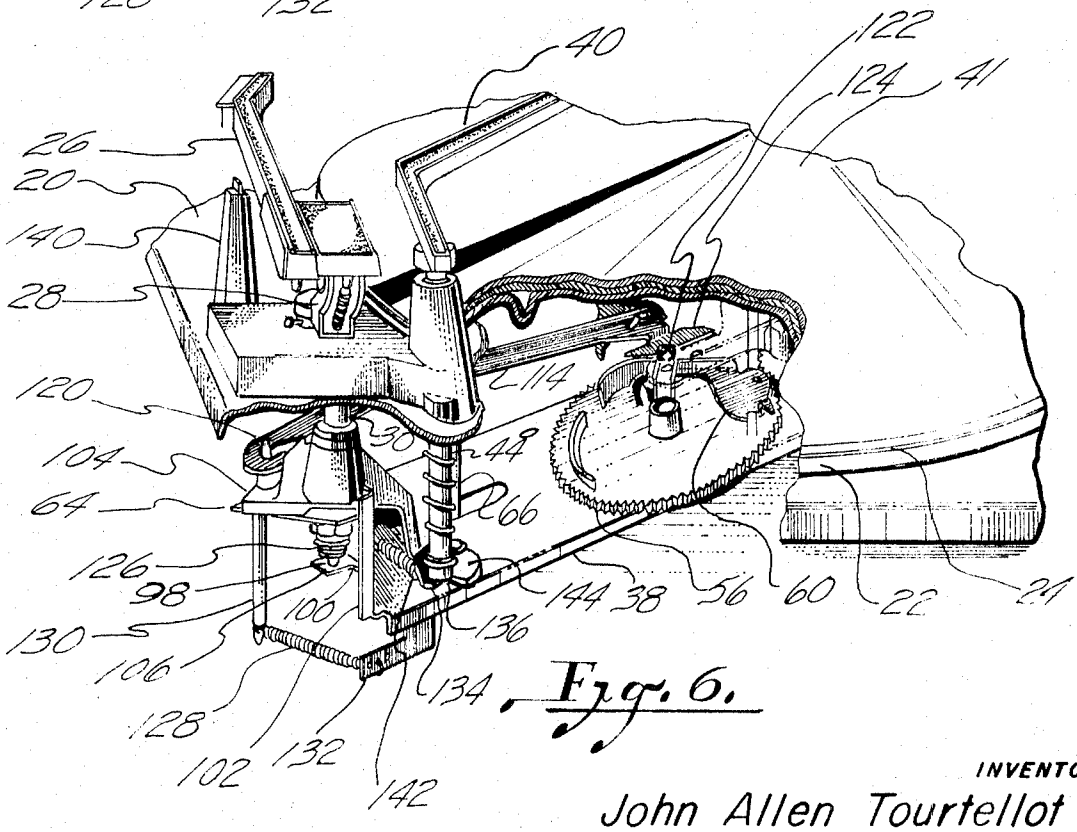


Fig. 6.

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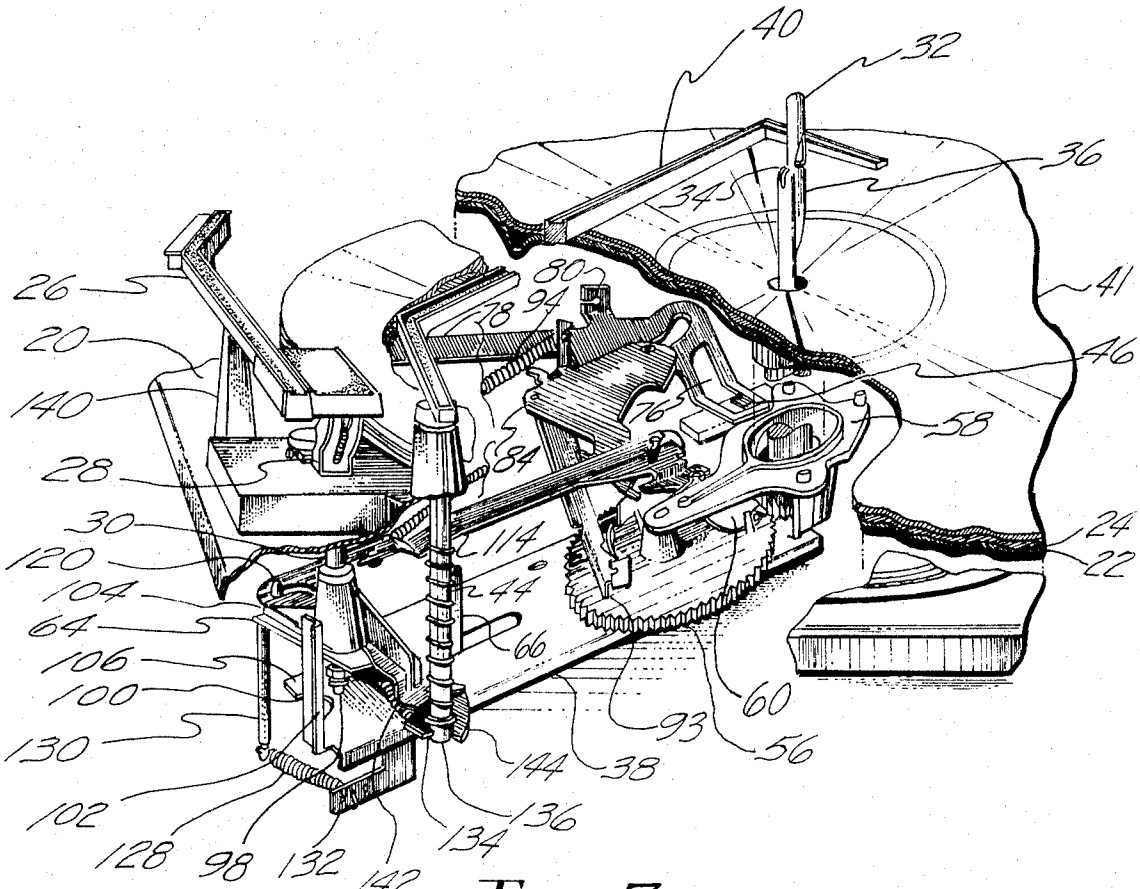


Fig. 7.

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AUTOMATIC RECORD CHANGER

The present invention relates to automatic record changers, and more particularly, to control and cycling mechanisms for such changers.

The utilization of automatic shut-off mechanisms in record changes is known. These mechanisms function to manipulate the changer motor power switch operator to open the switch contacts and de-energize the changer motor after the last record has been played and the tone arm is positioned on the tone arm rest. To achieve proper timing, that is, de-energization of the changer motor after the tone arm has landed on the tone arm rest with the changer components in their OFF position, critical parts tolerances are generally required. To avoid fire hazards, many changers are designed so that the power switch will be turned off early in the cycle after the last record has been played to insure that the power switch operator is moved to the OFF position to open the switch contacts. Unfortunately, with the changer motor de-energized, "helper" levers or springs are often required to provide additional power to complete the changer cycle and move the changer components to their OFF position.

It is an object of the present invention to provide an improved automatic record changer mechanism which is simple in construction, easy to manufacture at low cost, and reliable in operation.

In accordance with the present invention, a phonograph record changer includes a motor board supporting a turntable and a spindle adapted to support a stack of records. Means electrically energize the changer to effect rotation of the turntable. A cycling gear is positioned beneath the motor board and rotates during each record changing cycle. The cycling gear supports a first means which rotates with the gear. A second means is coupled to a shut-off lever to position the lever to interfere with the first means' path of travel after a last record has been played. When the first means contacts the shut-off lever it causes the lever to move. Means electrically de-energize the phonograph record changer in response to the movement of the shut-off lever.

A complete understanding of the present invention may be obtained from the following detailed description thereof, when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a top plan view of an automatic record changer embodying the present invention partly broken away to show the changer mechanisms;

FIG. 2 is an enlarged top plan view of the portion of the automatic record changer mechanism shown in FIG. 1 adjacent the changer cycling gear with the changer power switch operator in its OFF position;

FIG. 3 is a top plan view, partly broken away, of a portion of the automatic record changer mechanism shown in FIG. 1 at the moment just prior to de-energization of the changer motor;

FIG. 4 is a top plan view, partly broken away, of a portion of the automatic record changer mechanism shown in FIG. 1 with the changer motor de-energized and the changer components in their OFF position;

FIG. 5 is a partial perspective view of the automatic record changer mechanism shown in FIG. 1 partly broken away to show the changer mechanism with a record supported on the changer spindle;

FIG. 6 is a partial perspective view of the automatic record changer mechanism shown in FIG. 1 partly broken away to show the changer mechanism just after a record has dropped onto the changer turntable; and

FIG. 7 is a partial perspective view of the automatic record changer mechanism shown in FIG. 1 partly exploded and broken away to show the changer mechanism after the last record has been played and the changer motor de-energized.

Referring now to the drawings wherein like reference numerals designate similar elements in the various views, a record changer includes a motor board **20** which supports a rotatable turntable **22.** A rubber mat **24** is secured to the top portion of the turntable to provide a frictional contact with records resting on the turntable. A tone arm **26,** supporting a pickup near its free end, is mounted to and rotates with a swivel bracket **28.** The tone arm **26** is secured to the swivel bracket **28** so that the tone arm may be pivotally moved in a vertical plane. A tone arm shaft **30** extends from the swivel bracket **28** to the underside of the motor board **20.**

A record centering spindle **32** is mounted to the motor board **20** and projects up through the center of the turntable **22.** The spindle includes a shelf portion **34** for supporting a stack of records and a record ejector lever **36** which extends axially along the spindle **32** from a height slightly above the shelf **34** to beneath the motor board **20.** Movement of the ejector lever **36** by the changer cycling slide **38** results in a shifting of the lowermost record off the shelf so that the record can drop down along the spindle onto the turntable **22** or onto the topmost record supported by the turntable.

A record stabilizing arm **40** is mounted in a housing **42** on the motor board **20.** The arm **40** is mounted to be moved upward enough to clear the top of the spindle **32** and is rotatable to a position clear of the turntable so that records may be loaded on the spindle. After loading one or more records, here record **41,** the stabilizing arm **40** is rotated over the spindle **32** and lowered onto the top record of the stack to maintain the records in a horizontal position. After the last record of the stack has been dropped to the turntable **22,** the stabilizing arm **40** drops to a lower position to provide an indication to the automatic record changing mechanism that the last record has dropped to the turntable. The record stabilizing arm **40** includes a stab shaft **44** which extends below the motor board **20** and cooperates with other components of the record changing mechanism to move the power switch operator **46** to open the switch contacts to de-energize the changer motor after the last record has been played.

The changer motor and a speed change mechanism are mounted beneath the motor board **20.** The motor shaft **48** drives an idler wheel **50.** The idler wheel **50** contacts the inside rim of the turntable **22** to provide a multiple speed rim drive.

The turntable **22** includes, as an integral part, a hub which extends beneath the motor board **20** and supports a drive gear **52** and a boss or projection **54.** The drive gear **52** operates the mechanism which effects the automatic record change, and the projection **54** cooperates with other mechanisms to provide a velocity trip system for initiating a record changing cycle.

A cycling gear **56,** adapted to be driven by the gear **52,** is rotatably mounted to a support **58** on the underside of the motor board **20.** The cycling gear has a mu-

tilated sector, a portion having no teeth, in registry with the drive gear **52** prior to the initiation of a record changing cycle and during the playing of a record (FIGS. **1** and **7**). The teeth of the drive gear **52** do not mesh with the teeth of cycling gear **56** and no power is transmitted to the record changing mechanism during these periods.

On the top surface of the cycling gear **56** near the mutilated sector, a boss **59** pivotally supports a trip pawl **60**. A trip lever **62** is mounted on the underside of the motor board and tracks the movement of the pickup arm **26** to provide a velocity trip for the trip pawl. The trip lever is connected by a pickup arm lever **64** to the tone arm shaft **30**. The pickup arm lever **64** couples movement of the tone arm shaft **30** to the trip lever **62** which actuates a record changing cycle after each record is played.

The cycling slide **38** is mounted for reciprocating movement in a horizontal plane beneath the cycling gear **56**. The slide **38** is supported by a bearing washer, not shown, attached to a supporting shaft **66** which extends from the motor board **20** through an elongated slot **68** in the cycling slide **38** (FIGS. **3** and **4**) and by a guide slot in the cycling gear support **58**. The cycling slide **38** is driven in a known manner by a projection on the cycling gear **56**. The projection is offset from the axis of rotation of the cycling gear and is received in an elongated transverse slot in the cycling slide **38** to effect reciprocating movement of the slide in response to rotation of the cycling gear.

The record changer is operated by means of three slide controls positioned on the top of the motor board **20**. A first control **70** is positioned for the particular record size to be played. The control operates the portion of the changer mechanism which causes the tone to move a proper distance toward the spindle before letting down so that the pickup stylus engages the lead-in groove on the record. A second control **72** is positioned to adjust the speed change mechanism for the proper turntable rotational speed. The portion of the changer mechanism operated by controls **70** and **72** may be of the conventional type. One suitable arrangement is described in Record Changer Service Data File 1968 No. 45. Copies of the Service Data may be obtained from RCA Corporation, 600 North Sherman Drive, Indianapolis, Indiana.

A function control **74** is movable to four positions; the positions are, from the lowermost setting to the uppermost setting, OFF, MANUAL, AUTOMATIC, and SELECT. When the function control **74** is moved from the OFF position to the MANUAL position, a slot forming a guide **76** in the function lever **78** moves the changer motor power switch operator **46** to the ON position, closing the switch contacts to thereby energize the motor. At the same time, a tab **80** on the function lever **78** moves an automatic neutral lever **82** (FIG. **1**) away from the idler wheel mounting to allow the idler wheel **50** to contact the motor shaft **48** and turntable rim. The turntable now rotates. Simultaneously, a detent lever **84** is moved by a roller **86** mounted to one of its ends and guided in an angular slot **88** in function lever **78**. The detent lever latch finger **90** engages a latch or notched cut-out **92** in the motor board **20**. This holds the function lever **78** in position. A vertical tab **93** on the function lever **78** moves into a position to block the trip lever **62** and prevent it from contacting the trip pawl **60** on the cycling gear **56** which would set the cycling gear in motion. As is best shown in FIG. **4**, the cut-out has two steps **92***a* and **92***b* to provide a detent for the function lever in the MANUAL and AUTOMATIC positions.

With the function control **74** in the MANUAL position, the changer will not function automatically because the trip lever **62** is blocked by the trip pawl blocking tab **93** from contact with the trip pawl **60**. The records may be played by manually placing the record on the turntable **22** and lifting the pickup arm onto the record. The pickup arm must also be removed from the record manually at the end of a record.

When the function control is moved against a spring pressure (the detent lever spring **94**) to the SELECT position, held there momentarily and thereafter released, the function control returns to the AUTOMATIC position and the changer begins to cycle. In this position, the detent lever latch finger **90** is held by the tension of the detent spring **94** against cut-out step **92***b*. Moving the function control **74** to the SELECT position moves a tab **96** on the function lever into contact with the trip pawl **60** and pushes the pawl into position to start the automatic cycle. The trip pawl blocking tab **93** is no longer in the blocking position so that the trip lever **62** may contact the trip pawl **60** at the end of the record.

As the turntable rotates, the projection **54** on the turntable hub engages the trip pawl **60** causing the cycling gear **56** to rotate and engage the drive gear **52**. The cycling gear **56** will rotate until the mutilated sector on the gear is again opposite the drive gear **52**. When the cycling gear **56** begins to rotate, the cycling slide starts its reciprocating movement. During the change cycle, the cycling gear **56** completes one revolution and the cycling slide **38** completes one inward and outward excursion.

The cycling slide **38** as it moves inward forces a pickup arm lift rod **98** to ride up a ramp **100** at the outer end of the cycling slide. The pickup arm lift rod **98** reaches maximum height with one-quarter revolution of the cycling gear **56**. The pickup arm lever **64** which is secured to the tone arm shaft **30** rises and contacts a landing lever **104**. The landing lever **104** is coupled by a lever arrangement to the record size control **70** to control the let down point of the tone arm **26**. Further rotation of the cycling gear and subsequent inward movement of the cycling slide causes an upturned tab **102** on the outer end of the cycling slide **38** to contact the landing lever **104** and pickup arm lever **64** and rotate them. The rotation is imparted to the tone arm from the pickup arm lever **64** via its connection to the tone arm shaft **30**. During this portion of the cycling slide travel, the pickup arm lift rod **98** rides on a plateau **106** of the ramp **100**.

As the pickup arm **26** reaches a position at the outward travel where it will clear the edge of a **12** inch record, the cycling gear end of the cycling slide **38** contacts the portion of the record push-off lever **36** extending beneath the motor board **20**, causing the bottom record on the stack to be pushed off the shelf of the record spindle **32** and drop on the turntable **22**, completing the first half of the change cycle.

As the cycling gear **56** continues to rotate into the last half of the change cycle, the cycling slide **38** begins to travel outward. The outward movement of the cycling slide upturned tab **102** cause it to disengage from the landing lever **104** and the pickup arm lever **64** al-

lowing the landing lever tension spring **110** to rotate the two levers and move the pickup arm inward. A slot **112** at the end of a shut-off lever **114** rides on a pin **116** in the detent lever **84.** When the landing lever **104** rotates, the shut-off lever **114,** which is linked to the landing lever by means of a slot **118** and landing lever pin **120,** moves out of the path of a shut-off stud **122** on the cycling gear **56.** Thus, the stud **122** does not contact the ramp **124** at the end of the shut-off lever **114.** The shut-off lever **114** movement is guided by the captive detent lever pin **116** in the shut-off lever slot **112.**

The continued outward movement of the cycling slide **38** completes the release of the landing lever **104** and the pickup arm lever **64.** The pickup arm lift rod **98** rides off the plateau **106** and down the ramp **100** allowing the pickup arm **26** to descend to the record. As the pickup arm lift rod **98** nears the bottom of the ramp **100,** the compression of the pickup arm lift rod tension spring **126** is released and the pickup arm lever **64** moves away from the landing lever **104** leaving the pickup arm lever **64** free to move. Just before the cycling gear **56** completes the full revolution, at approximately seven-eighths revolution, the trip pawl **60** is reset. When the trip pawl **60** was initially actuated by the tab **96** on the function lever **78,** a portion of the pawl was moved to extend over a few teeth of the cycling gear **56.** As these teeth mesh with the teeth on the drive gear **52,** the pawl is pushed back to the non-trip position by the drive gear teeth.

When the pickup arm **26** lands on the record, the pickup stylus engages the lead-in groove on the record and moves inward. The movement of the pickup arm **26** is now controlled by the groove in the record. An anti-skate spring **128** is coupled between a depending stud **130** on the pickup arm lever **64** and a projecting ear **132** on the cycling slide **38.** The anti-skate spring **128** provides a small torque to compensate for the frictional drag force of the stylus on the record.

As the record plays, the pickup arm **26** is moved inward at a slow rate and at a constant distance per revolution. When the pickup arm **26** has advanced to the end of the record, the pickup stylus enters the fast advance or tripping groove which causes the pickup arm to move inward at a greater speed. The additional inward speed of the pickup arm **26** and, hence, trip lever **62,** is sufficient to move the trip pawl **60** into contact with the projection **54.** The engagement of the pawl and the projection causes the cycling gear to rotate so that its teeth mesh with the teeth in drive gear **52,** starting a change cycle.

The dropping of the last record in the stack permits the stabilizer arm **40** to also drop. When the stabilizer arm **40** drops during this cycle, the lower end **136** of the stab shaft **44** momentarily rests on the top of a shut-off latch **134** which is secured for rotation on the landing lever **104** and biased by a spring **142** coupled to the landing lever (FIG. **6**). As the landing lever **104** rotates, the lower end **136** of the stab shaft slips off the shut-off latch **134** and drops onto a shelf portion **144** on the landing lever. This does not affect the playing of the last record, but during the next cycle, the landing lever **104** in rotating moves out from under the stabilizer arm stab shaft end **136.** The stabilizer stab shaft bears against the shut-off latch **134** and rotates it so that the stab shaft may drop to its lowermost position (FIGS. **3, 4** and **7**). In this position the stab shaft end **136** is held captive between an edge of the landing lever **104** and an edge of the shut-off latch **134.** As the cycling slide **38** starts the outward journey, the stabilizer arm shaft end **136** blocks the movement of the landing lever **104** and the pickup arm lever **64,** holding them in their outward position with the pickup arm over the pickup arm rest **140.** With the landing lever **104** in this position, the shut-off lever **114** is held in a position where the ramp **124** will be contacted by the shut-off stud **122** on the cycling gear **56** and does not move in the manner previously described where the landing lever **104** was not blocked and the shut-off lever ramp **124** was moved out of the path of travel of the stud **122.**

As the cycling slide **38** continues the outward excursion, the pickup arm lift rod **98** rides down the ramp **100** and the pickup arm **26** is lowered onto the rest. The shut-off stud **122** on the cycling gear **56** contacts the shut-off lever ramp **124** and the shut-off lever **114** pushes the detent lever **84** to cause it to unlatch. Specifically, the detent lever latch finger **90** is caused to disengage from the notched cut-out **92.** This allows the function lever **78** to be returned to the OFF position by the force of the detent lever spring **94** acting through the slot **88** in the function lever. The function lever **78** in returning to the OFF position moves the changer motor power switch operator **46** to open the switch contacts to de-energize the changer motor and moves the neutral lever **82** to push the idler wheel **50** out of contact with the motor shaft **48** and turntable rim. The cycle has now been completed, and the record changer is turned off with the tone arm **26** resting on the tone arm support **140,** the mutilated sector of the cycling gear **56** adjacent the drive gear **52.** It should be noted that when the stabilizer arm **40** is lifted, either to unload records from the turntable **22** or to position records on the spindle **32,** the stab shaft end **136** is withdrawn from its captive position. When this occurs, the landing lever **104,** under the tension of the landing lever spring **110,** snaps back to its rest position and the shut-off latch **134,** under the tension of spring **142,** also moves to its rest position.

What is claimed is:

1. In a phonograph record changer of the type including a motor board supporting a rotatable turntable, a spindle adapted to support a stack of records to be played, the record stack being steadied by a stabilizer arm which is vertically movable and is mounted to a stabilizer arm stab shaft extending through the motor board, and a power switch having a switch operator for closing and opening the switch contacts to electrically energize and de-energize said phonograph record changer to control the rotation of said turntable, the improvement comprising:

a cycling gear having major surfaces and adapted to rotate during a record changing cycle of operation;

a shut-off stud secured for rotation with said cycling gear and projecting from a major surface of said gear;

a cycling slide coupled to said cycling gear to be driven in a reciprocating movement toward and away from the central axis of said turntable during a record changing cycle of operation;

a landing lever rotatably mounted beneath said motor board;

said cycling slide positioned to engage said landing lever during its movement toward the central axis of said turntable such that said landing lever is rotated in a first direction;

spring means coupled to said landing lever to bias said lever for rotation in a second direction;

a shut-off lever coupled to said landing lever;

said stab shaft positioned to block said landing lever from rotating in said second direction after a last record in said stack has been played and said cycling slide has disengaged from said landing lever during its movement away from the central axis of said turntable;

said shut-off lever positioned to interfere with said shut-off stud path of travel when said stab shaft blocks said landing lever;

said shut-off stud contacting said shut-off lever after said last record has been played to move said shut-off lever; and

a function lever coupled to said power switch operator and responsive to the movement of said shut-off lever to manipulate said operator to open the switch contacts.

2. A phonograph record changer as defined in claim **1** wherein said motor board has notched cut-out portions and including a detent lever coupled between said shut-off lever and said function lever, said detent lever having a projection adapted to cooperate with said motor board notched cut-out portion.

3. A phonograph record changer as defined in claim **2** including a shut-off latch rotatably secured to said landing lever, said stab shaft in the blocking position held captive between said shut-off latch and said landing lever.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,762,723 Dated October 2, 1973

Inventor(s) John Allen Tourtellot

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

At column 1, line 7, "changes" should read --changers--.
At column 3, line 35, after "tone" insert --arm--.

Signed and sealed this 2nd day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)
3530 6|72

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334