United States Patent

[11] 3,545,767

[72] Inventor **John A. Tourtellot**
Indianapolis, Indiana

[21] Appl. No. **717,614**
[22] Filed **April 1, 1968**
[45] Patented **Dec. 8, 1970**
[73] Assignee **RCA Corporation**
a corporation of Delaware

[54] **AUTOMATIC RECORD CHANGER**
4 Claims, 13 Drawing Figs.

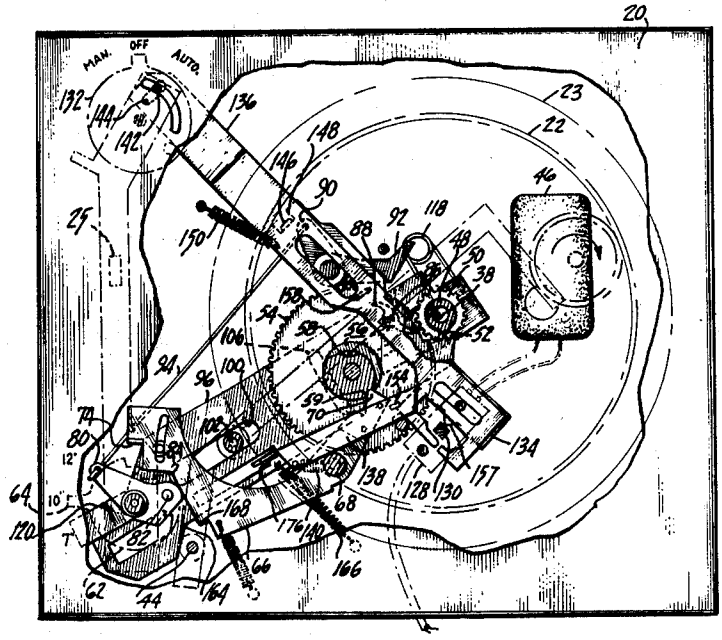
[52] **U.S. Cl.** **274/10**
[51] **Int. Cl.** **G11b 17/00**
[50] **Field of Search** 274/10

[56] **References Cited**
UNITED STATES PATENTS

2,701,721	2/1955	Mullaney	274/10
3,197,212	7/1965	De Weese	274/10

Primary Examiner—Samuel S. Matthews
Attorney—Eugene W. Whitacre

ABSTRACT: A simplified phonograph record changer mechanism is provided wherein after the last record has been played, the changer's reciprocating cycling slide is caused to be shifted sideways and coact with means operable to effect power shutoff.



PATENTED DEC 8 1970

3,545,767

SHEET 1 OF 5

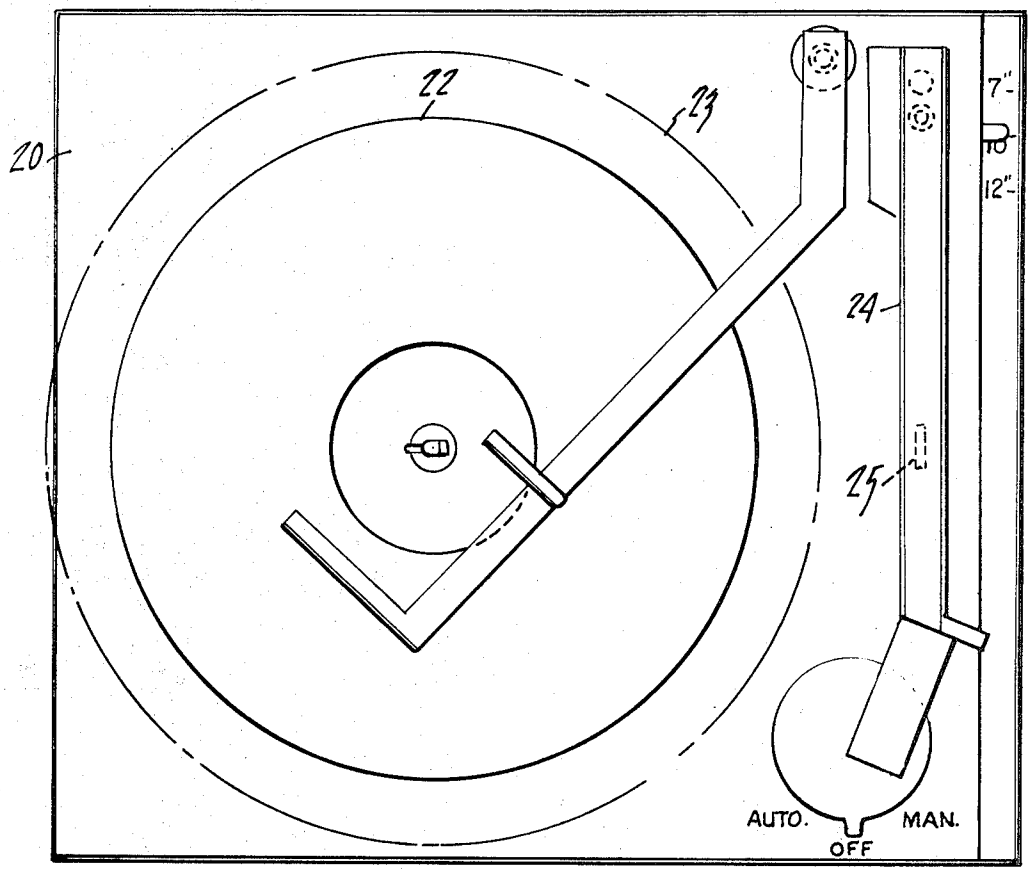


Fig. 1.

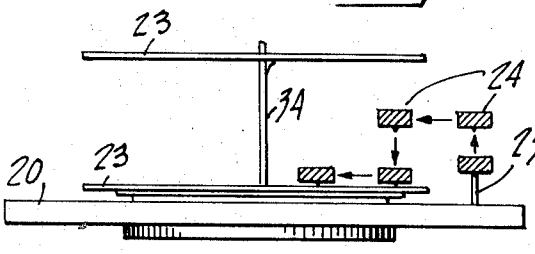


Fig. 1a.

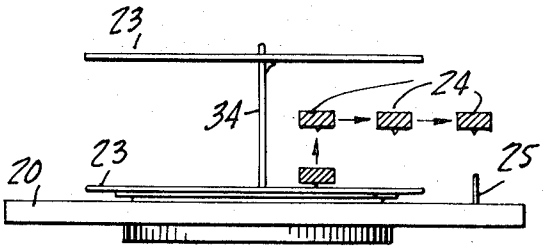


Fig. 1b.

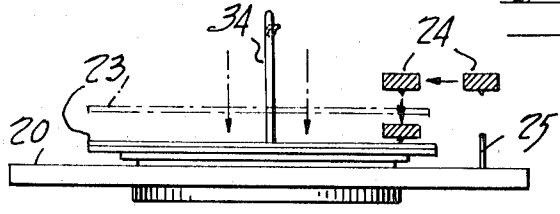


Fig. 1c.

INVENTOR
John A. Tourtellot

BY

ATTORNEY

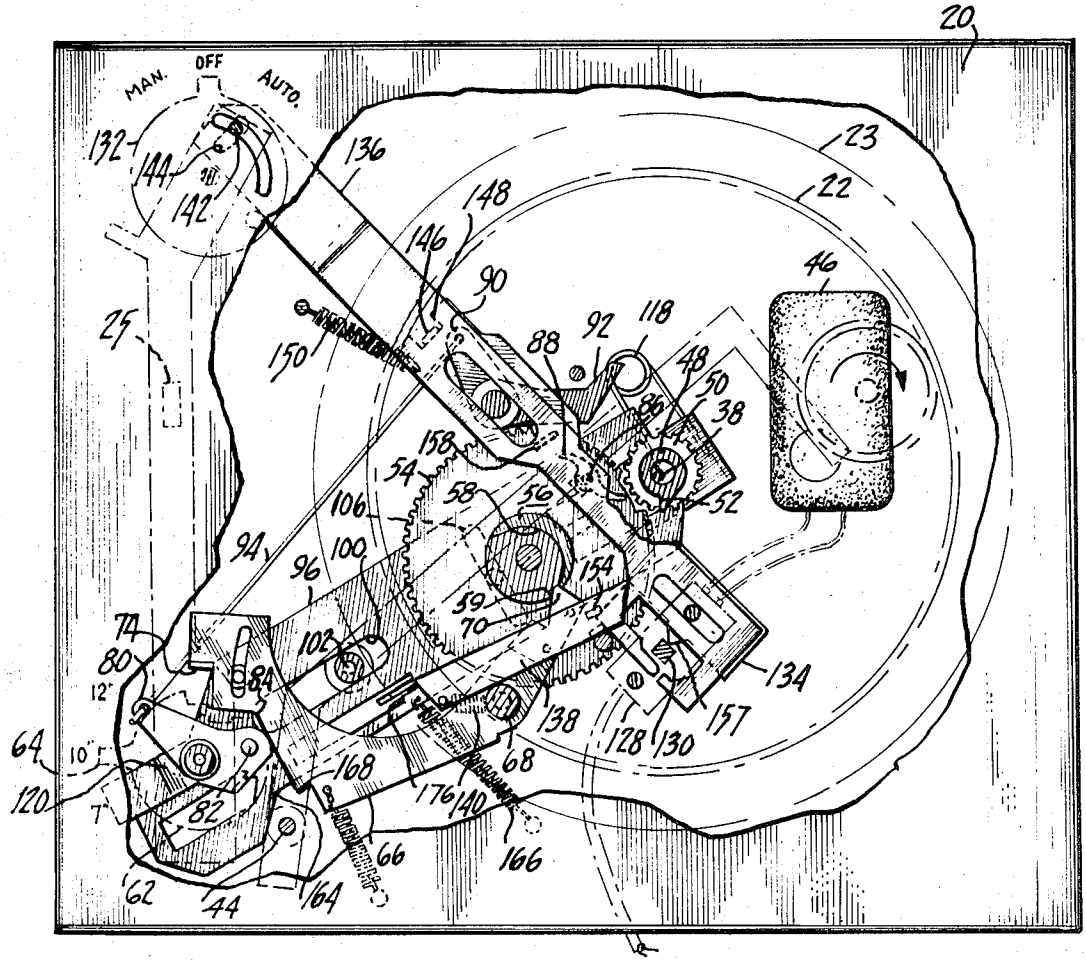


Fig. 2.

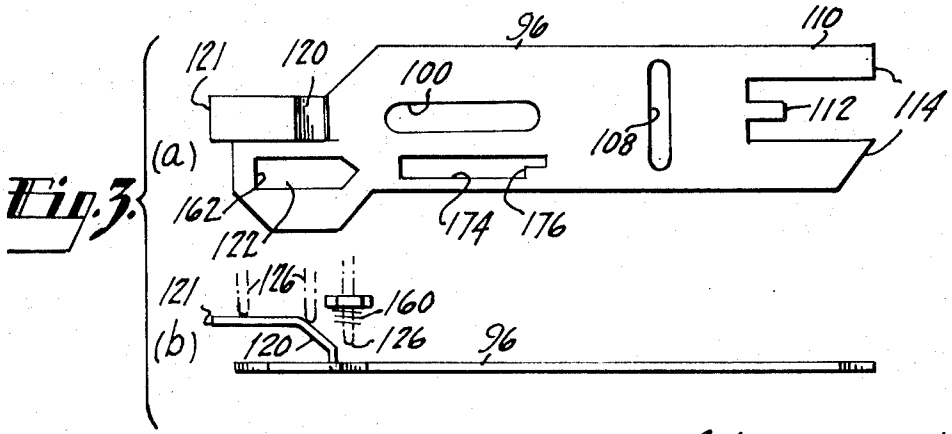


Fig. 3.

INVENTOR
John A. Tourtellot

BY J. M. Whitacre

ATTORNEY

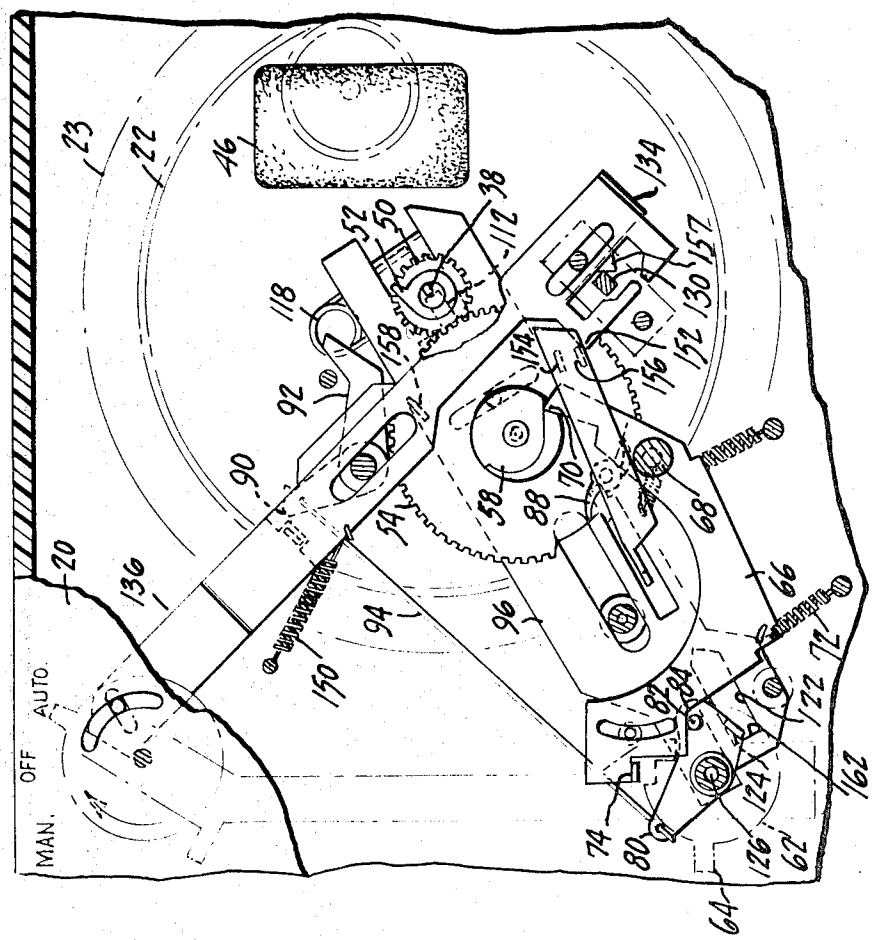


Fig. 5.

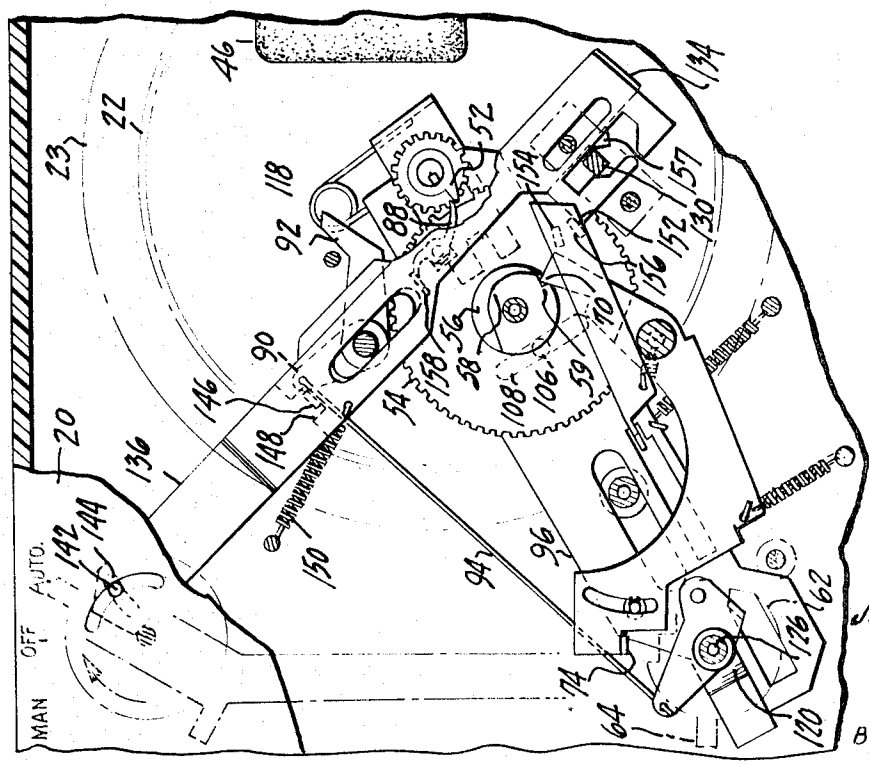


Fig. 4.

INVENTOR
John A. Tourtellot

BY

ATTORNEY

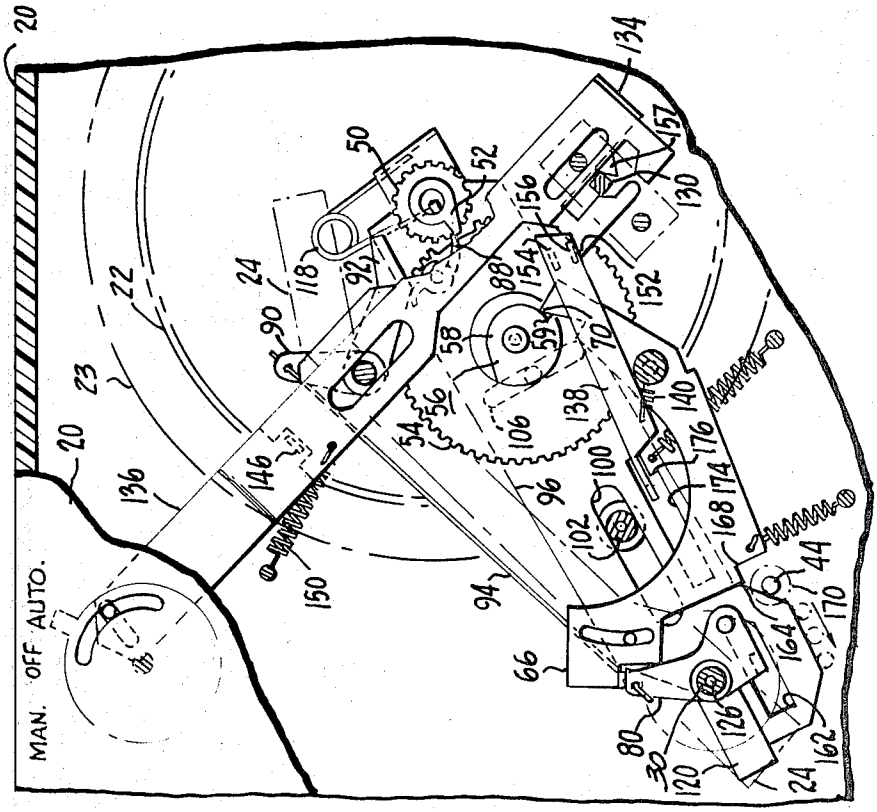


Fig. 7.

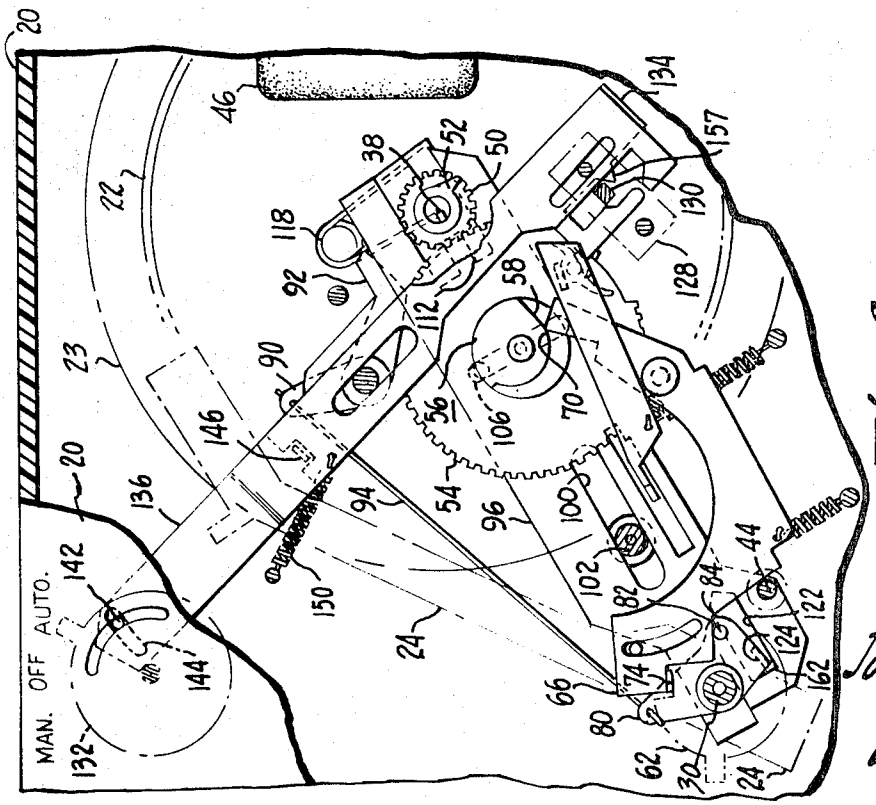


Fig. 6.

INVENTOR
John A. Tourtellot
Whitacre
ATTORNEY

PATENTED DEC 8 1970

3,545,767

SHEET 5 OF 5

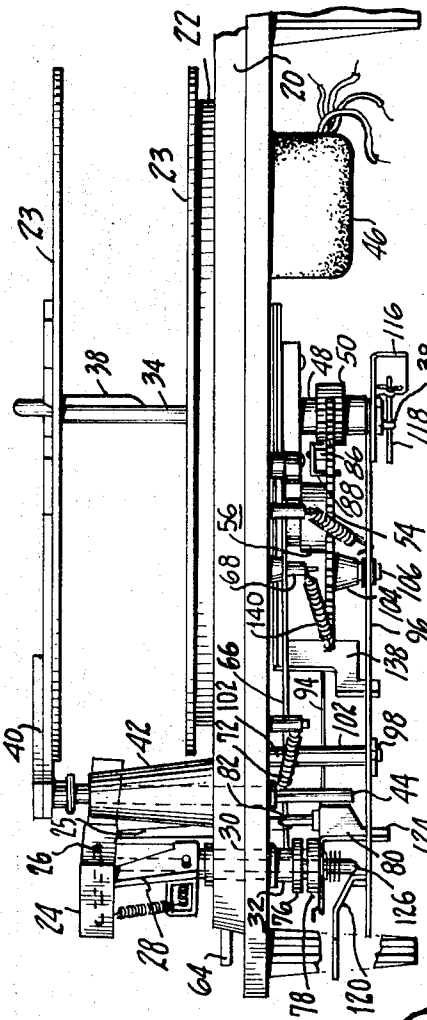


Fig. 9.

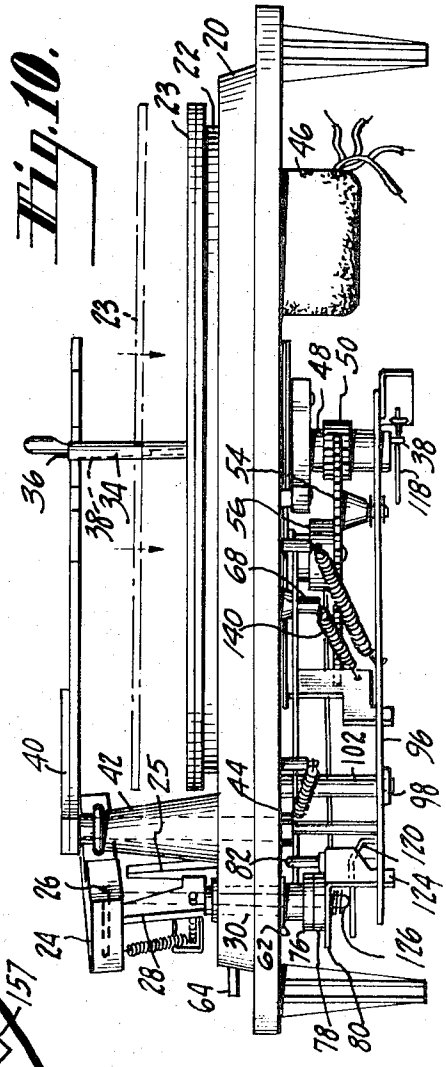


Fig. 10.

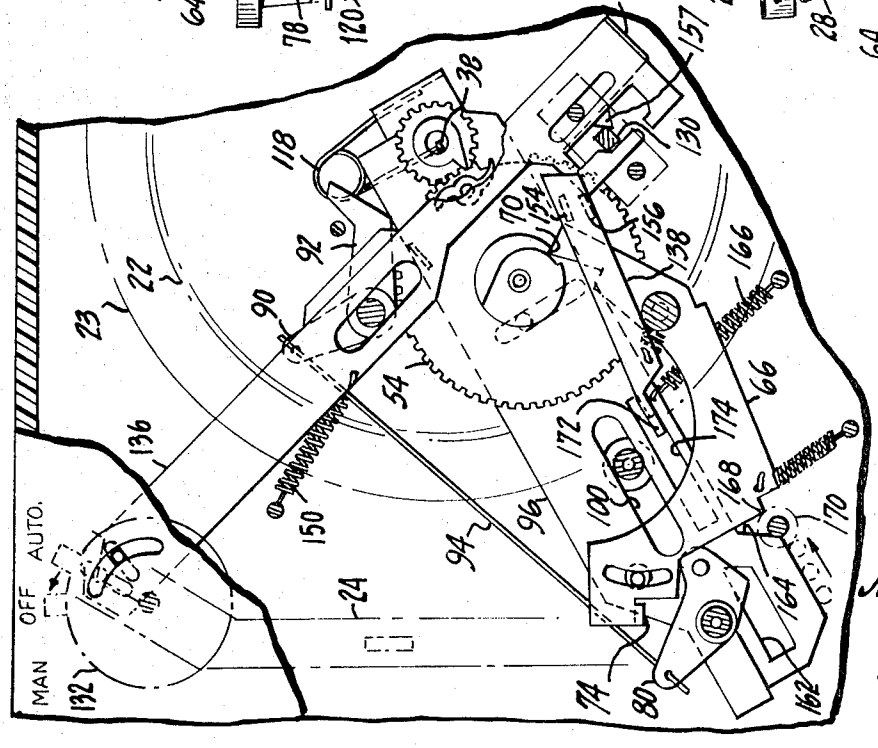


Fig. 8.

INVENTOR
John A. Tourtellot
O'Mulvihill
ATTORNEY

AUTOMATIC RECORD CHANGER

This invention relates to automatic record changers and more particularly to control and cycling mechanisms for said changers.

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.

An automatic record changer constructed in accordance with the invention includes a cycling slide adapted to be reciprocatingly driven toward and away from the central axis of the changer turntable during a record changing operation. Means are provided for causing said cycling slide to be shifted sideways during its reciprocating excursion following the playing of a last record on the turntable and in response to said slide shift to cause said phonograph record changer to be electrically deenergized.

The novel features which are considered to be characteristic of this invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation as as well as additional objects and advantages thereof, will best be understood from the following description when read in connection with the accompanying drawings in which:

FIG. **1** is a front top plan view of a record changer constructed in accordance with the present invention;

FIGS. **1***a*, **1***b* and **1***c* are diagrammatic elevation views of the record changer showing different positions of the changer tone arm during a cycling operation.

FIG. **2** is a top plan view of the record changer partly broken away showing the position of the cycling mechanism prior to the initiation of a cycling operation with the tone are arm in rest position and the function selector in OFF position.

FIGS. **3***a* and **3***b* are respective top plan and side elevation views of the cycling slide member of the changer cycling mechanism.

FIG. **4** is a partial top plan view of the record changer, partly broken away showing the position of the cycling mechanism just after the initiation of a cycling operation and with the function selector in AUTO position.

FIG. **5** is a partial top plan view of the record changer partly broken away showing the position of the cycling mechanism when the tone arm is vertically raised above its rest position just after a record has dropped to the turntable.

FIG. **6** is a partial top plan view of the record changer, partly broken away showing the position of the cycling mechanism when the tone arm is in its vertically raised position above the lead in groove of a record on the turntable.

FIG. **7** is a partial top plan view of a record changer, partly broken away showing the position of the cycling mechanism when the tone arm is in the end groove of a record on the turntable and just prior to the initiation of the last record shutoff cycling operation.

FIG. **8** is a partial top plan view of the record changer, partly broken away showing the position of the cycling mechanism with the tone arm in its rest position just before the function selector is caused to move to the OFF position.

FIG. **9** is a rear elevation view of the record changer, illustrating the tone arm elevating pin and cam assembly.

FIG. **10** is rear elevation view of the record changer illustrating the position of the tone arm elevating pin and cam assembly and stabilizer arm and stab shaft just after the last record has dropped to the turntable.

Referring now to the drawings wherein like reference numerals will be used to indicate the same elements throughout the FIGS., and particularly to FIGS. **1**, **2** and **9**, the record changer includes a motorboard **20** which supports a rotatable turntable **22**. A tone are arm **24** is mounted by means of a pin **26** and swivel bracket **28** on a tone arm shaft **30** for rotation therewith and for pivotal movement in a vertical plane about the pin **26**. The tone arm shaft **30** extends through a tubular projection or boss **32** formed on the underside of the motorboard. A phonograph pickup, (not shown), is supported near the free end of the tone arm **24**.

A record centering spindle **34** projects upwardly from the center of the turntable **22**. The spindle **34** includes a shelf portion **36** for supporting a stack of records and a record ejector lever **38** which extends axially along the spindle **34** from a height slightly above the shelf **36** to beneath the motorboard **20**. Movement of the ejector lever **38** by the cycling slide to be hereinafter described results in a shifting of the lowermost record supported on the shelf **36** off the shelf so that the record can drop down along the spindle into operative playing relation on the turntable **22**.

The record stabilizing arm **40** is mounted in a housing **42** on the motorboard **20** and preferably integrally formed therewith. The arm **40** is mounted to be moved upwardly high enough to clear the top of the spindle **34**, and is rotatable to a position clear of the turntable so that records may be loaded on the spindle **34**. After loading of one or more records, the stabilizing arm **40** is rotated over the spindle **34** 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, as shown in FIG. **10**, 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 motorboard **20** and cooperates with the record changing mechanism to disable the record changer after the last record has been played, as will hereinafter be explained.

Beneath the motorboard **20** there is supported a motor **46** coupled to a speed change and turntable drive mechanism (not shown) to provide a multiple speed rim drive of the turntable in known manner.

As best shown in FIGS. **2** and **9**, the turntable **22** which is rotatable rotatably mounted on the motorboard **20** includes as an integral part thereof a hub **48** which supports a pinion drive gear **50**. The hub **48** has an integrally formed projection **52** between the drive gear **50** and the turntable **22**. The drive gear **50** operates the mechanism which effects the automatic record change, and the projection **52** cooperates with other mechanisms to be hereinafter described to provide a velocity tripping mechanism which initiates a record changing cycle.

A cycling gear **54** formed with a central hub **56** having an eccentric portion defining a cam surface **58** is rotatably mounted on the underside of the motorboard **20** in position for driving engagement by the drive gear **50**. As can be seen in FIG. **2**, the cycling gear **54** has a mutilated portion with no teeth, in registry with the drive gear **50** prior to the initiation of a record changing cycle and during the playing of a record (FIG. **7**). Accordingly, the teeth of the drive gear **50** do not mesh with the teeth of the cycling gear **54**, and no power is transmitted to the record changing mechanism.

A record size selector cam **62** is mounted for rotation about the motorboard boss **32** and concentric with the tone arm shaft **30**. The selector cam **62** is formed with a plurality of steps along the outer surface thereof for determining the swing position of the tone arm **24** according to the diameter of the record to be played. A tab **64** extends from the selector cam through an aperture in the motorboard **20** to provide a means for indicating a selected step position.

An index lever **66** is pivotally supported on a boss **68** depending from the underside of the motorboard **20**. One end of the index lever **66** carries a cam follower **70** biased into cooperative engagement with the cam surface **58** on the cycling gear hub **56** by means of a spring **72**. The other end of the index lever is provided with an upstanding tab **74** arranged to engage one of the steps on the size selector cam **62** upon pivotal movement of the index lever **66**.

A disc **76** is secured beneath the size selector cam **62** at the end of the motorboard boss **32**. Arranged for cooperation with the disc **76** and in opposing relation thereto is a rubber clutch disc **78** frictionally coupled to a tone arm lever **80** and the tone arm shaft **30** for rotation therewith. The tone arm lever **80** carries a pin **82** arranged to engage a shoulder **84** formed in the index lever **66** to effect a horizontal swing movement of

the tone arm via its coupling to the tone arm shaft upon pivotal movement of the index lever **66**.

Formed on the top surface of the cycling gear **54** near the mutilated portion thereof is a boss **86** pivotally supporting a trip pawl **88**. A trip lever **90** is mounted concentrically with a clutch lever **92** on the underside of the motorboard so as to be in coupling relation to the trip pawl **88** when the cycling gear mutilated sector is adjacent the drive gear **50** (FIG. **2**). A trip link **94** connects the trip lever **90** to the tone arm lever **80** for coupling movement of the tone arm **24** to the clutched levers **90** and **92**, thereby to provide a velocity trip system for actuation of a record changing cycle at the completion of a record playing cycle as will hereinafter be described.

Referring now to FIGS. **3***a* and **3***b* along with FIGS. **2** and **9**, a cycling slide **96** is mounted for reciprocating movement in a horizontal plane beneath the cycling gear **54**. The slide **96** is supported near its center by means of a screw **98** which extends through an elongated slot **100** in the cycling slide **96** into a depending boss **102** on the underside of the motorboard **20**. Depending from the bottom surface of the cycling gear **54** and axially offset from the axis of rotation thereof is a boss **104** mounting a pin **106**. The pin **106** is received in an elongated slot **108** in the cycling slide **96** to effect reciprocating movement thereof in response to a driven rotation of the cycling gear **54** by the drive gear **50**. One end **110** of the cycling slide is cut away to define a finger **112** intermediate a pair of leg members **114**. The slide end **110** is supportedly mounted by means of a bracket **116** beneath the turntable hub **48** with the finger **112** positioned to push directly against the lower end of the record ejector lever **38** upon a forward or inward movement of the cycling slide **96**. The ejector is normally biased toward the slide finger by means of a tensioned hairpin spring **118**. The other end of the slide extends beneath the tone arm mounting and includes an angled portion defining an inclined ramp **120** and an apertured portion **122** receiving a bent over projecting ear portion **124** of the tone arm lever **80**. The ramp portion **120** is positioned beneath a tone arm lift pin **126** fitted in the tone arm shaft **30** for free vertical movement therein.

A slide switch **128** for controlling power to the motor **46** is mounted on the motorboard **20**. The switch mover **130** extends beneath the motorboard **20** and is coupled to an actuating control or function selector **132** by means of a control lever **134** and operating lever **136** assembly mounted for horizontal movement in the direction of its longitudinal axis. A shutoff lever **138** is mounted above the cycling slide **96** in coupling relation to the control lever **134**. A spring **140** is connected so as to urge the lever **138** in the direction of the control lever **134**. As can best be seen in FIGS. **2** and **4**, a boss portion **142** of the selector **132** is pinned to a slot **144** in the operating lever **136** so that clockwise rotation of the selector from the indicated oFF position (FIG. **2**) to the AUTO position (FIG. **4**) pushes the operating lever **136** forward. The operating lever in turn is resting on the control lever **134** so that a dependent ear **146** of the operating lever **136** which is received in a complimentary cutout **148** in the control lever carries the control lever forward in response to a forward movement of the operating lever **136** and against the bias of a spring **150**. As the control lever moves forward, a corner edge **152** thereof which was engaging a first stop projection **154** on the shutoff lever **138** (FIG. **2**) is carried forward to engage second **156** stop projection on the shutoff lever **138** (FIG. **4**) which has in turn moved toward the control lever **134** during the interval that the control lever edge **152** was between stop projections. At the same time, the switch mover **130** which is in contact with a cam surface **157** in the control lever **134** is allowed to move down the cam surface **157** in a direction transverse to the movement of the control lever, thereby turning the switch **128** to its ON position and energizing the motor **46**. Likewise turning the function selector in a counterclockwise direction from OFF, or going into the manual (MAN) position allows the switch mover **130** to ride down the other side of the cam surface **157** to energize the motor for manual play.

To initiate a record-changing cycle, the function n selector **132** is momentarily rotated clockwise about 30° past the AUTO indicating position, so that a depending ear **158** on the control lever **134** is caused to push against the trip pawl **88** and pivot it into engagement with the turntable hub projection **52** which rotates with the drive gear **50** (FIG. **4**). The rotation of the projection **52** against the trip pawl **88** causes the cycling gear **54** to be rotated so that the teeth of the cycling gear mesh with those of the drive gear **50**, and the index lever cam follower **70** rides out of a detent notch **59** on the cam surface **58** of the cycling gear hub **56**. As the cycling gear **54** starts to rotate, in a clockwise direction as viewed in the FIGS. the cycling slide **96** starts an inward motion. This is due to the pin **106** extending downward from the cycling gear **54** and traveling in the elongated slot **108** in the slide **96**. During a record changing cycle, the cycling gear will complete one revolution, and the slide **96** will perform one complete excursion (inward and outward) of travel.

As the cycling slide **96** starts inward, the tone arm lift pin **126** is caused to engage and ride up the inclined ramp portion **120** to the horizontally disposed portion **121** of the slide **96** (FIGS. **3***a* and **9**). The upward movement of the lift pin **126** causes the top end of the pin to push against the tone arm **24** and raise it vertically from its rest position. The vertical movement of the lift pin **126** also pushes the tone arm shaft **30** upward through a spring **160** to cause the rubber clutch disc **78** to come into contact with the disc **76** extension of the motorboard boss **32** and add a frictional drag to overcome the tone arm inertia during lateral movement thereof as will next be described.

As the cycling slide **96** approaches its most inward position corresponding to a one half revolution of the cycling gear **54**, the slide finger **112** is brought into engagement with the extended lower end of the spindle record ejector lever **38** to push the ejector lever forward, causing it to pivot in a manner to displace the lowermost record supported on the spindle shelf off the shelf into alignment with the major portion of the spindle, whereupon the lowermost record drops to the turntable (FIGS. **5** and **10**). At the same time, and if for example a recycling record changing operation has been initiated and the tone arm is poised above a record just played, the back closed edge **162** of the slide aperture **122** engages a depending ear portion **124** of the tone arm lever **80**. The tone arm lever **80** is thereby rotated and the tone arm **24** is caused to swing horizontally outward from the turntable **22** until stopped by the action of the tone arm lever pin **82** engaging the shoulder edge **84** of the index lever **66**. As the cycling gear **54** continues to rotate, the cycling slide **96** reverses its direction of travel, and the curvature of the cam surface **58** on the cycling gear hub **56** which is being tracked by the cam follower **70** on the other end of the index lever **66** causes the index lever to pivot about the boss **68** and against the force of the spring **72**. This action urges the pin **82** in a direction to rotate the tone arm lever **80** so that the free end of the tone arm **24** is moved horizontally inward toward the record to be played. The tone arm movement continues until the tap **74** on the index lever **66** engages one of the steps on the size selector cam **62** (FIG. **6**). These steps are at different radii and are proportionate to the lead-in groove landing sizes of the records to be played. This insures that when the tone arm is swung out over the record to be played, it is set to land properly on the lead-in groove of the size record selected.

Continued inward movement of the cycling slide **96** now in an outward direction causes the tone arm lift pin **126** to ride down the inclined ramp **120**, thereby lowering the tone arm toward the turntable to permit the phonograph pickup stylus to engage the lead-in groove of the record to be played whereupon the tone arm lift pin is at the end or bottom of the ramp thereby disengaging the clutched discs **76** and **78**, and the slide will have completed one inward and outward excursion. At this time the index lever cam follower **70** will have fallen into the notch **59** in the hub cam **58** and the mutilated (toothless) sector of the cycling gear will be opposite the drive

gear **50**, thereby referencing the cycling gear to its out of cycle position.

After the playing of a record has been completed, the relatively rapid motion of the tone arm toward the center of the record causes a relatively rapid pivotal movement of the trip pawl **88** due to its engagement with the clutch lever **92** and the coupling between the trip lever **90** via and trip link **94** to the tone arm lever **80**. The trip pawl **88** is thereby made to positively engage the rotating projection **52** above the drive gear **50**, and causes the cycling gear **54** to be rotated so that the teeth thereof mesh with the teeth on the drive gear **50** (FIG. **7**). A record changing cycle is thereby initiated and progress in the manner described above.

The operation of the last record shutoff mechanism will now be described.

During a record changing cycle and as was hereinbefore described, when the cycling slide **96** is at its innermost position corresponding to a one half revolution of the cycling gear **54**, the slide finger **112** pushes against the ejector lever **38** to cause a record to be dropped from the spindle shelf **36** to the turntable **22**. If this is the last record supported on the shelf, then when the record is dropped to the turntable, the stabilizing arm **40** will drop from the position shown for example in FIG. **9**, to a lower position as shown in FIG. **10** wherein the lower end of the stab shaft **44** is resting on the top surface of the cycling slide **96**. As the cycling operation continues and the cycling slide moves towards its outward position, the stabilizing arm drops to a still lower position wherein the lower end of the stab shaft **44** is alongside the cycling slide **96** and adjacent a corner edge **164** thereof.

After the playing of the last record and when the cycling slide starts its inward excursion during the next cycling operation, the cycling slide will be urged sideways against the bias of spring **166** by the cam action of the stab shaft **44** against the slide edge **164** (FIG. **7**). At the same time a corner edge **168** of the index lever **66** will, under the control of the cam follower **70**, be brought into abutment with a larger diameter portion **170** of the stab shaft **44** now in its lowered position (FIG. **8**). This halts further pivoting of the index lever **66** so as to prevent the index lever tab **74** from contacting one of the steps of the size selector **62** and the coupled tone arm lever from laterally moving the tone arm toward the turntable.

As can best be seen in FIGS. **7**, **8** and **10**, the shutoff lever **138** has a dependent arm **172** received in a generally rectangular cutout **174** in the cycling slide **96**. During the inward excursion of the slide and due to a sideward shift of the slide by the stab shaft **44**, the shutoff lever arm **172** will be aligned with a shoulder edge **176** of the cycling slide cutout **174**. As the cycling slide then moves outward to complete the change cycle, the slide shoulder edge **176** is caused to bear against the lever arm **172** moving the shutoff lever **138** backward so that the control lever edge **152** is disengaged from the shutoff lever second stop projection **156**. The control lever is thereby pulled by the force of the spring **150** back toward the shutoff lever first stop projection **154** which is the changer OFF position. The backward movement of the control lever **134** also forces the switch mover **130** up the cam surface **157** which electrically shuts the changer motor off.

I claim:

1. In a phonograph record changer of the type including a motorboard supporting a rotatable turntable, a tone arm one end of which is supported on a rotatable shaft extending through said motorboard, and means for electrically energizing said phonograph record changer to effect rotation of said turntable, the improvement comprising:

a cycling slide positioned beneath said motorboard;

means coupled to said slide and responsive to the rotation of said turntable for causing said slide to be reciprocatingly moved in a direction toward and away from the central axis of said turntable during a record changing cycle of operation, said cycling slide during at least a portion of its movement coacting with means operable to effect vertical and rotational displacement of said tone arm;

shift means responsive to the playing of a last record on said turntable for causing said cycling slide to be shifted sideways during its reciprocating excursion in the record changing cycle following the playing of a last record on said turntable; and

shutoff means coupled to said electrically energizing means and responsive to said sideways movement of said cycling slide for causing said phonograph record changer to be electrically deenergized.

2. A phonograph record changer as defined in claim **1** wherein said shift means includes a record stabilizing arm having a shaft portion extending below said motorboard in a position to engage said cycling slide and cause it to be shifted sideways during the record changing cycle following the playing of a last record on said turntable.

3. A phonograph record changer as defined in claim **2** wherein said shutoff means includes a lever positioned to engage said cycling slide and be moved to a position to deenergization of said phonograph record changer in response to a sideways shift of said cycling slide.

4. A phonograph record changer as defined in claim **1** and further including:

index means responsive to the rotation of said turntable during a record changing cycle of operation and adapted to coupled to said tone arm shaft for rotation thereof to effect an inward horizontal displacement of said tone arm free end; and

record size selection means mounted beneath said motorboard concentric with said tone arm shaft and having a plurality of manually selectable steps for determining the inward horizontal displacement of said tone arm free end; and

said index means being further adapted to engage a selected one of said steps to limit the tone arm rotation and thereby effect a desired inward horizontal displacement of said tone arm free end.