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Evans

[11] **3,847,401**

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[54] **RECORD PLAYERS**

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[73] Assignee: **Glenburn Engineering Limited,** Hamilton, Bermuda

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

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

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

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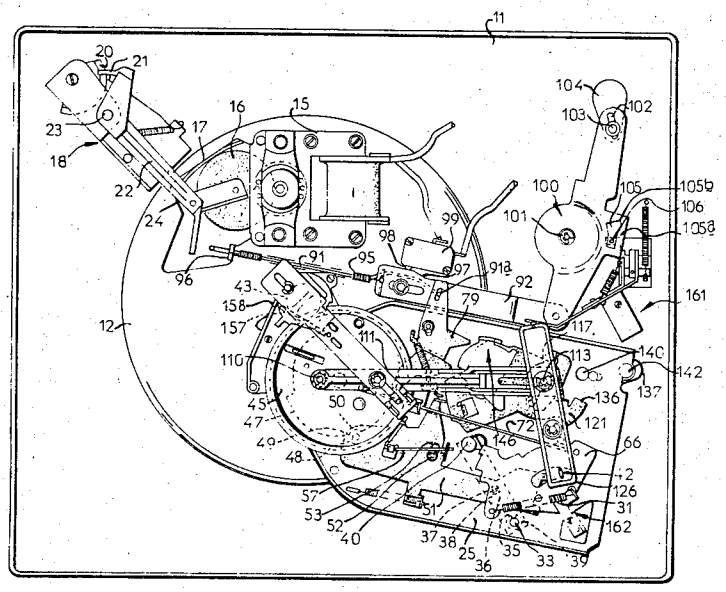
Primary Examiner—Louis R. Prince
Assistant Examiner—Steven L. Stephan
Attorney, Agent, or Firm—Holman & Stern

[57] **ABSTRACT**

An automatic record player for playing disc records of different sizes including an automatic mechanism for raising and lowering the pick-up arm and pivoting the pick-up arm inwardly and outwardly of the turntable which mechanism includes a drive gear and means for rotating the drive gear during a record changing cycle, a drive lever connected between the drive gear and a vertical spindle upon which the pick-up arm is carried to pivot pick-up arm inwardly and outwardly of the turntable, a drive link, separate from the drive lever and pivotally connected to an eccentric on the drive gear and slidably mounted adjacent its other end on the deck plate of the record player and adapted to raise and lower the pick-up arm and to move a selector latch into and out of position for engagement with a selector plate provided on the vertical spindle to determine the position of arrest of inward movement of the pick-up arm by the drive lever.

14 Claims, 11 Drawing Figures



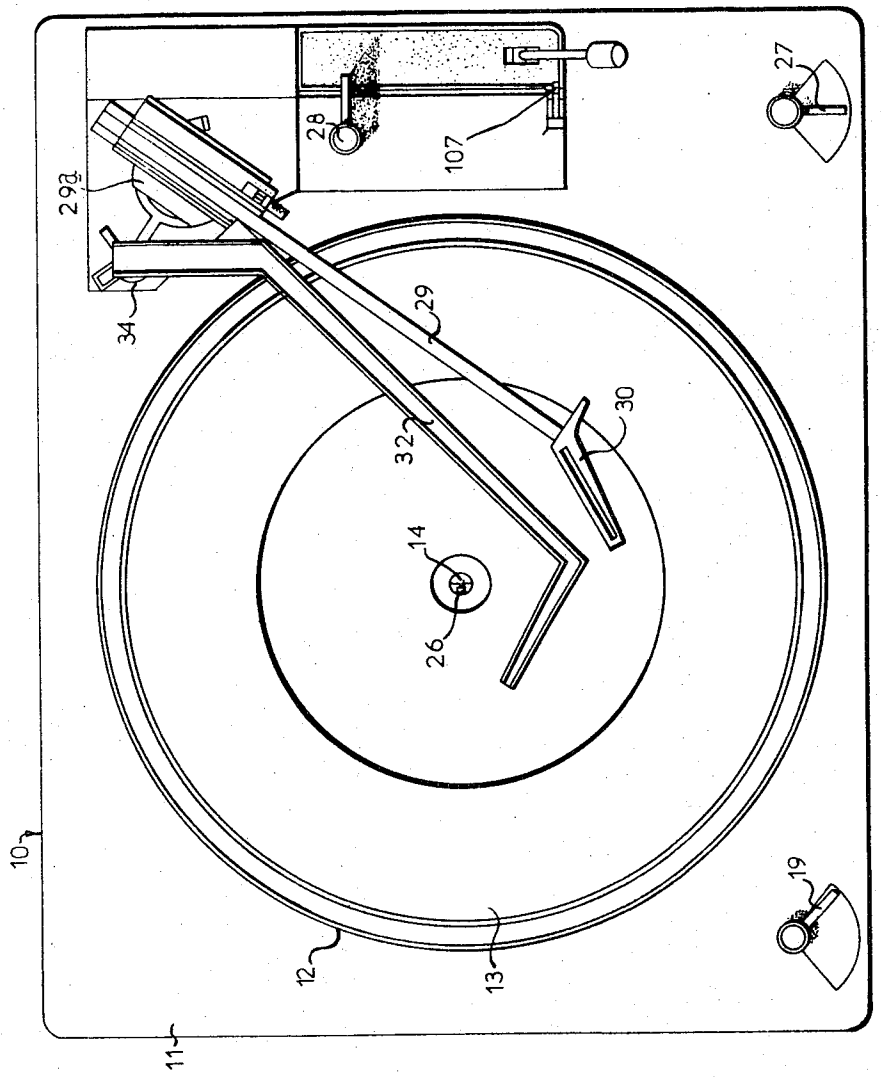


Fig. 1

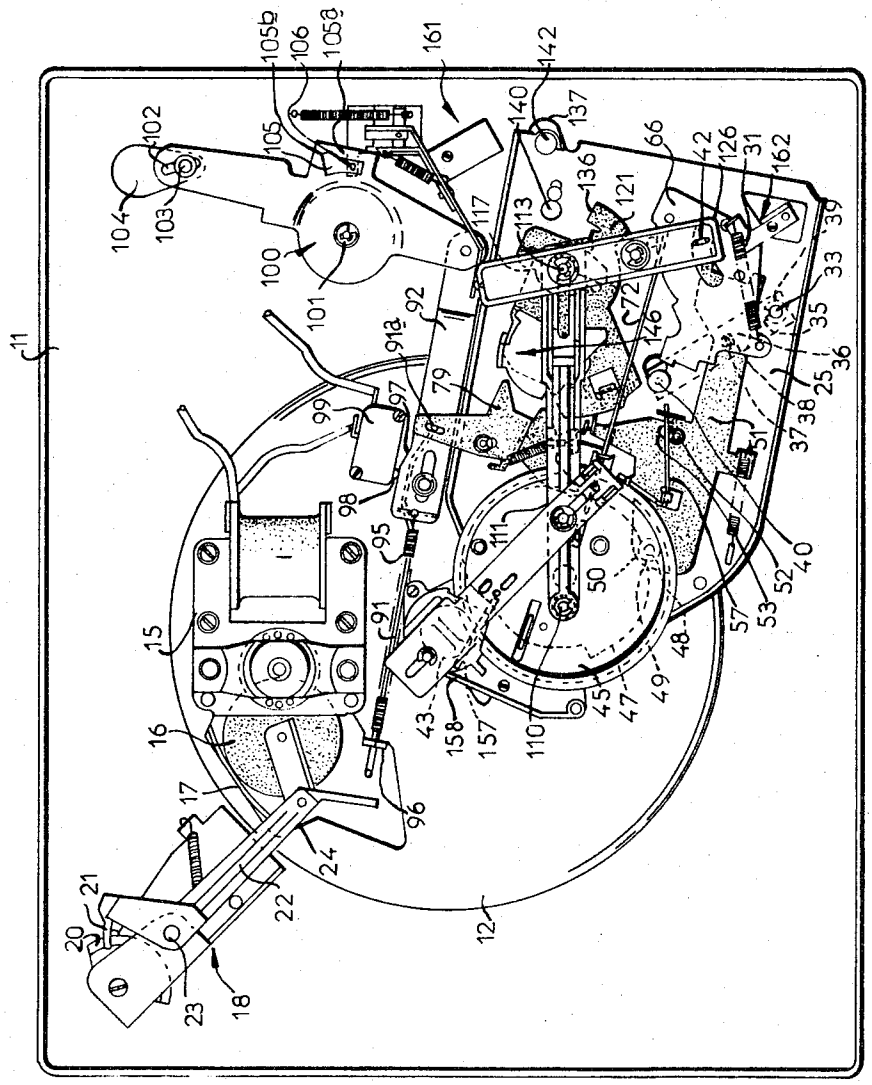

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Fig. 2

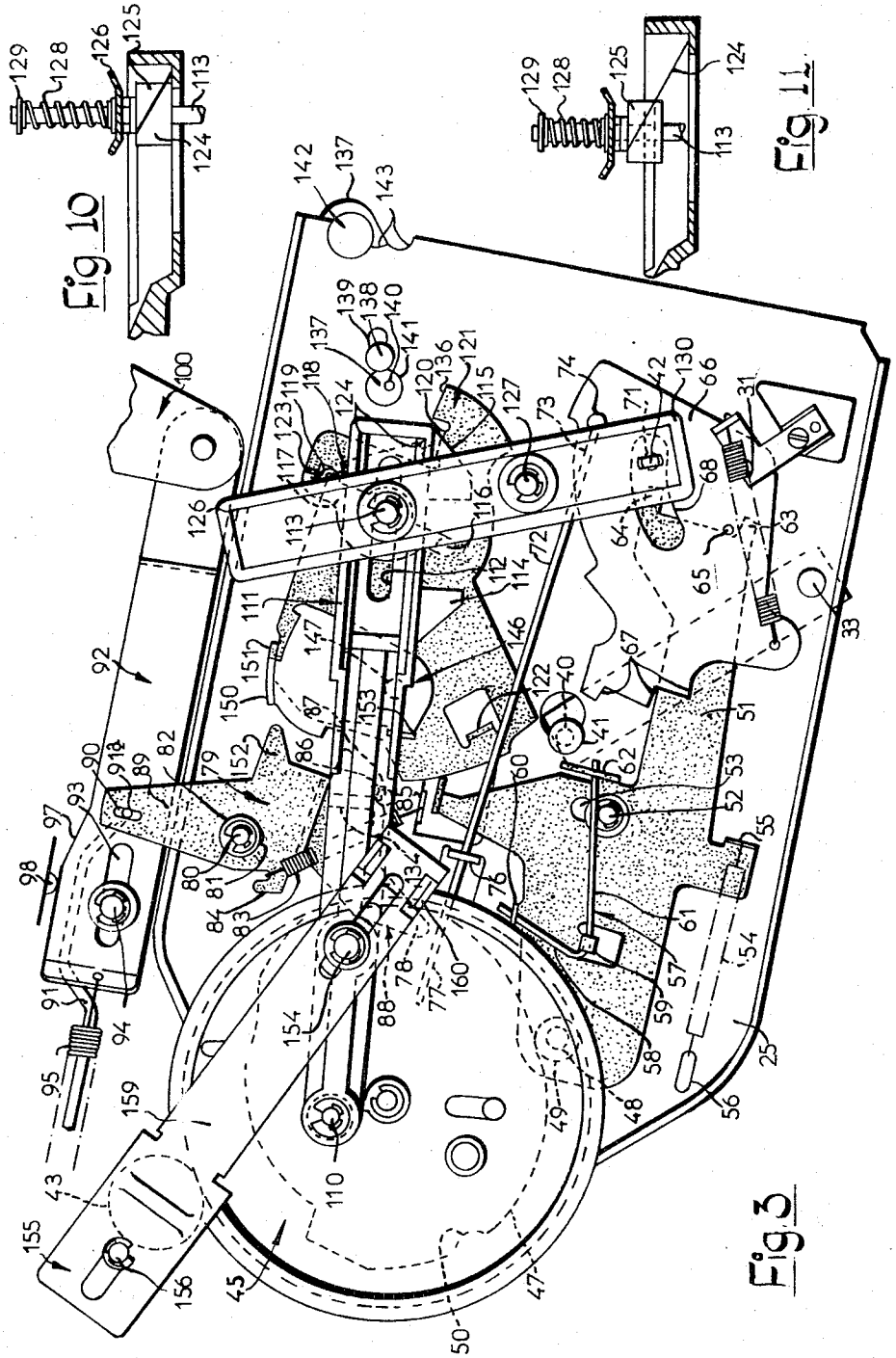

Fig. 10

Fig. 11

Fig. 3

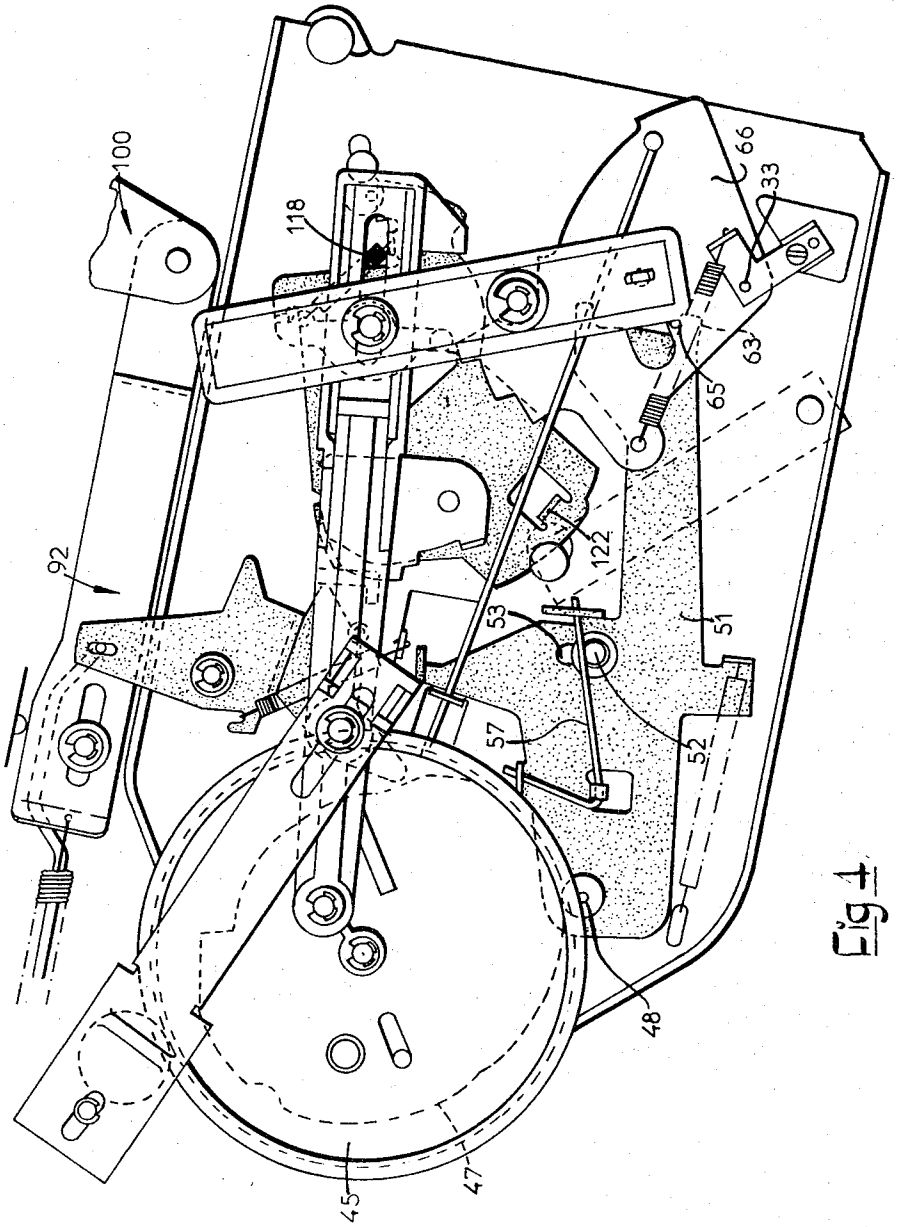

Fig 1

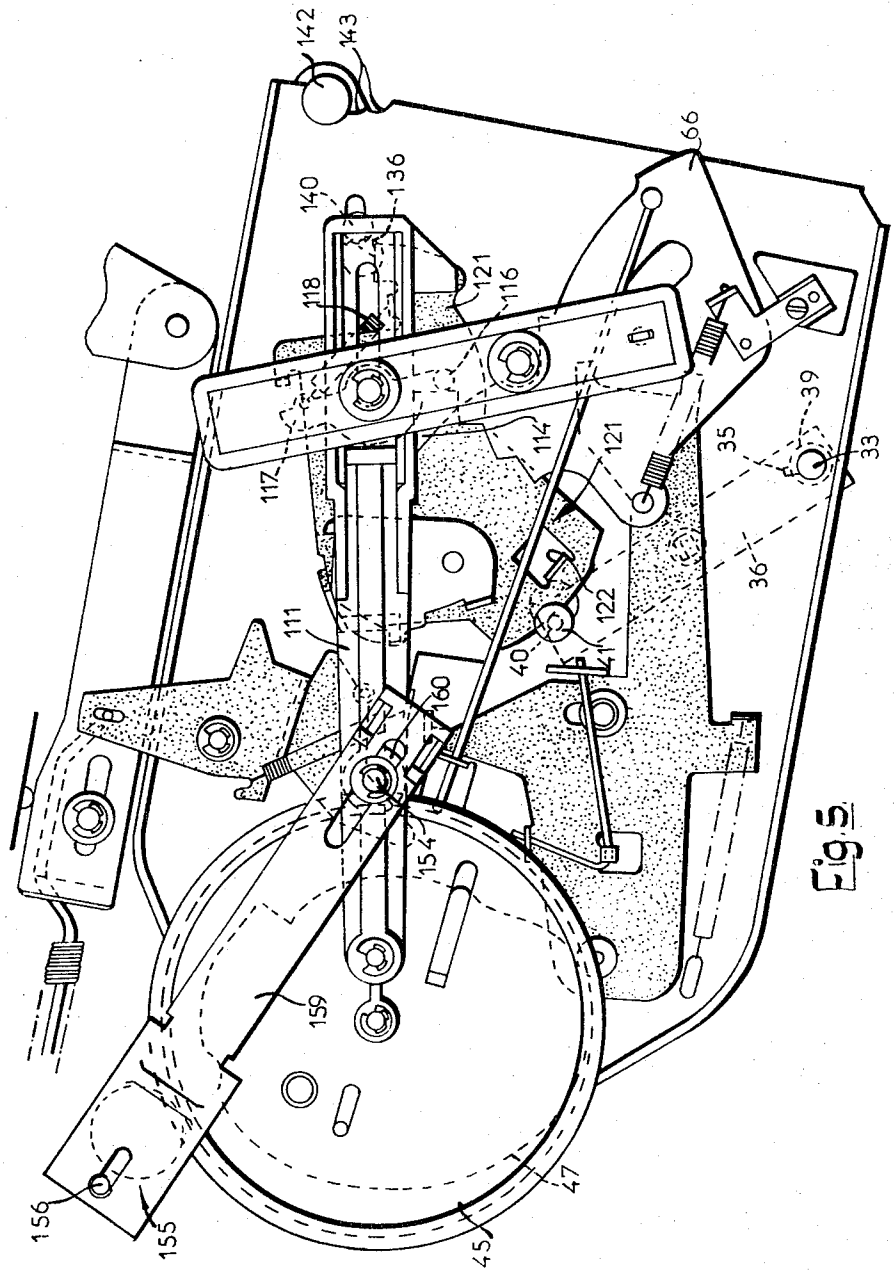
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Fig. 5

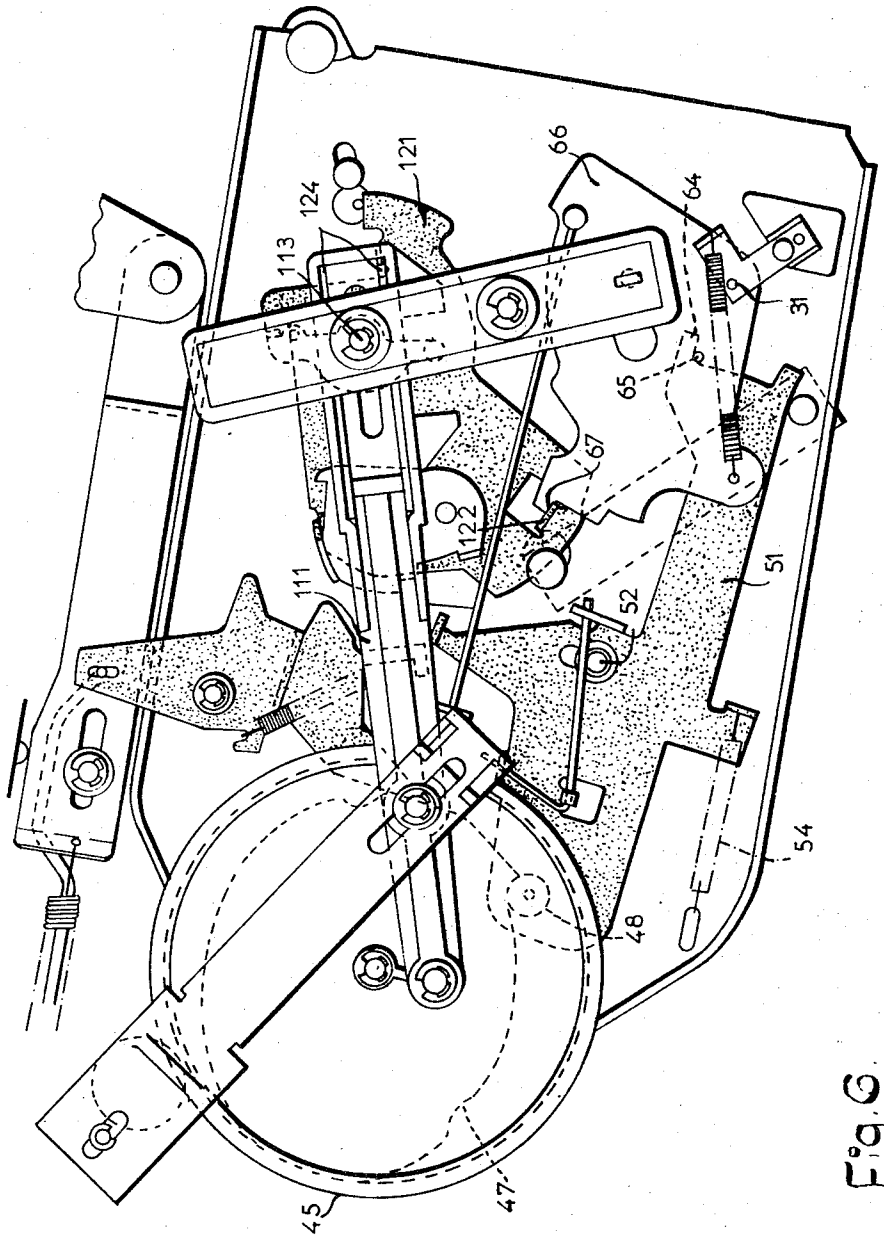

Fig. 6

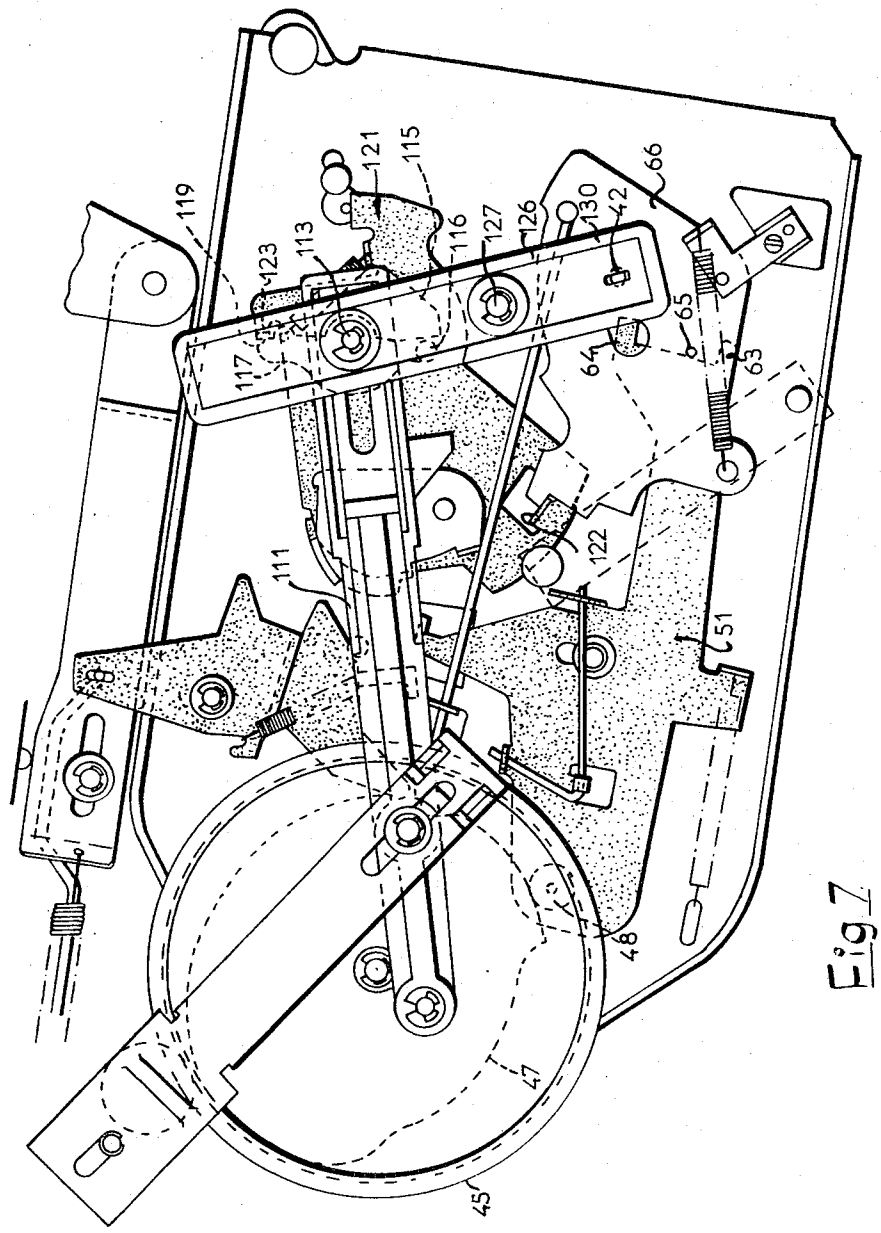
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Fig 7

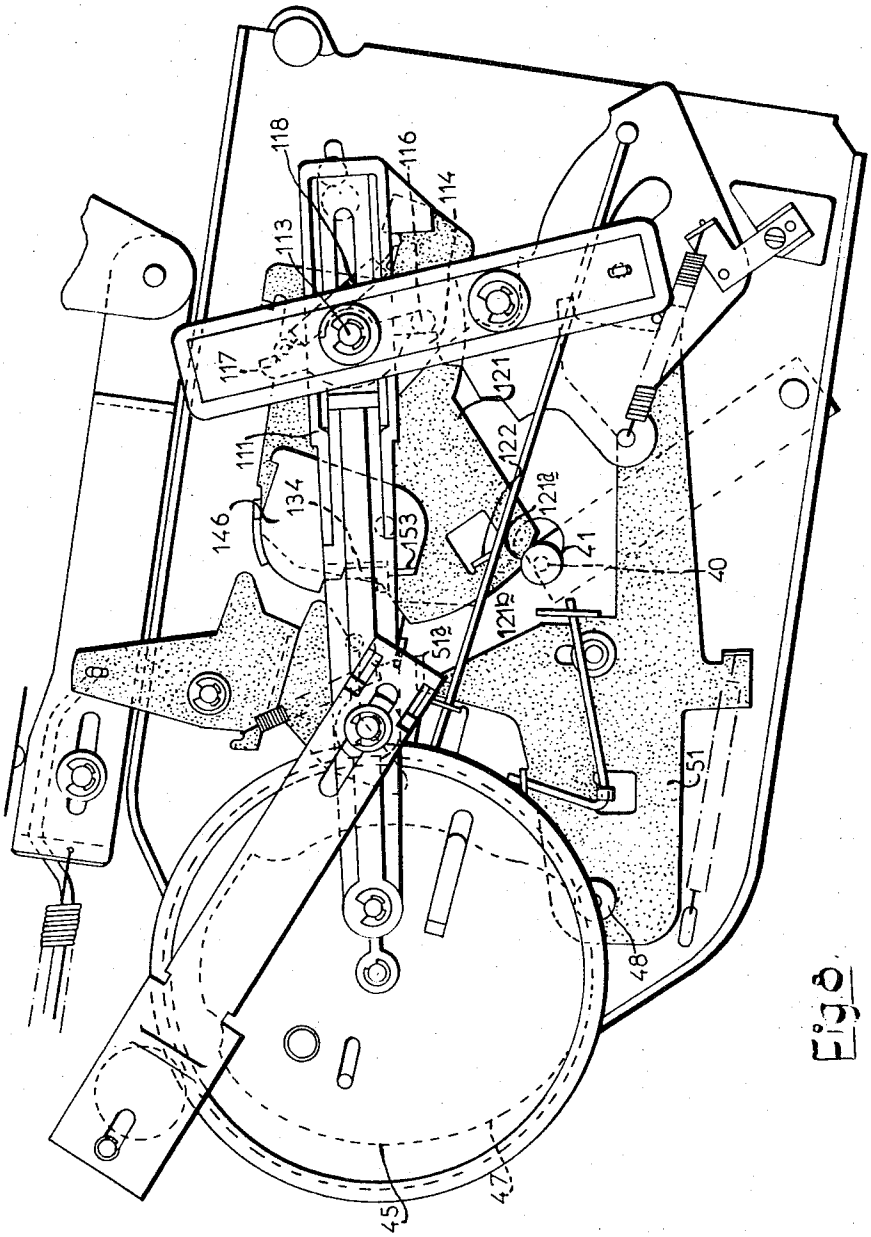
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Fig 8

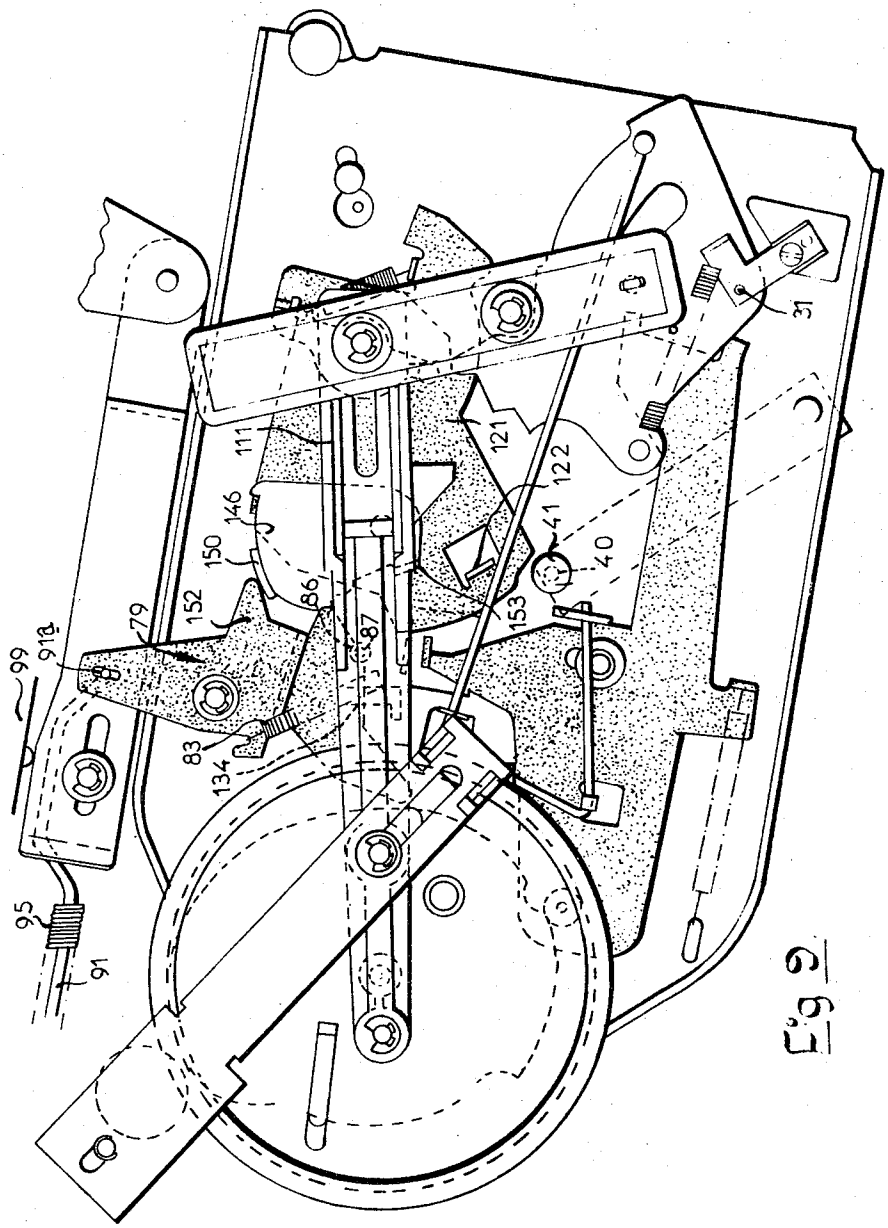

Fig. 6

RECORD PLAYERS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an automatic record player for playing disc records of different sizes of the type comprising a deck plate, a turntable rotatably mounted on plate and driven, in use, by an electric motor, a centre spindle extending upwardly from the centre of the turntable and from which records are fed singly in succession from the bottom of the stack on to the turntable, a pick-up arm, pivotally mounted for movement about a horizontal axis on the upper end of a vertical spindle, the vertical spindle being pivotally mounted for movement about a vertical axis relative to the deck plate, a selector plate provided on the vertical spindle for rotation therewith, the selector plate having a plurality of abutment edges angularly spaced apart around the axis of the vertical spindle and at different radial distances thereform, a selector latch movable from a first position in which free movement of the selector plate is permitted into a second position for engagement with a desired one of the abutment edges to limit pivotal movement of the selector plate, the position of the selector latch being adjustable so that it is in a position to engage the appropriate one of the abutment edges corresponding to the size of record to be played and to thus halt the inward movement of the pick-up arm in the correct position for the size of record to be played, a drive gear rotatably mounted on the deck plate, and means for rotating the drive gear during a record changing cycle.

In such a known apparatus, there is automatic mechanism, driven from the drive gear, which, after playing each record, causes a cycle of operations to take place, which includes pivoting the pick-up arm about said horizontal axis to raise the pick-up arm to disengage the pick-up from the record player, then pivoting the vertical spindle to swing the pick-up arm outwardly to a position clear of the path of downward movement of the record, then releasing the lowermost record from the stack to drop into the turntable then pivoting the vertical spindle about said vertical axis to swing the pick-up arm inwardly to position the pick-up over the edge of the record to be played and then pivoting the pick-up arm to engage the pick-up with the record.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a new and improved record player of the type specified.

According to the present invention we provide an automatic record player of the type specified, including, a drive link, one end of the drive link being pivotally connected to the drive gear about an axis spaced from, and parallel to, the axis of rotation of the drive gear, the other end of the drive link being mounted on the deck plate for sliding movement relative thereto and for pivotal movement about an axis spaced from, and parallel to, the axis of rotation of the drive gear, the drive link being operative to raise and lower the pick-up arm on movement of the drive link resulting from rotation of the drive gear, selector latch drive means being provided on the drive link to move the selector latch between said first and second positions.

BRIEF DESCRIPTION OF THE DRAWING

The invention will now be described in more detail by way of example with reference to the accompanying drawings wherein,

FIG. **1** is a plan view of a record player embodying the invention, showing the record player at the end of playing a record,

FIG. **2** is an underneath plan view of the record player of FIG. **1**, showing the record player in the same position as in FIG. **1**,

FIG. **3** is an underneath plan view, to an enlarged scale, of part of the record player of FIG. **1** and showing the record player at the end of a first stage of a record changing cycle of operations,

FIG. **4** is a view similar to that of FIG. **3** showing the record player at the end of a second stage of the record changing cycle,

FIG. **5** is a view similar to that of FIG. **3**, showing the record player at the end of a third stage of the record changing cycle,

FIG. **6** is a view similar to that of FIG. **3**, showing the record player at the end of a fourth stage of the record changing cycle,

FIG. **7** is a view similar to that of FIG. **3**, showing the record player at the end of a fifth stage of the record changing cycle,

FIG. **8** is a view similar to that of FIG. **3**, showing the record player just after the end of the third stage of the cycle, but during a switch-off cycle of operations,

FIG. **9** is a view simiilar to that of FIG. **3**, showing the record player during a sixth stage of the cycle but during a switch off cycle of operations,

FIG. **10** is a fragmentary cross-section view showing part of the record player during the first part of the cycle, and,

FIG. **11** is a fragmentary cross-section view showing part of the record player at a later stage during the first part of the cycle.

Referring to the Figures, a record player is indicated generally at **10** and comprises a deck plate **11** having a circular well **12** formed therein within which a turntable **13** is rotatably mounted about a vertical axis **14** and driven by means of an electric motor **15** in conventional manner by means of a jockey pulley **16** interposed between the rim **17** of the turntable and a stepped spindle not shown, of the motor **15.**

Record speed change means **18** are provided to permit the speed of rotation of the turntable to be adjusted to any one of the usual three desired speeds, namely 78 r.p.m., 45 r.p.m. and 33⅓ r.p.m. The record speed change mechanism **18** comprises a hand engageable member **19** connected to a rotary cam member **20** which engage one end **21** of a two-armed lever **22** pivotally and slidably mounted on the deck plate **11,** as indicated at **23.** The other end **24** of the lever **23** carries the jockey pulley **16.**

As the hand engageable member **19** is rotated the cam member **20** causes the two-armed lever **22** to be moved vertically up and down so that the jockey pulley **16** can be engaged with a desired one of the steps on the stepped motor spindle. In addition, as the two-armed lever **22** is moved between the steps on the spindle both in an upward and in a downward direction the lever **22** is rotated to lift the jockey pulley **16** out of engagement with the spindle.

A sub-plate **25** is mounted beneath the deck plate **11** and a centre spindle **26** of conventional form is provided in the centre of the turntable **13** to support a stack of records thereon in conventional manner. The centre spindle **26** has the ususal rocking lever and ledge to enable a single record to be dropped from the bottom of the stack of records onto the turntable **13** or onto the top of a record already on the turntable.

The deck plate **11** is provided with a manually operable "on/off" lever **27** and a manually operable record size selector lever **28.** A pick-up arm **29** carrying a pick-up head **30** is pivotally mounted on the upper end of a vertical spindle **31** for up and down movement about a horizontal axis and the vertical spindle **31** is mounted on the deck plate **11** for movement about a vertical axis to allow swinging movement of the pick-up arm **29** inwardly and outwardly of the turntable **13.** In addition, a record control arm **32** is pivotally and slidably mounted on the deck plate **11** in conventional manner by means of a spindle **33,** the lower end of which is engaged in an aperture in the subplate **25,** and the upper end of which is journalled in a bearing provided on a boss **34** upstanding from the deck plate. The spindle **33** carries a radial projection **35** on the part of the spindle **33** which extends between the deck plate **11** and the sub-plate **25.** Engaged around the spindle **33** between the projection **35** and the upper end of the boss **34** is a coil compression spring which urges the spindle **33,** and hence the record control arm **32,** downwardly to supplement the effect of gravity thereon.

The radial projection **35** of the spindle **33** is arranged to engage a lever **36** mounted, adjacent its mid-point, on the upper side of the sub-plate **11** by means of a headed tag **37** pushed out of the sub-plate, and there being a coil compression spring **38** engaged between the sub-plate and the underside of the lever. A further coil compression spring **39** is engaged between the sub-plate and the end of the lever **36** engaged by the projection **35.** The opposite end of the lever **36** to that engaged by the projection **35** is engaged with one end of a trip latch pin **40** which extends through the sub-plate **25** and the opposite end of which has an enlarged head **41** disposed on the underside of the sub-plate **11.** When the control arm **32,** and hence the projection **35,** moves downwardly the lever **36** is caused to pivot about its mounting on the sub-plate so that said opposite end thereof moves upwardly to permit the strip latch to move upwardly. The coil compression spring **38** permits movement of the lever **36** away from the head of the tag **37** when pivotal movement of the lever **36** is completed, but downward movement of the spindle **33** continues.

A pick-up arm raising spindle **42** is mounted in an aperture in the sub-plate **25** and in a boss, not shown, on the deck plate for sliding up and down movement in a vertical direction. The upper end of the spindle **42** engages a portion **29***a* of the pick-up arm **29** so that the pick-up arm is pivoted up and down about its horizontal axis in accordance with up and down movement of the spindle **42.**

Referring now particularly to FIGS. **2** and **3,** the turntable **13** has a pinion **43** formed integrally therewith, and surrounding the centre spindle **26,** and adapted to engage with gear teeth, not shown, provided on a drive gear **45** rotatably mounted on the sub-plate **25.** The drive gear **45** has a number of teeth omitted and is provided with a pawl mechanism of conventional form so that when a record changing cycle of operations is desired the pawl is moved into position for engagement by a dog, not shown, provided on the turntable beneath the pinion **43** to initiate rotation of the drive gear **45** and engage the teeth thereon with the pinion **43.** When the drive gear has been rotated through a single revolution the gap in the teeth is again aligned with the pinion and the pawl mechanism has been moved out of position for engagement with the dog and hence the drive gear is rotated through only a single revolution.

The drive gear **45,** which is made as a die casting, has formed integrally therewith a radially outwardly facing cam surface **47** and a drive pillar **48** which may be provided with a roller **49** is engaged with the cam surface **47.** The cam surface **47** is provided with a recess **50** to act in co-operation with the roller **49** to locate the drive gear in its "at rest" position, shown in FIG. **2,** in which the gap in the teeth is aligned with the pinion **43.**

The drive pillar **48** is carried on a drive lever **51** which is mounted on the underside of the sub-plate **25** by means of a downwardly extending pivot post **52** fixed to the sub-plate **25** and which is engaged with a transversely extending slot **53** formed in the drive lever **51.** A coil compression spring **54** is engaged between a down-turned lug **55** on the lever **51** and an aperture **56** is provided in the sub-plate **25,** in addition, an overload spring **57** in the form of a two-armed wire is engaged with the lever **51,** one arm **58** thereof extending between downwardly extending lugs **59** and **60** on the level **51.** The other arm **61** extends from the lug **59** to engage the pivot post **52** whilst the free end of the arm **61** is engaged in a horizontal slot in a lug **62** on the lever **51** to prevent movement of the spring **57** in a direction normal to the plane of the lever **51** whilst permitting movement of the arm **61** in a plane parallel thereto.

The coil compression spring **54** is provided to rotate the drive lever **51** about the pivot post **52** to provide a drive to the record player pick-up arm in a direction inwardly of the record, as hereinafter to be described, whilst the spring **57** provides an overload arrangement if the pick-up arm is moved forcibly outwardly.

The end of the lever **51** remote from the pillar **48** is bifurcated to provide a fork having two limbs **63** and **64** between which is engaged a selector plate drive peg **65** depending downwardly from a selector plate **66.**

The selector plate **66** is fixed to the pick-up arm vertical spindle **31** and is of generally conventional form, having three abutment surfaces **67** which are spaced angularly about the axis of pivot of the vertical spindle **31** and are spaced at different radial distances therefrom. A part annular slot **68** is formed in the selector plate **66** to accommodate the pick-up arm raising spindle **42** and a coil compression spring, not shown, is engaged around the spindle **42** above a circlip, not shown, to act on the selector plate **66** through a washer **71** when the spindle **42** is raised as described hereinafter.

A wire **72** is pivotally connected at one end **73** to a downwardly extending pin **74** of the selector plate **66** whilst the other end of the wire **72** extends through an aperture formed in a lug **76** in the sub-plate **25** so that the wire **72** is guided for sliding movement in its longitudinal direction. The end **77** of the wire **72** is positioned adjacent to the periphery of the drive gear **45** for engagement with the pawl mechanism thereof, as will hereinafter be described.

Also positioned adjacent the periphery of the drive gear **45** to operate on the pawl mechanism thereof is an end portion **78** of one arm **88** of a two-armed cut-off lever **79** pivoted adjacent its mid-point on a pin **80** extending downwardly from the sub-plate **25** and engaged in a slot **81** formed in the lever **79** and retained in position thereon by means of a circlip **82.** A coil tension spring **83** extends between a lug **84** on the cut-off lever **79** and a lug **85** provided on the sub-plate **25.**

An indent part **86** is formed in one edge of the lever **79** for engagement with a pin **87** depending downwardly from the sub-plate **25** and the spring **83** urges the lever **79** in the direction to engage the edge thereof containing the indent part **86** with the pin **87.** The other arm **89** of the lever **79** is provided with a slot **90** in which is engaged an end part **91***a*, of a link **91,** depending downwardly through a switch slide **92,** which itself has a longitudinal extending slot **93** in which is engaged a pin **94** depending downwardly from the deck plate. A coil tension spring **95** extends between the slide **92** and a lug **96** depending downwardly from the deck plate. A cam surface **97** is provided on the switch slide **92** to engage the operating member **98** of an electric "on/off" switch **99.**

The other end of the slide **92** is pivotally connected to a switch-off lever **100** which is pivotally mounted on the deck plate adjacent its mid-point by a pivot pin **101.** The opposite end of the switch-off lever **100** has an inclined slot **102** formed therein in which is engaged a pin **103** fixed to an "on/off" reject plate **104** pivotally mounted on the deck plate and having the hereinbefore mentioned "on/off" lever **27** mounted thereon on the top side of the deck plate **11.**

The switch-off lever **100** has a cam track **105** provided thereon with which is engaged the lower end **106** of a pick-up arm rest clamp lever **107.**

The drive gear **45** carries a pin **110** which pivotally connects one end of a drive link **111** thereto. At its other end the drive link **111** is provided with a longitudinally extending slot **112** within which a selector control pivot post **113** is received.

The link **11** is made as a moulding in a suitable synthetic plastics material and has formed integrally therewith a pair of lugs **114** and **115** spaced apart in the longitudinal direction of the link. The lugs **114** and **115** are provided to alternately engage with a pin **116** moulded integrally with a selector latch drive moulding **117** also made of synthetic plastics material and rotatably mounted on the post **113.** A coil tension spring **118** is connected between a part **119** of the selector drive latch moulding and a lug **120** formed integrally on a selector latch **121** which is also mounted for pivotal movement about the post **113,** and which is provided with a lug **122** for engagement with one of the abutment surfaces **67** of the selector plate **66,** as hereinafter to be described in more detail. The selector latch **121** has an abutment **123** for engagement with the part **119** of the selector latch drive moulding **117.**

The underside of the portion of the drive link **111** adjacent the selector control pivot post **113** is provided with a pair of longitudinally extending ramp surfaces **124** which are inclined upwards to diminish in height towards the free end of the drive link **111.** The ramp surfaces **124** have engaged therebetween a shouldered bush **125** on the post **113** whereby the shoulder of the bush **125** lies under the ramp surfaces **124.** The shouldered portion lies above a transfer lever **126** which is pivoted adjacent its midpoint on a post **127** depending downwardly from the sub-plate **25,** there being a coil compression spring **128** engaged around the post **127** beneath the lever **126** and retained thereon by means of a circlip **129.** The end **130** of the lever **126** remote from the post **117** is adapted to engage a shoulder on the control arm lever raising spindle **42.**

Referring now to the selector latch **121,** the position which this latch occupies so that the lug **122** thereof is positioned for engagement with a desired one of the abutment surfaces **67** is determined by means of the record size selector lever **28** which is connected to a shaft which carries a size selector control lever beneath the deck plate **11.** The size selector control lever has a slot in which is engaged a pin carried on a selector control plate **137** slidably and pivotally mounted above the sub-plate **25** by engagement of a headed pin **138** in a slot **139.** A pin **140** is carried by the selector control plate **137** and projects through an aperture **141** in the sub-plate **25** for engagement with a part **136** of the selector latch **121.** The selector control plate **137** has a roller-like element **142** which can be engaged in one of three notches **143** formed on the end of the sub-plate **25.** A coil tension spring is connected between the plate **137** and the sub-plate **25** to urge the roller-like element **142** into engagement with a desired one of the notches **143.**

Thus, by movement of the knob **28** the angular position of the control lever **134,** and hence of the plate **137,** may be adjusted whereby the pin **140** carried on the control plate **137** is moved towards and away from the part **136** of the selector latch **121.**

The selector latch **121** carries a cut-out latch **146** mounted for pivotal movement on the selector latch **121** about a pin **147.** A coil compression spring, not shown, is engaged between a circlip, not shown, on the pin **147** and the latch **146** to provide a frictional restraint to pivot the latch **146.** The cut-out latch **146** has a downwardly extending abutment portion **150** for engagement with a stop lug **151** of the selector latch to limit rotation of the cut-out latch in a clockwise direction in FIG. **2** and hence to locate the cut-out latch **146** in a first position relative to the selector latch **121** during a normal record playing cycle. The downwardly extending abutment portion **150** can also engage with a part **152** provided on the cutoff lever **79** when the cut-out latch **146** is in a second position relative to the selector latch **121** during a "switch-off" cycle of operations.

The cut-off latch **146** has a further downwardly extending lug **153** for engagement with an upwardly extending abutment **134** moulded integrally with the drive link **111,** as hereinafter to be described in more detail.

The drive link **111** carries a record feed lever drive peg **154** on its undersurface and a record feed lever **155** is slidably and pivotally mounted on the base plate adjacent the underside of the centre spindle, as indicated at **156,** to operate the rocking lever of the spindle in conventional manner. A light coil tension spring **157** is provided between the lever **155** and the deck plate at **158** in order to give a light upward pressure to the feed lever to ensure that it remains in engagement with the lower end of the rocking lever of the spindle.

The feed lever is of two-part construction, comprising a main part **159** and a slider part **160** mounted for sliding movement relative to the main part **159** and en-

gaged with the pin **152.** A relatively heavy coil tension spring is provided between the parts **159** and **160** so that initially the two parts move together but when the maximum extent of movement of the main part **159** has been reached, continued movement of the feed lever drive peg **154** is permitted due to extension of the relatively heavy coil tension spring.

The operation of the record player will now be described during a normal record changing cycle after the playing of at least one record and before the playing of the last of a stack of records.

The cycle will be described starting from a position in which a record is nearing the end of playing. The parts of the record player being in the position shown in FIGS. **1** and **2.** When the record has been played the pick-up of the pick-up head **30** engages in the usual run out track on the record, causing a rapid inward movement of the pick-up arm **29,** thus moving the wire **72** longitudinally inwardly to operate the conventional pawl mechanism on the drive gear **45** to engage the teeth thereof with the pinion **43** on the turntable, thus starting the gear **45** to rotate in a clockwise direction in FIG. **2.**

In order to facilitate description of the record player reference will be made to various stages of rotation of the drive gear which will be described by the extent of angular rotation of the drive gear **45.** It should be appreciated, however, that the specified degrees of rotation are merely approximate to facilitate understanding of the operation of the record player and they are not the precise degrees of rotation at which, in practice, the various stages begin and terminate.

During the first 75° of rotation of the drive gear **45** from the position shown in FIG. **2** to that shown in FIG. **3** the pick-up arm **29** is raised. This is achieved in the following manner.

As the drive gear **45** rotates the drive link **111** is moved to the left in FIG. **2.** It will be appreciated that because the link **111** is slidably and pivotally mounted on the selector control pivot post **113** and is pivotally connected to the drive gear **45** the link moves in the manner of a crank shaft.

The component of movement of the link **111** to the left causes the ramp **124** formed on the underside thereof to engage the shoulder on the hereinbefore described boss **125,** thereby causing the end of the transfer lever **138** engaged with the post **113** to move downwardly so that the end thereof engaged with the pick-up arm raising spindle **42** is moved upwardly so that the pick-up head **30** is lifted out of engagement with the record.

The coil compression spring engaged between the end of the transfer lever **130** and the selector plate **66** is compressed when the pick-up arm **29** is raised, thus exerting a frictional force on the selector plate **66** to restrain any tendency for pivotal movement thereof, and hence of the pick-up arm **29,** about the vertical spindle **31.**

Because the transfer lever **130** is mounted on the post **127** with a coil compression spring interposed between the lever **130** and a circlip on the end of the post, if the pick-up arm **29** is accidentally moved downwardly no damage to the mechanism occurs as the downward movement would cause pivoting of the lever **113** about the post **127** with the coil compression spring on the post **127** being compressed to permit this to occur.

Between **75** and 140° of rotation of the drive gear **45** from the position shown in FIG. **3** to that shown in FIG. **4** the pick-up arm **29** is swung outwardly of the record. This is achieved in the following manner.

The cam surface **47** on the drive gear which is in engagement with the drive pillar **48** on the selector plate drive lever **51** urges the pillar **48** in a direction outwardly of the drive gear **45,** thus pivoting the lever **51** about the pivot post **52.** The limb **63** of the fork engages the selector plate drive peg **65** on the selector plate **66** and pivots the selector plate in a clockwise direction from the position shown in FIG. **3** to that shown in FIG. **4,** thus swinging the pick-up arm **29** outwardly of the record.

Because the pivot post **52** is provided in the slot in the drive lever **51** if the pick-up arm **29** is manually moved inwardly, thus tending to move the lever **51** in the direction to move the pillar **48** against the cam surface **47,** then such movement is permitted as a result of sliding movement of the lever **51** relative to the post **52** against the bias of the spring **57.**

From 140° to 180° of movement of the drive gear **45** from the position shown in FIG. **4** to that shown in FIG. **5** the selector latch **121** is moved into engagement with the selector plate **66** in order to determine the extent of inward movement of the pick-up arm **29** and, during the latter part of this stage, the lowermost record of the stack is dropped into the turntable **13.**

The extent of inward movement of the pick-up arm **29** is determined by selection of the appropriate record size with the manual record size selector lever **28** which moves the selector control lever so that the element **142** is engaged in one of the recesses **143,** thus determining the position of the pin **140** for engagement by the abutment part **136** on the selector latch **121.** As the pin is moved upwardly in FIG. **5** so the extent of pivotal movement of the selector latch **121** in the direction towards the selector plate **66** is reduced and so the positioning of the abutment **122** on the selector latch **121** for engagement with an abutment surface **67** on the selector plate is spaced further from the axis of rotation thereof, thus permitting progressively further inward movement of the pick-up arm **29.**

Movement of the selector latch **121** into position for engagement with the selector plate **66** is achieved by means of engagement of the integral lug **114** on the drive link **11** with the downwardly extending peg **116** provided on the selector drive moulding **117** which rotates the selector drive moulding and thus rotates the selector latch **121** through the spring **118.**

As explained hereinbefore, the extent of rotation of the selector latch **121** is determined as a result of engagement of the abutment part **141** of the latch with the pin **140.** When inward movement of the selector latch **141** to the extent thus determined is achieved further movement of the drive link **111** is permitted to occur because of extension of the spring **118** as shown in FIG. **5.**

As mentioned above, towards the end of this stage of movement the last record of the stack is dropped onto the turntable **13** or onto a record already on the turntable.

This is achieved as a result of the feed lever drive peg **154** on the drive link **111** moving the feed lever **155** to the left in FIG. **5** to cause the rocking lever of the centre spindle **12** to be operated to displace the lowermost record of the stack of records from the shoulder of the

centre spindle and allow it to fall onto the turntable **13** or onto the top of a record already on the turntable.

The movement of the main part **159** of the feed lever **155** to effect operation of the rocking lever is completed before movement of the drive peg **154** in the direction to move the lever to the left in FIG. **5** is completed and continued movement of the peg **154** is permitted due to the two part construction of the lever, permitting the slide part **160** to continue to move due to extension of the spring, as mentioned hereinbefore.

From 180° to 285° of rotation of the drive gear **45** from the position shown in FIG. **5** to that shown in FIG. **6** the pick-up arm **29** is moved inwardly into position for lowering onto the start of a record. This is achieved in the following way.

The drive pillar **48** which is maintained in engagement with the cam surface **47** by the spring **54** is permitted to move inwardly as a result of engagement with a portion of the cam surface **47** which is spaced closer to the axis pivot of the drive gear **45.** Thus, the selector plate drive lever **51** is pivoted in a clockwise direction about the pivot post **52** under the influence of the spring **54** and thus the limb **64** of the fork engages the peg **65** on the selector plate **66** to pivot the selector plate **66** in an anticlockwise direction about its axis of rotation **31,** thus pivoting the pick-up arm **29** inwardly of the record. This inward movement continues until the abutment **122** on the selector latch **121** engages the pre-determined abutment surface **67** depending upon the extent of movement of the latch **121** as described hereinbefore.

In addition, during this phase of rotary movement of the drive gear the drive link **111** starts to move to the right in FIG. **6** but thus far the ramps **124** on the underside thereof are not moved sufficiently to the right for the shouldered boss **125** on the selector control pivot post **113** to be in engagement therewith.

If the selector plate **66** is not to be moved to its innermost position then when the appropriate abutment **67** engages the abutment **122** of the latch plate **121** further pivotal movement of the selector plate **66,** and hence of the drive lever **51,** will be prevented and thus the pillar **48** will be held out of engagement with the cam surface **47.**

From 285° to 305° of rotation of the drive gear **45** from the position shown in FIG. **6** to that shown in FIG. **7** the drive lever **51** is rapidly returned to its neutral position and the pick-up started to be set down onto a record.

The first of these movements is achieved in the first two or three degrees of movement of the drive gear **45** from the position shown in FIG. **6** by the pillar **48,** being engaged by a portion of the cam surface **47** spaced further from the axis of rotation of the drive gear **45** and so the drive lever **51** is returned rapidly to its neutral position so that the limbs **63** and **64** of the fork are spaced from the pin **65** on the selector plate **66** to permit free tracking of the pick-up **29** during playing of the record.

The second of the above movements is achieved due to continued movement of the drive link **111** to the right to the position shown in FIG. **7,** causing the ramps **124** on the underside thereof to permit the shouldered boss **125** provided on the post **113** to move upwardly, thereby causing the end of the transfer lever **126** in the region of the post **113** to move upwardly so that the end **130** thereof moves downwardly to allow the spindle **42** to move downwardly thereby lowering the pick-up head **30** on to the beginning of a record for playing.

From 305° to 360° of rotation of the drive gear **45** from the position shown in FIG. **7** to that shown in FIG. **2** set down of the pick-up arm **29** is completed as a result of continued movement of the drive link **111.** In addition, the selector latch **121** is pivoted to move the abutment **122** thereon out of the path of movement of the abutments **67** on the selector plate **66** to permit free movement thereof during playing of a record.

This is achieved as a result of the drive link **111** continuing to move to the right from the position shown in FIG. **7,** so that the integral lug **115** thereon engages the pin **116** on the selector latch drive moulding **117** and rotates it in a clockwise direction in FIG. **7,** to engage the part **119** thereof with the lug **123** on the selector latch **121,** thus rotating the selector latch **121** clockwise from the position shown in FIG. **7** rapidly back To its original position, shown in FIG. **2,** thereby permitting free movement of the selector plate **66** during tracking of the pick-up arm during playing of a record.

As the drive gear **45** moves up to the 360° position the pawl mechanism is not operative, and so the drive gear **45** comes to rest in the region where the teeth are omitted therefrom, and the drive gear **45** is held in this position by the notch **50** in the cam surface **47** which is engaged by the roller **49** on the drive lever **51.**

The record is then played and the pick-up arm **29** is thus moved gradually inwardly until it reaches the end of playing, whereupon it is again moved rapidly inwardly, causing the wire **72** to again actuate the pawl mechanism to start a further cycle of operations as described hereinbefore.

The manner in which the record player is switched on for the start of playing will now be described with particular reference to FIGS. **1** and **2.**

It will be appreciated that when the record player is first switched on the pick-up arm will be in its outermost position.

The manually operable on/off lever **27** is actuated to pivot the on/off reject plate **104** in an anti-clockwise direction, in FIG. **2,** about its axis, thus pivoting the switch lever **100** to cause the pick-up arm clamp to open, due to engagement of the lower end **106** of the clamp lever **107** thereof with the part **105***a* of the cam surface **105,** and also to slide the switch slide **92** in the direction to operate the electric switch **99** to switch on the electric circuit to the record player.

Continued movement of the on/off lever **27** then causes further movement of the switch slide **92** to rotate the cut-off lever **79** about the pin **80** to engage the arm **88** thereof with the pawl mechanism on the drive gear **45** to start the drive gear rotating. The springs **95** and **83** tend to return the mechanism but the spring **83** also urges the cut-off lever **79** towards the pin **87** so that the return movement of the mechanism is arrested when the detent part **86** engages the pin **87** to afford a latching action for the whole mechanism. The cycle then proceeds as described hereinbefore except that the movements to raise and to pivot the pick-up arm **29** outwardly do not have any effect on the pick-up arm **29,** as it is already raised and in an outward position, except that the arm **29** is raised slightly off its rest.

The end of playing of a stack of records will now be described.

The playing of the penultimate record proceeds as described hereinbefore and the cycle at the end of playing the penultimate record also proceeds as described hereinbefore until the drive gear **45** has moved to the 180° position shown in FIG. **5** whereat the last record has just been fed onto the turntable.

When this occurs, the control arm **32** falls downwardly so that the radial projection **35** on the vertical spindle **33** thereof engages with the lever **36** mounted on the upperside of the sub-plate **25** to cause the lever to move the trip latch pin **40** upwardly under the bias of the spring **39.**

The selector latch member **121** is, at this phase of the cycle, in the position shown in FIG. **5** so the enlarged head **41** is moved up by the spring **39** until it overlaps and engages the edge of the latch member **121.** It will be appreciated that in previous cycles the raised position of the control arm **32** has maintained the head **41** spaced below the selector latch **121,** permitting free movement of the latch **121** above the head **41.**

When the selector latch **121** is moved out of engagement with the selector plate **66,** as described hereinbefore, the trip latch pin **40** moves further upwardly under the bias of the spring **39** until its head **141** engages the underside of the sub-plate **25.** The remainder of this cycle of operations then continues as described hereinbefore.

When the last record has been played the pick-up arm again moves rapidly inwardly to cause the wire to operate the pawl mechanism to start a last record changing cycle.

This cycle continues in the normal manner up to the 140° position of the drive gear.

Continued rotation of the drive gear **45** from this stage to the stage shown in FIG. **8** causes the same operations to occur as in a normal cycle except that, as the selector latch **121** is swung anti-clockwise as a result of engagement between the abutment **114** on the drive link **111** and the pin **116** on the selector latch drive moulding **117** the inward movement of the selector latch is arrested by engagement between an edge portion **121***a* thereof and the head **41** of the trip latch pin **40,** as shown in FIG. **8.** The selector latch drive moulding **117** is permitted to continue to rotate after arrest of the latch **121** due to elongation of the spring **118.**

During the last part of the 140° to 180° stage of movement of the drive gear **45** the centre spindle is again operated but because there is no record thereon this movement is redundant.

Just after the 180° stage the abutment **153** of the cut-out latch **146** is engaged by the upwardly extending abutment **134** of the drive link **111,** as shown in FIG. **8,** and the cut-out latch is thereby caused to rotate from the first position tO the second position mentioned hereinbefore.

During the 180° to 285° phase of movement the selector plate drive lever **51** is tended to be pivoted in a clockwise direction about the pin **52** to move the pick-up arm **29** inwardly. However, movement of the drive lever **51** in this direction is prevented as a result of engagement between an extension part **51***a* thereof and a part **121***b* of the latch plate **121** (see FIG. **8**) and no drive is communicated to the selector plate **66** and so the pick-up arm **29** is not moved inwardly.

From 285° to 360° the pick-up arm **29** is lowered as described hereinbefore, but because it has not been moved inwardly over the record it is lowered onto the rest. At the same time, the selector latch **121** is pivoted to move the abutment **122** thereof out of the path of movement of the abutments **67** on the selector plate **66,** as described hereinbefore, but because the cut-out lever **146** has been moved to the second position described hereinbefore the lug **150** thereof engages with the part **152** of the cut-out lever **79,** as shown in FIg. **9,** to move it against the bias of the spring **83** to disengage the detent **86** and pin **87** to permit the cut-out lever **79** to rotate under the bias of the springs **83** and **95** to operate the switch **99** to switch off the electric motor **15,** to lift the jockey pulley **16** out of engagement with the turntable rim **17** and the stepped spindle of the motor **15** by means of the link **91,** and also to close the clamp of the rest due to engagement of the lower end **106** of the clamp lever **107** with the part **105***b* of the cam surface **105.**

It should be appreciated that the pick-up arm **29** can be moved manually, at any time, over the whole of its range of movement without damage to the mechanism. If the pick-up arm **29** is moved whilst the drive lever **51** is operative to move the pick-up arm **29** inwardly or outwardly then movement of the pick-up arm manually outwardly will cause pivoting of the lever **51** about the post **52** against the bias of the spring **54** to lift the pillar **48** off the cam surface **47.** Alternatively, if the pick-up arm **29** is pivoted inwardly then the lever **51** will slide laterally as a result of movement of the post **52** within the slot **53** against the bias of the spring **57.**

At all other times the lever **51** will be in its neutral position and movement of the pick-up arm over its whole range of movement is permitted because of the spacing between the limbs **63** and **64:**

By spacing the lower end of the pick-up arm vertical spindle **31** and the pick-up arm raising spindle **42** from the selector control pivot post **113** and providing the transfer lever **26** for raising and lowering the pick-up arm the lower end of the pick-up arm vertical spindle **17** is relative unobstructed thereby facilitating the provision of ancillary equipment such as, the viscous set-down device and the anti-skate device indicated generally at **161** and **162** respectively in FIG. **2.**

The switch off mechanism described above prevents any damage to the mechanism of the on/off lever **27** obstructed during automatic switch off.

I claim:

1. An automatic record player for playing disc records of different sizes comrprising a deck plate, a turntable rotatably mounted on the deck plate and driven, in use, by an electric motor, a centre spindle extending upwardly from the centre of the turntable and from which records are fed singly in succession from the bottom of the stack onto the turntable, a pick-up arm, pivotally mounted for movement about a horizontal axis on the upper end of a vertical spindle, the vertical spindle being pivotally mounted for movement about a vertical axis relative to the deck plate, a drive gear rotatably mounted on the deck plate, and means for rotating the drive gear during a record changing cycle, a drive lever, having a first end and a second end, movably mounted on the deck plate, said first end being drivingly connected to the drive gear and said second end being drivingly connected to the vertical spindle to pivot the pick-up arm outwardly and inwardly of the turntable as a result of movement of the drive lever caused by rotation of the drive gear, a selector plate

provided on the vertical spindle for rotation therewith, the selector plate having a plurality of abutments angularly spaced apart around the axis of the vertical spindle, a selector latch movable from a first position in which free movement of the selector plate is permitted into a second position for engagement with a desired one of the abutments to limit pivotal movement of the selector plate, the position of the selector latch being adjustable so that it is in a position to engage the appropriate one of the abutments corresponding to the size of record to be played and to thus halt the inward movement of the pick-up arm in the correct position for the size of record to be played, a drive link, separate from the drive lever, one end of the drive link being pivotally connected to the drive gear, about an axis spaced from, and parallel to, the axis of rotation of the drive gear, the other end of the drive link being mounted relative to the deck plate for sliding movement relative thereto and for pivotal movement about an axis, spaced from, and parallel to, the axis of rotation of the drive gear as a result of rotation of the drive gear, the drive link being operative to raise and lower the pick-up arm on movement of the drive link resulting from rotation of the drive gear, and selector latch drive means being provided on the drive link to move the selector latch between said first and second positions.

2. A record player as claimed in claim **1** wherein the drive means to move the selector latch into said second position comprises a lost motion device to permit continued movement of the drive link after the selector latch has been moved into said second position.

3. A record player as claimed in claim **2,** wherein the lost motion device includes a spring means which communicates drive from the drive link to the selector latch to move the selector latch into said second position, and which is stressed to permit continued movement of the drive link when movement of the selector latch is arrested.

4. A record player as claimed in claim **1** wherein a cut-out latch is mounted on the selector latch for movement relative thereto, an abutment portion provided on the drive link means to position the selector latch in a third position so that during a last record changing cycle at the end of the playing the last record said cut-out latch is in position for engagement with the abutment portion so that movement of the drive link displaces the cut-out latch so that a portion thereof is moved into position for engagement with an element in a switch-off mechanism of the record player, to switch off the record player when the selector latch is moved to said first position.

5. A record player as claimed in claim **4,** wherein said means to position the selector latch in a third position includes a trip element movable betweeen a first position, occupied during a penultimate, or preceding, record changing cycle in which a penultimate record is fed to the turntable to permit the selector latch to move between said first and second position, and a second position, occupied during the last record changing cycle, to position the selector latch in said third position.

6. A record player as claimed in claim **5,** wherein said trip element is moved between said first and second positions during a penultimate record changing cycle in which a last record is fed to the turntable, by means operated by a record steady arm, the trip element being maintained in said first position when the record steady arm is maintained in a raised position due to engagement of a record on the centre spindle, and the trip element being permitted to move towards said second position when the record steady arm is moved to a lowered position when the last record is fed onto the turntable during said penultimate cycle.

7. A record player as claimed in claim **6,** wherein when the trip element is permitted to move towards said second position the selector latch is in said second position and the trip element engages with a part of the selector latch so that movement of the trip element to said second position is not completed until the selector latch is moved to said first position during said penultimate record changing cycle.

8. A record player as claimed in claim **1** wherein the other end of the drive link is mounted for rectilinear sliding movement relative to the deck plate.

9. A record player as claimed in claim **1** wherein the other end of the drive link is pivotally and slidably mounted relative to the deck plate at a position spaced from the pick-up arm vertical spindle.

10. A record player as claimed in claim **1** characterised in that the drive link is provided with cam means whereby movement of the link relative to the deck plate in the longitudinal direction of the link causes movement of a cam follower as a result of engagement thereof with the cam means, said cam follower being connected to a pick-up arm raising spindle whereby the pick-up arm is raised and lowered.

11. A record player as claimed in claim **10,** wherein the cam means causes movement of the cam follower in a direction normal to the plane of the base plate.

12. A record player as claimed in claim **10** wherein a transfer lever is pivotally mounted on the deck plate at a position intermediate the ends thereof, said cam follower acting on the transfer lever adjacent one end, and the other end of the transfer lever being connected to the said pick-up arm raising spindle.

13. A record player as claimed in claim **12** wherein the transfer lever is mounted relative to the deck plate so that the transfer lever may be moved in a direction downwardly relative to the deck plate against resilient biasing means in the event of an overload being applied to the pick-up arm raising spindle.

14. A record player as claimed in claim **13** wherein the transfer lever is mounted on a downwardly depending post there being a coil compression spring engaged around the post between the underside of the transfer lever and an abutment on the post.

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