United States Patent [19]

Miyoshi

[11] **3,848,875**

[45] **Nov. 19, 1974**

[54] **AUTOMATIC RECORD PLAYER**

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[73] Assignee: **Matsushita Electric Industrial Co., Ltd.,** Osaka, Japan

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[21] Appl. No.: **310,708**

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Dec. 6, 1971	Japan	46-98782
Dec. 6, 1971	Japan	46-98783
Dec. 10, 1971	Japan	46-100393
Dec. 10, 1971	Japan	46-100394
Dec. 11, 1971	Japan	46-100482
Dec. 7, 1971	Japan	46-115157[U]
Dec. 7, 1971	Japan	46-115158[U]
Dec. 11, 1971	Japan	46-116972[U]
Dec. 9, 1971	Japan	46-117075[U]
Dec. 9, 1971	Japan	46-117076[U]
Dec. 9, 1971	Japan	46-117078[U]
Dec. 9, 1971	Japan	46-117079[U]
Dec. 8, 1971	Japan	46-117082[U]
Dec. 8, 1971	Japan	46-117083[U]
Dec. 8, 1971	Japan	46-117084[U]
Dec. 8, 1971	Japan	46-117085[U]

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

[51] **Int. Cl.** **G11b 17/08**

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

[56] **References Cited**

UNITED STATES PATENTS

3,625,521	12/1971	Caddy	274/10 R
3,697,087	10/1972	Takahashi	274/10 R
3,762,723	10/1973	Tourtellot	274/10 R

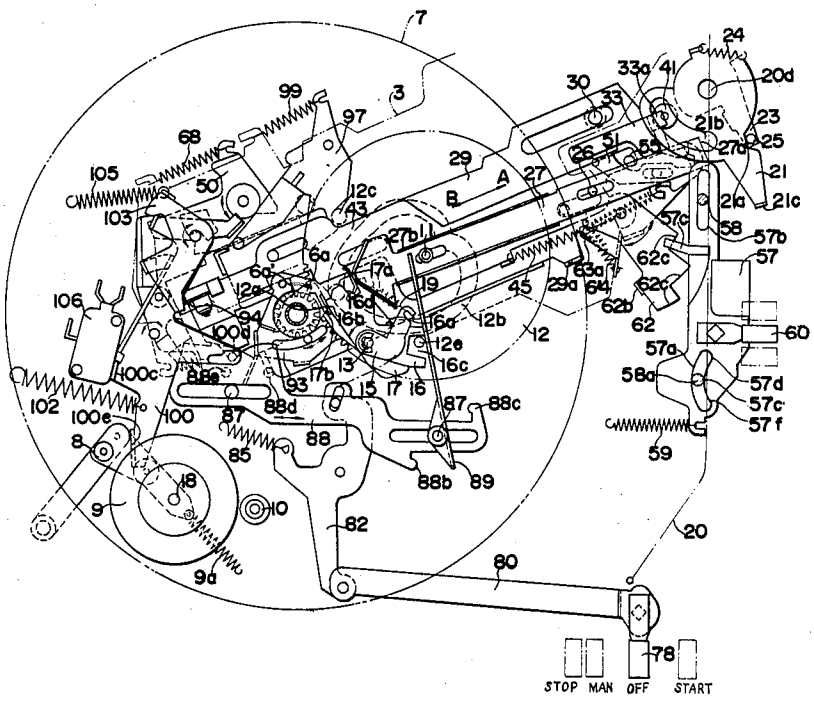
Primary Examiner—Harry N. Haroian

Attorney, Agent, or Firm—Wenderoth, Lind & Ponack

[57] **ABSTRACT**

An automatic record player capable of functioning with various capabilities, which essentially comprises a tonearm, a turntable, a turntable drive system for rotating the turntable at a predetermined speed selected by the setting of a speed control knob, an operational mode control including a control knob manually movable to any one of start, manual and stop positions and a record size selector for permitting the tonearm to be brought to the lead-in groove of a record of a predetermined diameter at the time of start of operation of the record player. The automatic record player herein provided is easily manufactured with a substantial reduction of the costs in manufacture.

8 Claims, 36 Drawing Figures



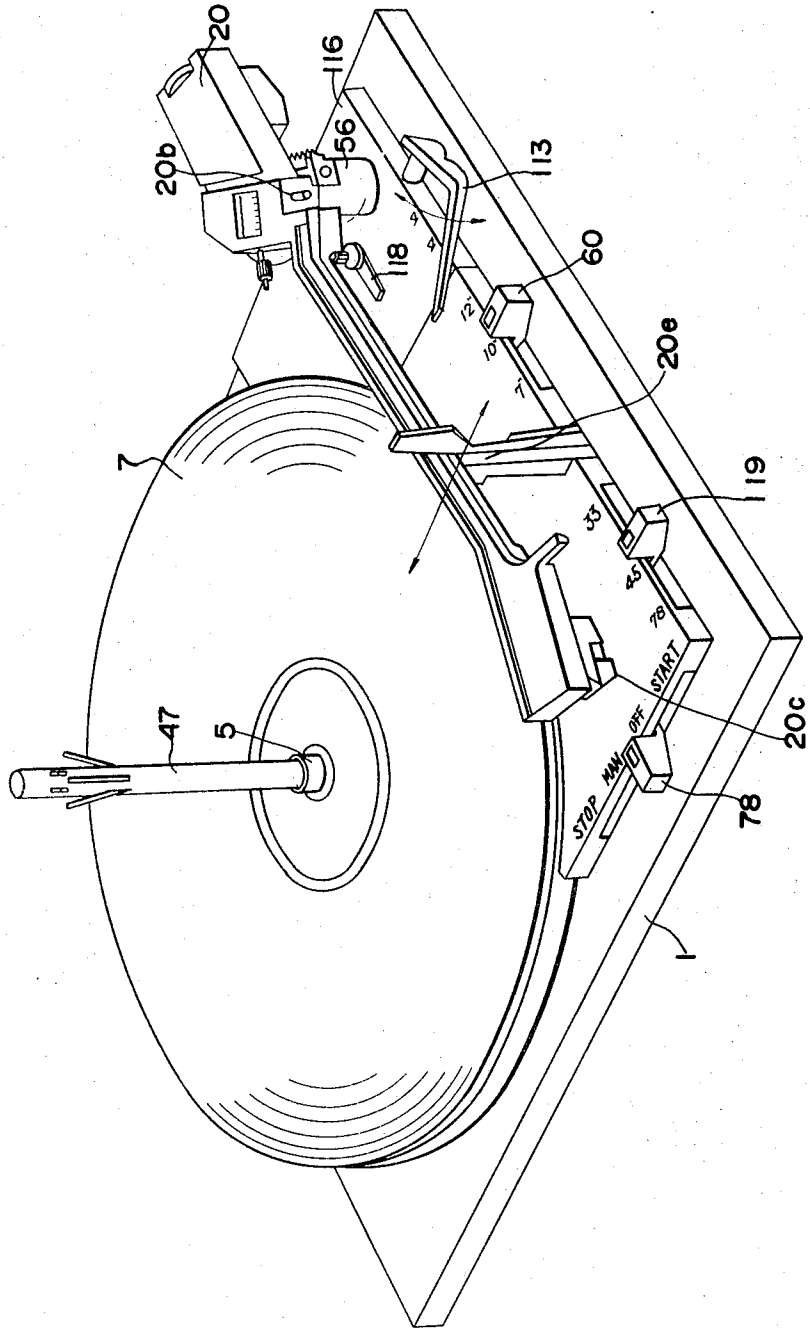


FIG. 1

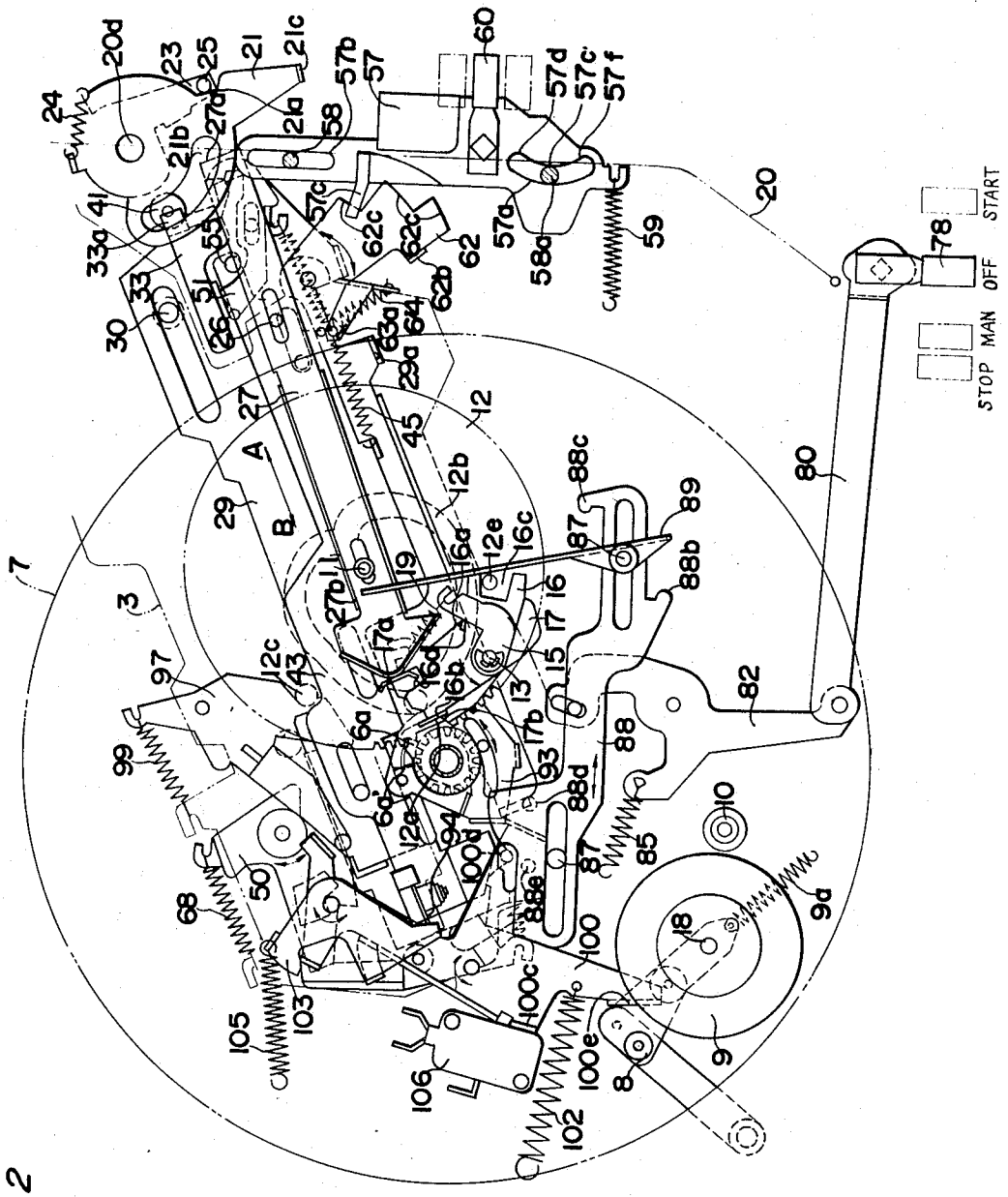


FIG. 2

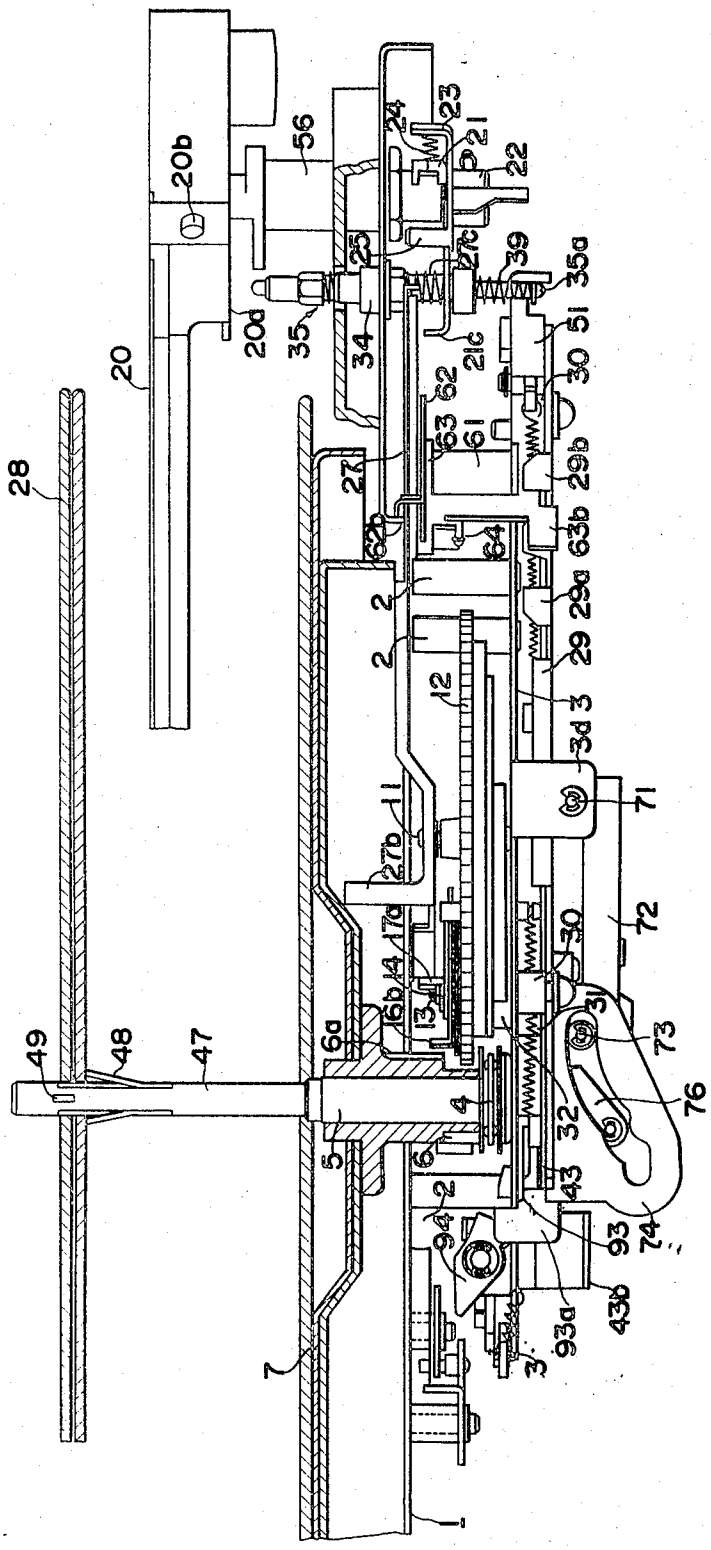
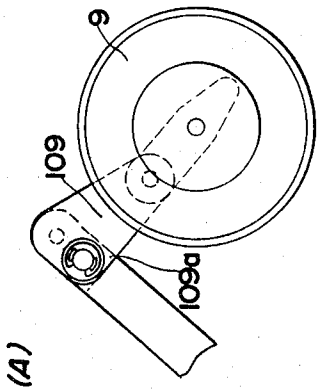

20b
56
24
23
21
22
25
27c
39
35a
20d
35
34
21c
51
30
62
63
61
29b
28
27
20
63b
64
62
29a
2
29
12
3
3d
71
11
27b
72
17a
30
14
16b
13
31
73
49
48
47
6a
4
32
76
5
6
43
2
94
93
74
93a
43b
3'
7
1

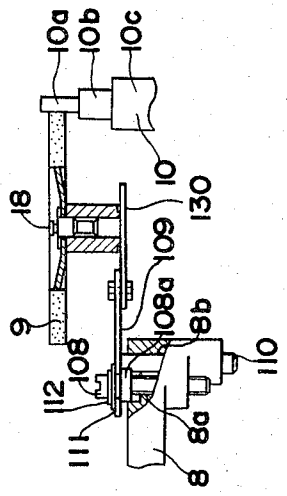
FIG. 3

FIG. 5



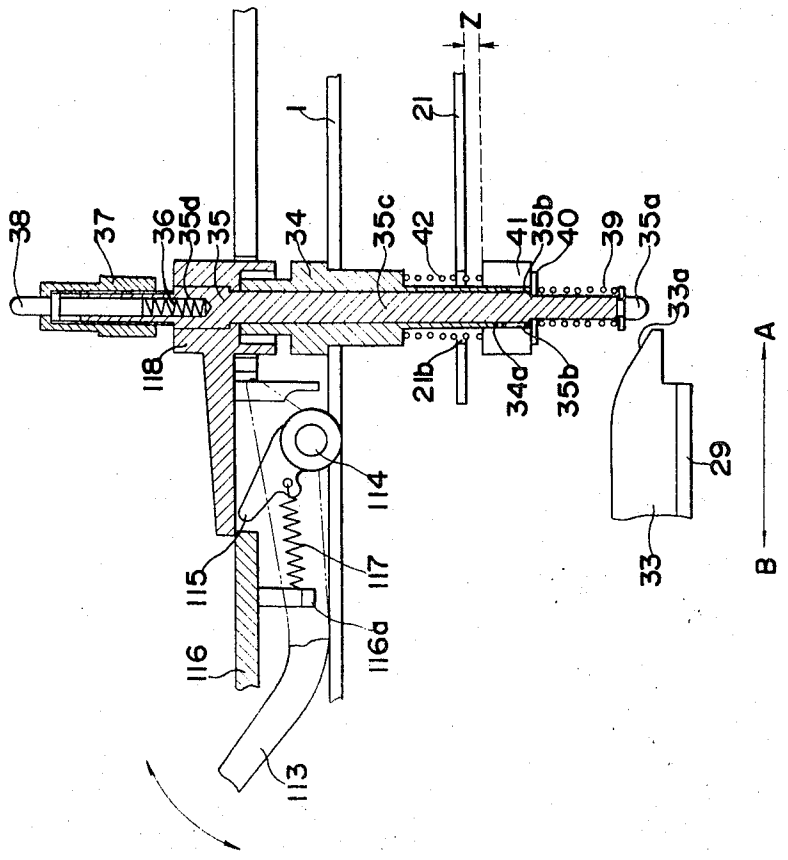
(A)

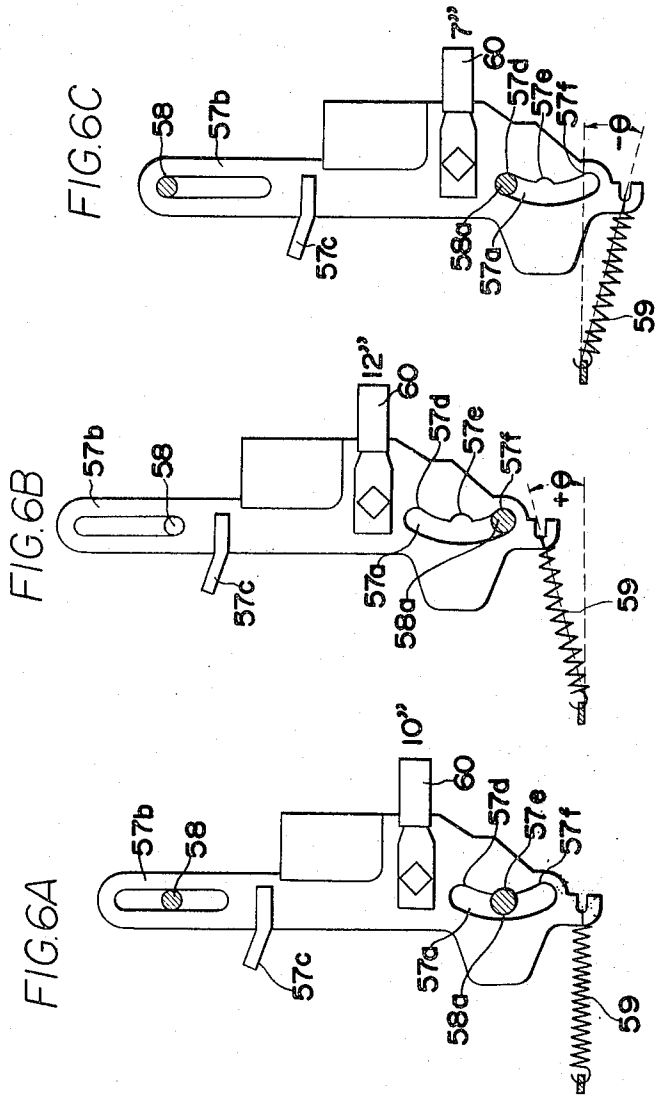
FIG. 5



(B)

FIG. 4




FIG.6C
7"
60
57d
57e
57f
-θ
58
57b
57c
58a
57a
59
FIG.6B
12"
60
57d
57e
57f
+θ
57b
58
57c
57a
58a
59
FIG.6A
10"
60
57d
57e
57f
57b
58
57c
57a
58a
59

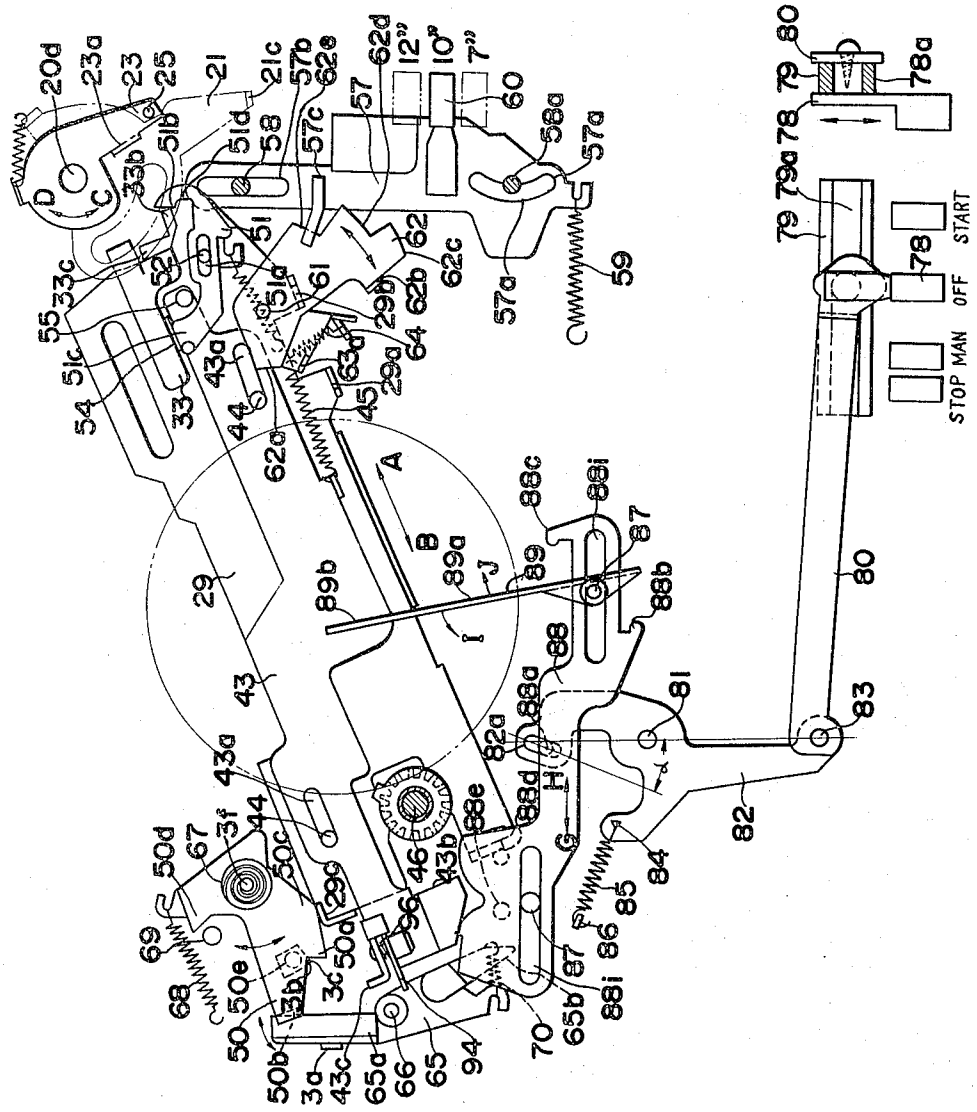


FIG. 7

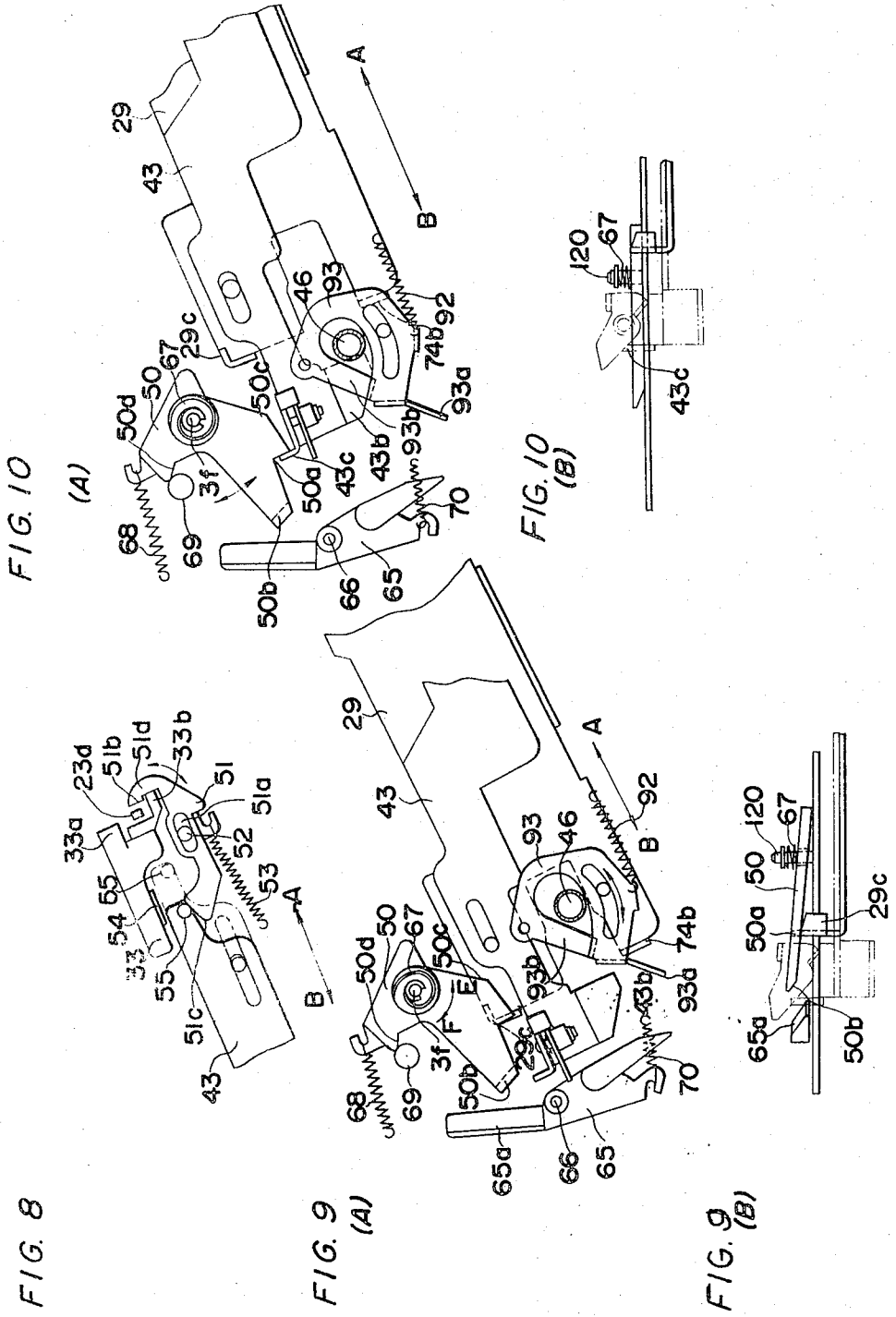

FIG. 10 (A)
FIG. 10 (B)
FIG. 8
FIG. 9 (A)
FIG. 9 (B)

FIG. IIA

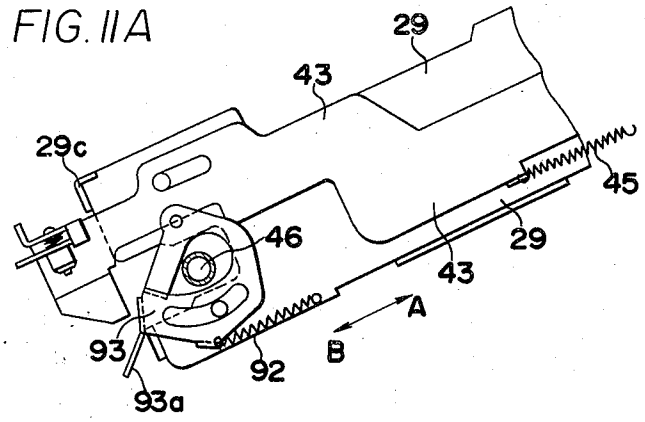


FIG. IIB

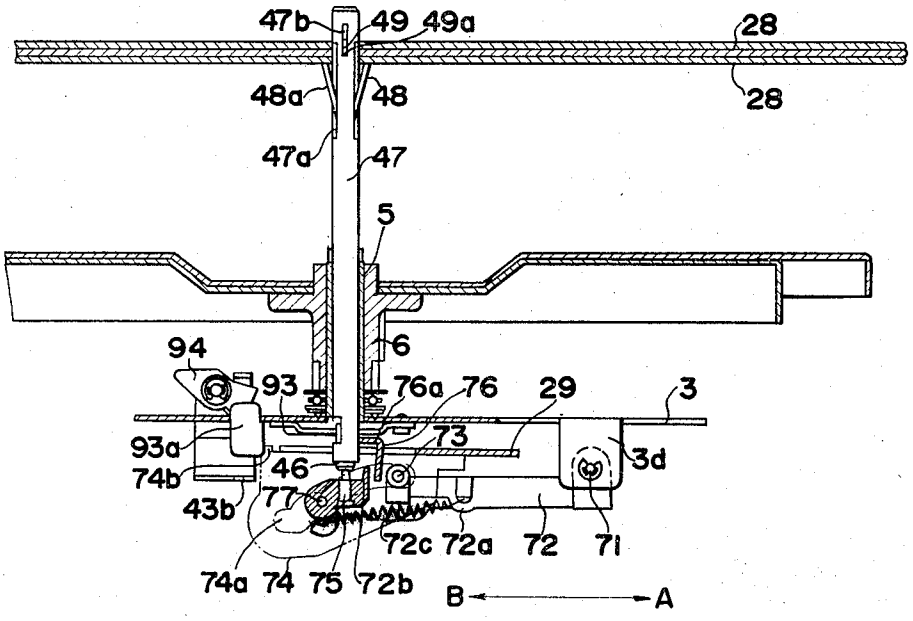


FIG. 12A

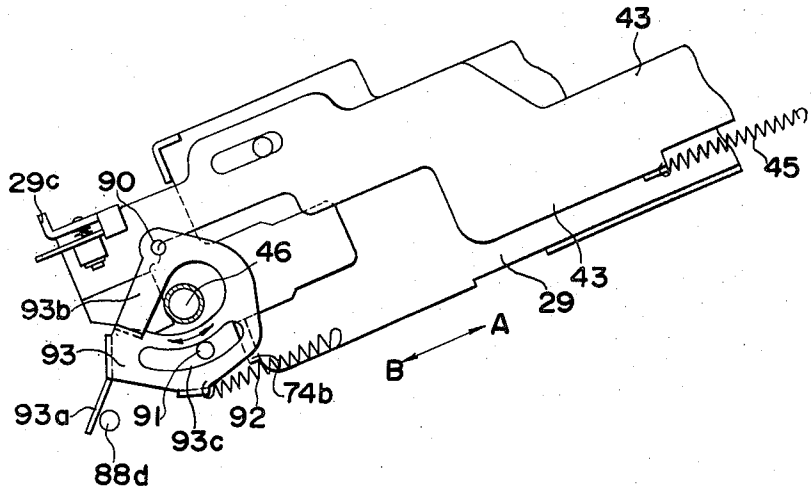


FIG. 12B

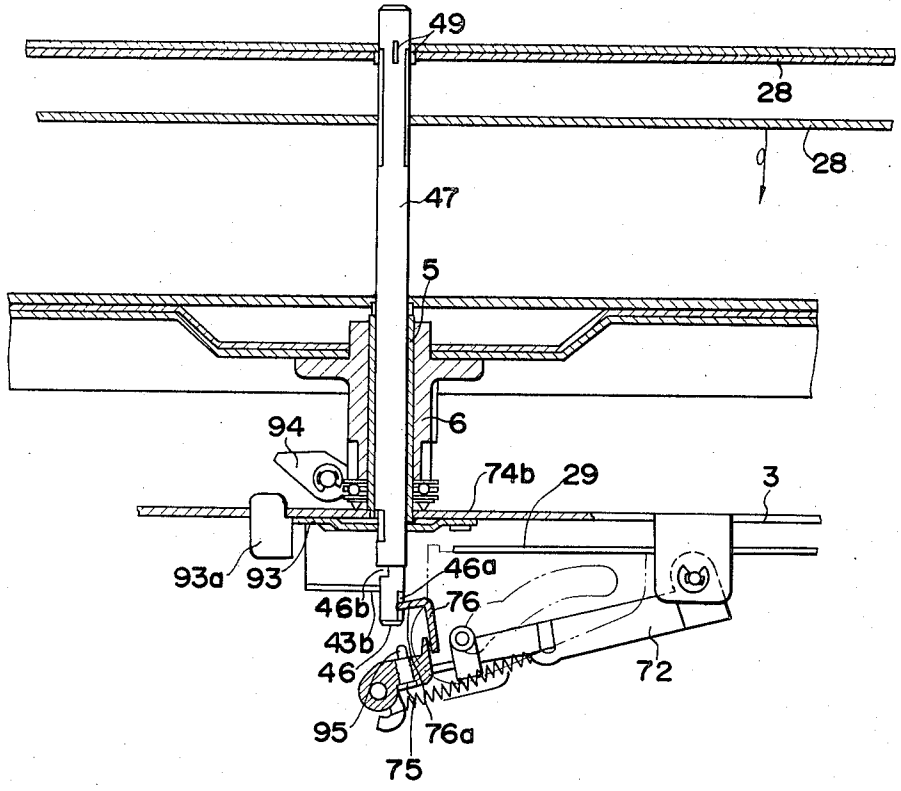


FIG.13A

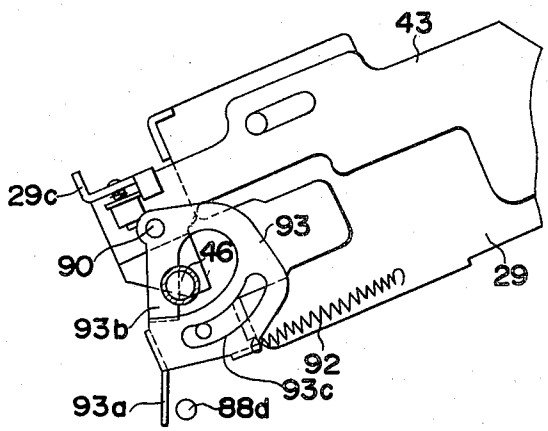


FIG.13B

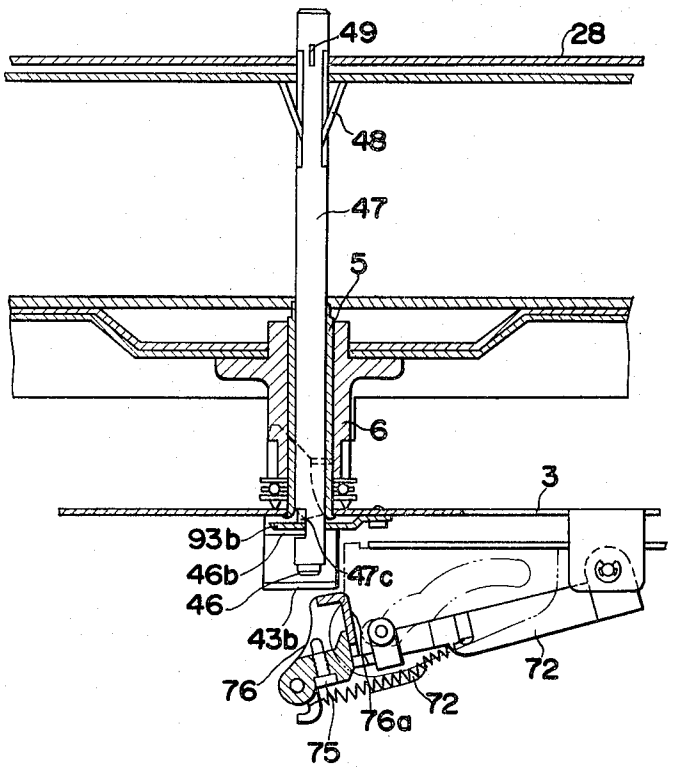


FIG. 14A

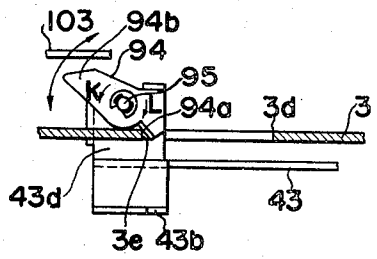


FIG. 14B

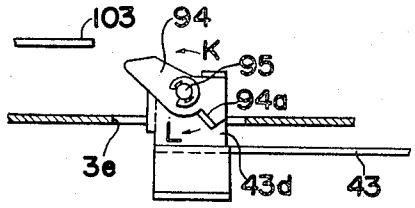
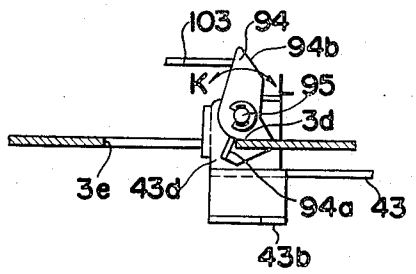


FIG. 14C



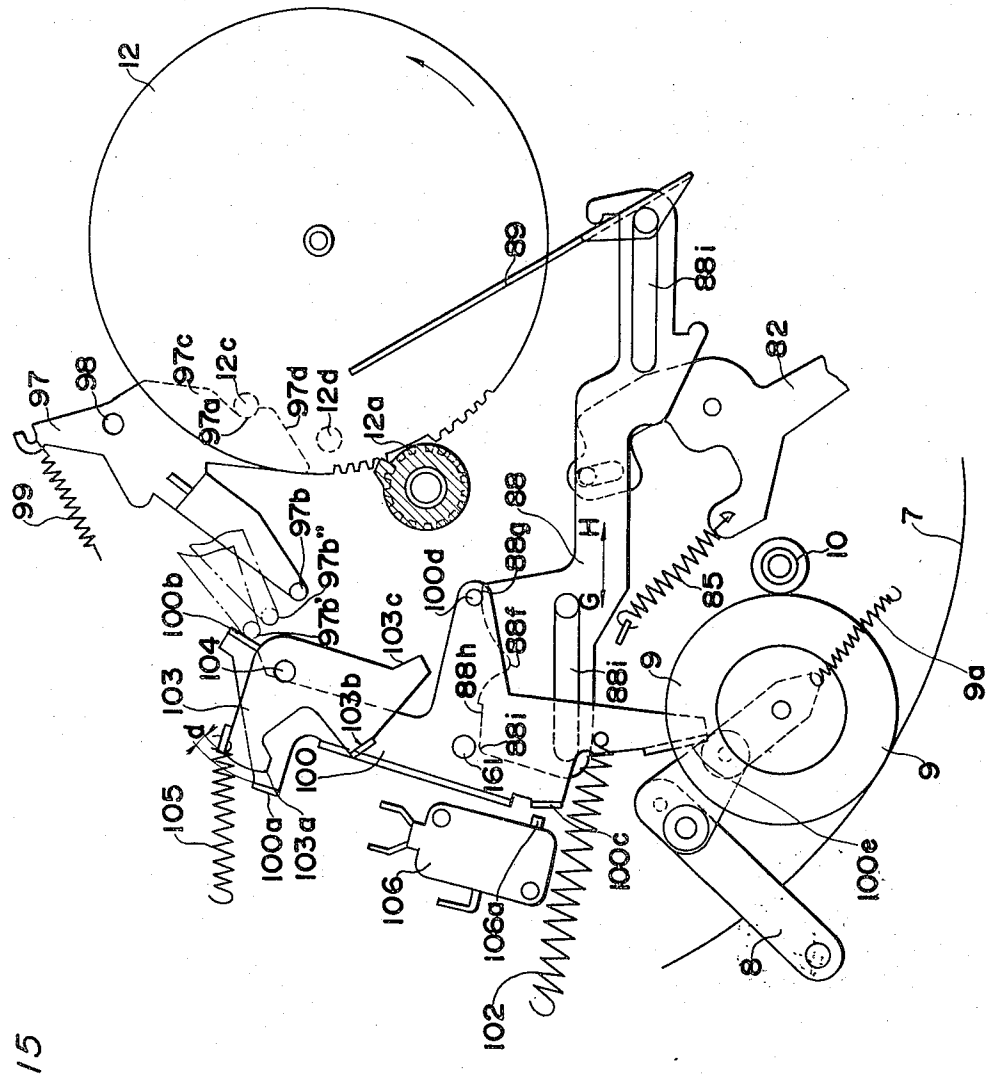

12
89
88i
82
97
98
97c
12c
97a
97d
12d
12a
99
97b
97b'
97b"
88g
88
H
G
100d
100b
103c
88f
88h
104
103
103b
88i
85
10
7
9a
9
105
100
100a
103a
106
106a
100c
100e
102
8

FIG. 15

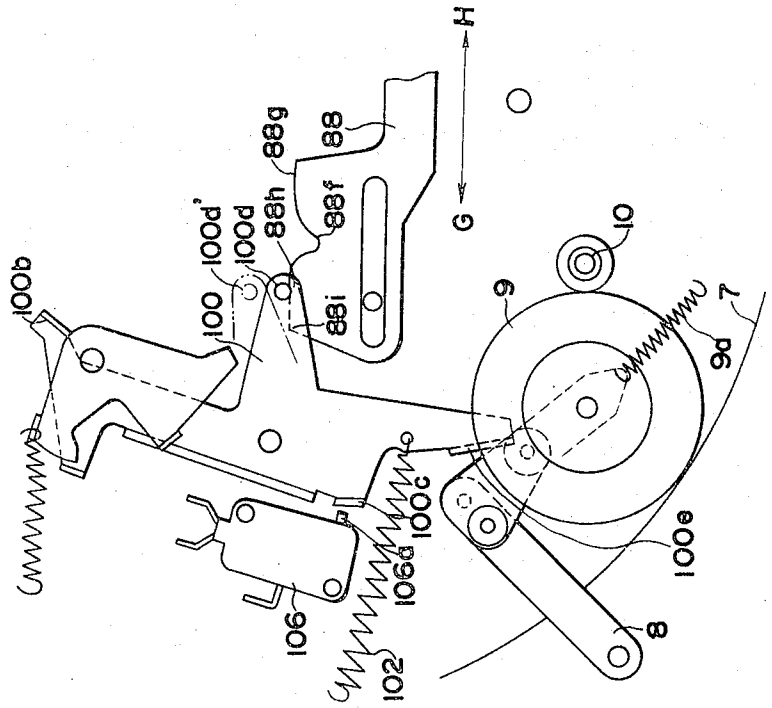

H
G
88g
88
88h
88f
100d'
100d
88i
100
100b
10
9
7
9a
100c
100a
106a
106
102
8

FIG. 17

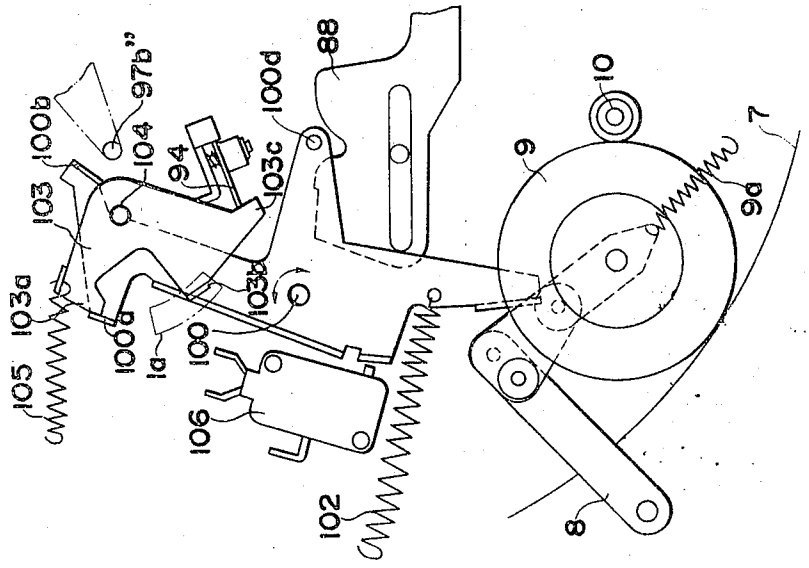

97b''
104
100b
103
94
103c
88
100d
10
9
7
9a
103a
103b
105
100a
1a
100
106
102
8

FIG. 16

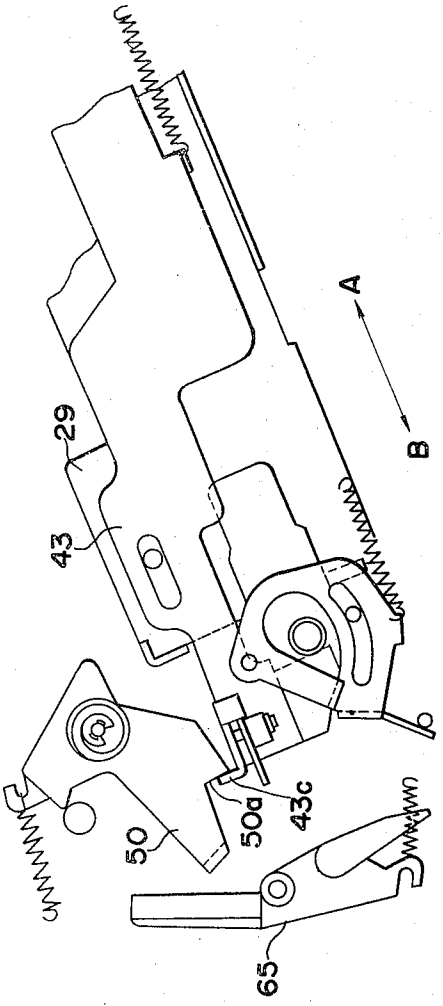


FIG. 18A

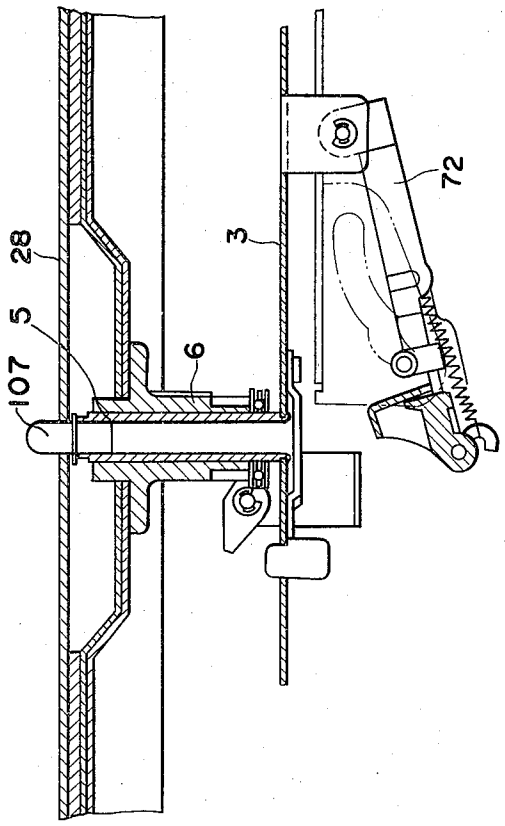


FIG. 18B

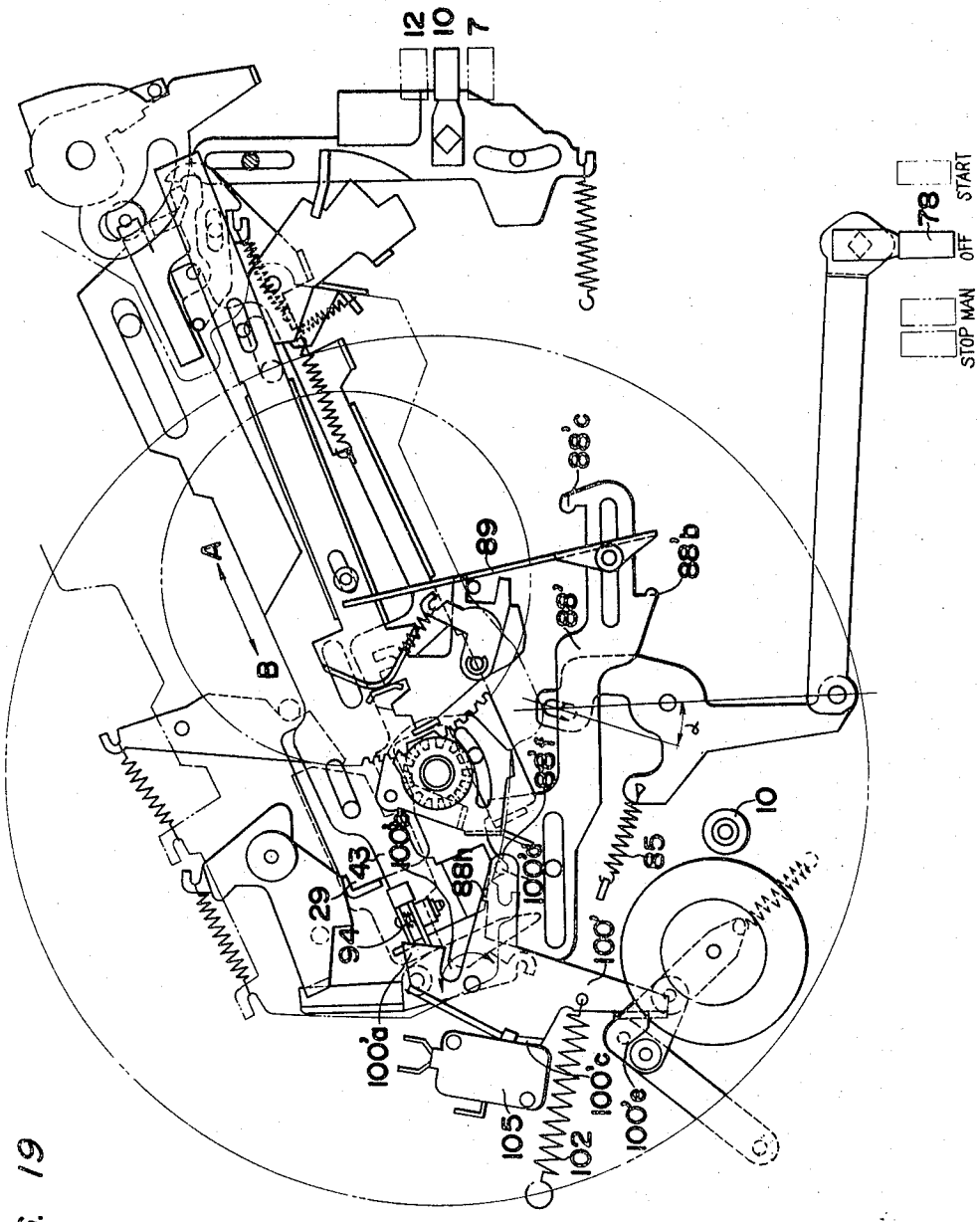

12
10
7
78
START
OFF
STOP MAN
88'c
88'b
89
88'
A
B
88'f
85
10
43
29
94
88h
100'
100'a
100'c
100'e
105
102

FIG. 19

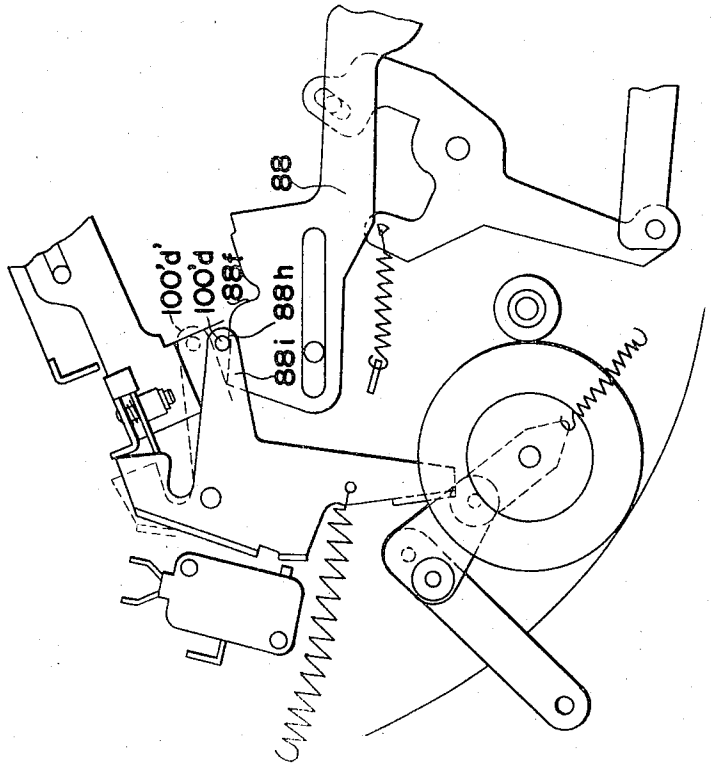

88
100'd'
100'd
88f
88h
88i

FIG. 21

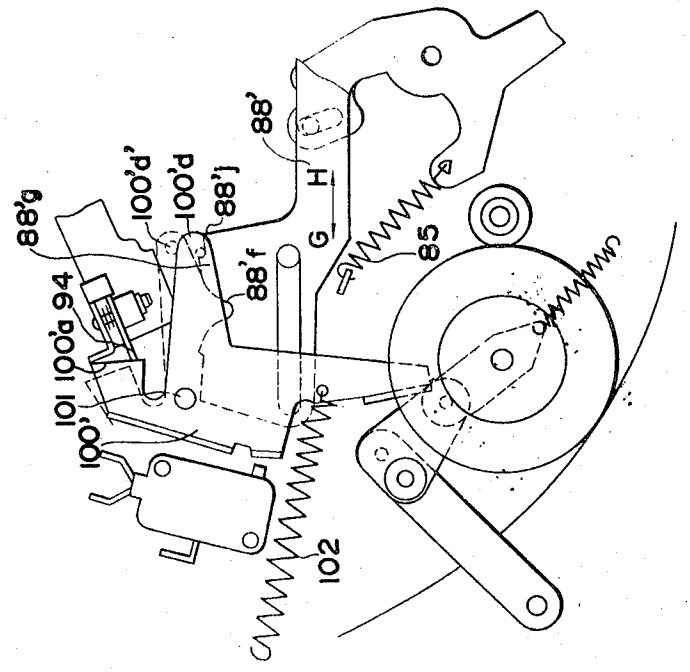

88'
H
G
100'd'
100'd
88'j
88'g
88'f
85
94
100'd
101
100'
102

FIG. 20

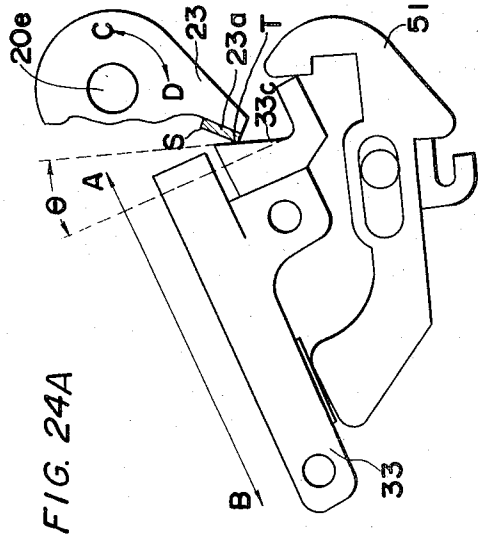


FIG. 24A

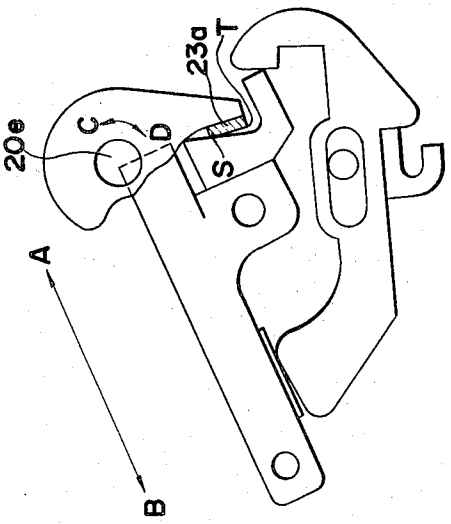


FIG. 24B

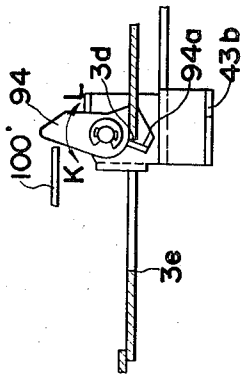


FIG. 22

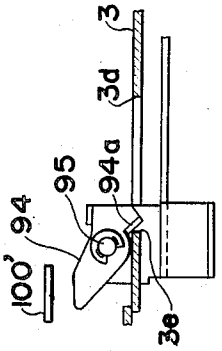


FIG. 23

AUTOMATIC RECORD PLAYER

The present invention relates to an automatic record player and has for its object to provide an automatic record player having the following various capabilities:

1. Automatic individual performance of a plurality of records mounted on the multi-play turntable spindle in a stacked arrangement. In this case, only by setting the control knob to the START position, the various movable mechanisms of the record player can be set in operation and, after the last one of the stacked records has been played out, automatically return to their respective initial positions with the power source switched off.

2. Manual shift of the tonearm to the lead-in groove of the record on the turntable. In this case, only by setting the control knob to the "MAN" position, the tonearm can be conditioned so as to be manually shifted to anywhere on the record on the turntable and, after the record has been played out, the movable mechanisms of the record player can be automatically returned to their respective initial positions with the power source switched off.

3. Rejection of the record being played without permitting the next one of the stacked records to be fed down the multi-play turntable spindle on to the rotating turntable.

4. Interchangeability of the turntable spindle with any one of the multi-play turntable spindle and single-play turntable spindle.

5. Manual vertical shift of the tonearm shifting structure. This is possible by the provision of the cuing device. By operating the cuing device, the tonearm can be vertically shifted with the pickup stylus clearing the record and automatically, slowly returned to the downwardly shifted position.

These and other objects and features of the present invention will become apparent from the following description taken in conjunction with preferred embodiments thereof shown in the accompanying drawings, in which;

FIG. **1** is a schematic perspective view of a record player with the multi-play turntable spindle constructed in accordance with the present invention,

FIG. **2** is a top plan view of the arrangement of various mechanisms of the record player, with a mounting panel removed,

FIG. **3** is a schematic side view of the record player shown in FIG. **1**,

FIG. **4** is a schematic longitudinal sectional view of a tonearm lifting structure combined with a cuing device, both being employed in the record player of FIG. **1**,

FIG. **5**(A) is a top plan view of a portion of the idler wheel and its support employed in the record player of FIG. **1**,

FIG. **5**(B) is a side sectional view of the structure of FIG. **5**(A),

FIG. **6**(A) is a schematic top plan view of a record size selecting control, showing the selector knob positioned at the "10′′" position,

FIG. **6**(B) is a similar view to FIG. **6**(A), showing the selector knob positioned at the "**12**′′" position,

FIG. **6**(C) is a similar view to FIG. **6**(A), showing the selector knob positioned at the "**7**′′" position.

FIG. **7** is a top plan view of a portion of the arrangement of the various mechanisms of the record player, with the mounting panel and a base plate removed,

FIG. **8** is a schematic diagram showing a portion of a tonearm shifting device,

FIG. **9**(A) is a schematic diagram showing the arrangement of a transmission lever and a rejection link with the drive plate moved to one position,

FIG. **9**(B) is a schematic side view of the arrangement of FIG. **9**(A),

FIG. **10**(A) is a similar diagram to FIG. **9**(A), showing the transmission lever and the rejection link with the drive plate being moved towards the opposite position,

FIG. **10**(B) is a schematic side view of the arrangement of FIG. **10**(A),

FIGS. **11**(A) and **11**(B) are a schematic top plan view and side view, respectively, of a portion of a turntable spindle drive mechanism, showing the condition wherein the stacked records are supported above the turntable,

FIGS. **12**(A) and **12**(B) are similar views to FIGS. **11**(A) and **11**(B), showing the condition wherein the lowermost one of the stacked records is being fed on to the turntable,

FIGS. **13**(A) and **13**(B) are similar views to FIGS. **11**(A) and **11**(B), showing the condition wherein the downward shift of the inner shaft of the turntable spindle is obstructed by a barrier plate,

FIGS. **14**(A), **14**(B) and **14**(C) are schematic diagrams showing a top plate in various sequential operation positions,

FIG. **15** is a similar view to FIG. **2**, showing a portion of the arrangement in detail,

FIG. **16** shows the portion of FIG. **15** actuated when the control knob is moved to the "START" position,

FIG. **17** shows the portion of FIG. **15** actuated when the control knob is moved either to the "MAN" position or to the "STOP" position,

FIGS. **18**(A) and **18**(B) are a schematic top plan view and side view, respectively, of a portion of the turntable spindle drive mechanism showing the condition wherein the single-play turntable spindle is employed,

FIG. **19** is a similar view to FIG. **2**, but showing another preferred embodiment of the present invention,

FIG. **20** is a diagram showing a portion of FIG. **19** actuated when the control knob is moved to the START position,

FIG. **21** is a diagram showing the portion of FIG. **19** actuated when the control knob is moved to the MAN position,

FIGS. **22** and FIG. **23** are schematic diagrams showing the stop plate in different postures, and

FIGS. **24**(A) and **24**(B) are schematic diagrams of a modified cam member, respectively showing the tonearm shifting device in different operative positions.

Referring to FIGS. **1** to **3**, a base plate **3** fixedly suspended from the undersurface of a mounting panel **1** by means of a plurality of suitable fixtures **2** spacing said base plate **3** from said undersurface of said mounting panel **1** rigidly carries a sleeve **5** upwardly extending therefrom through the mounting panel **1**. This sleeve **5** has mounted therearound a thrust ball bearing **4** and rotatably carries a turntable **7** having a downwardly extending geared collar **6** secured to or integrally formed

with said turntable in alignment with the center of said turntable and with the longitudinal axis of said sleeve **5.** The thrust ball bearing **4** is, when the turntable **7** is mounted on said sleeve **5,** sandwiched between the base plate **1** and the lowermost end face of the geared collar **6** for permitting the geared collar **6** and, hence, the turntable **7** to undergo a smooth rotation about the longitudinal axis of said sleeve **5.**

The gear collar **6** has integrally formed thereon a projection **6***a* extending at right angles to the longitudinal axis of said collar **6,** the function of which projection **6***a* will be mentioned later.

The turntable **7** can be rotated in one predetermined direction by a suitable electric motor (not shown) having a drive shaft rigidly connected with or integrally formed into a capstan **10** of any known construction having a plurality of, for example, three, different diameter portions **10***a*, **10***b* and **10***c*, as seen in FIG. **5B,** the rotational force of said motor being transmitted to said turntable **7** in any known manner through a selected one of said different diameter portions **10***a*, **10***b* and **10***c* of said capstan **10** via an idler wheel **9** selectively engageable with the peripheral flange of the turntable **7** and said capstan **10.** The idler wheel **9** is mechanically connected with a speed selector knob **119** through a turntable rotating speed control (not shown) of any known construction such that, depending upon the positioning of the speed selector knob **119** to any one of 33⅓, 45 and 78 positions which respectively stand for the conventionally standardized speeds of rotation of the turntable **7** and are associated with the different diameter portions **10***a*, **10***b* and **10***c* of the capstan **10,** the idler wheel **9** can be brought into register with the selected one of the different diameter portions **10***a*, **10***b* and **10***c* of the capstan **10** thereby to permit the turntable **7** to be rotated at a preselected speed.

The turntable rotating speed control may be of any known construction, for example such as disclosed in the U.S. Pat. No. 3,549,153 patented on Dec. 22, 1970. However, according to the present invention, the linkage between the idler wheel **9** and the speed control is modified as shown in FIGS. **5**(A) and (B) thereby to permit the height of the idler wheel **9** to be manually adjustable with respect to any one of the different diameter portions **10***a*, **10***b* and **10***c* of the capstan **10.** The linkage so far shown in FIGS. **5**(A) and (B) comprises a first arm member **8** suitably pivotally carried by the mounting panel **1** and having one end slidably engaged with the caming structure (not shown) of the speed control and the other end formed with a threaded hole **8***a* and a bearing hole **8***b* adjacent to said threaded hole **8***a*. This first arm member **8** carries an adjustment screw **108** adjustably threaded into the threaded hole **8***a* of the arm member **8** and said adjustment screw **108** has integrally formed thereon a large diameter portion **108***a* adjacent to the head portion thereof, which has a diameter greater than that of the head portion of said screw **108.**

A second arm member **109** has one end portion formed with an opening (not shown) of a diameter slightly greater than that of the head portion of the adjustment screw **108,** but smaller than that of the large diameter portion **108***a* thereof, through which opening the head portion of the adjustment screw **108** extends with the end portion of said second arm member **109** resting on the large diameter portion **108***a*. Adjacent to this opening, the second arm member **109** is provided with a downwardly extending pin member **110** inserted in the bearing hole **8***b* of the first arm member **8** thereby to support the second arm member **109** in position. However, for preventing a possible separation of the second arm member **109** from the adjustment screw **108,** the end portion of the arm member **109** adjacent to the opening is held in position by means of suitable fastening members, such as a snap ring **112** and a spring washer **111.**

The idler wheel **9** is rotatably mounted on a shaft **18** which is in turn rigidly secured to a third arm member **130** pivotally carried by the second arm member **109.** The pivotal connection between the second and third arm members **109** and **130** may be omitted if the fulcrum about which the first arm member **8** pivots is provided such that the idler wheel **9** can contact any one of the different diameter portions **10***a*, **10***b* and **10***c* of the capstan **10** and also the peripheral flange of the turntable **7** thereby to transmit the rotational force from said capstan **10** to said turntable **7.**

From the foregoing, it has now become clear that, by turning the adjustment screw **108** in either direction, the height of the idler wheel **9** with respect to the capstan **10** can be varied.

It is to be noted that the idle wheel **9** is urged to contact both the capstan **10** and the peripheral flange of the turntable **7** by the action of a tension spring **9***a*.

A main gear **12** is rotatably mounted on a shaft **11** rigidly upwardly extending from the base plate **3.** This main gear **12** has formed on its upper surface a link axle **13** on which a link boss **14** is rotatably mounted. The link boss **14** carries a friction link **17** rigidly secured thereto, on an upper portion of which a friction lever **15** and an actuating link **16** are relatively rotatably mounted. A tension spring **19** is disposed between said friction lever **15** and actuating link **16** so as to bias said lever **15** and link **16** in the opposite directions. However, since the friction lever **15** is, while relatively pulled by said spring **19,** abutted against a stopper **16***a* formed in the actuating link **16,** the pulling force of the spring **19** is transmitted to the boss **14** through said friction lever **15** and also through said actuating link **16** whereby friction is imparted between said actuating link **16** and said friction link **17** through said link boss **14.**

It is to be noted that rotation of the actuating link **16** is through a predetermine angular distance defined by a cut-out portion **16***c*, formed in said link **16,** in cooperation with a stopper pin **12***e* formed in the gear **12** and situated within said cut-out portion **16***c* of said actuating link **16.** Another cut-out portion may be formed in the actuating link **16** as at **16***d* for restricting unnecessary rotation of the friction link **17** relative to the actuating link **16,** in cooperation with a bent edge **17***a* formed in said link **17** and situated within said other cut-out portion.

In any event, the actuating link **16** and friction link **17** may be a one-piece construction in which case, the link boss **14** and other cut-out portion **16***d* may be omitted.

A tonearm **20** of any conventional construction having a pickup stylus **20***c* is horizontally rotatable about the axis of an upright stud **56** secured to the base plate **3** and also vertically pivotable about the axis of a transverse spindle **20***b*. The main gear **12** has a toothless portion, formed as at **12***a*, normally positioned in regis-

ter with the geared collar **6** of the turntable **7**, in which condition engagement between the geared collar **6** and the main gear **12** does not take place. The tonearm **20** is horizontally rotatably supported by a tonearm shaft **20***d* through said transverse spindle **20***d*, said tonearm shaft **20***d* rotatably extending through said upright stud **56** and having rigidly mounted thereon a positioning plate **21** rotatable together with said tonearm **20.** The positioning plate **21** is secured to a boss **22,** an auxiliary positioning plate **23** being rotatably mounted on the tonearm shaft **20***d* between said positioning plate **21** and said boss **22.** The positioning plate **21** and the auxiliary positioning plate **23** are relatively biased in the opposite directions by a tension spring **24,** connected therebetween, whereby a pin **25** formed in the auxiliary positioning plate **23** abuts against a stop **21***a* formed in the positioning plate **21.**

While in this arrangement, the pin **25** is, as the tonearm **20** is horizontally rotated with the pickup stylus **20***c* moving towards a center spindle **47** in a manner as will be described later, engageable with a bent edge **27***a* of an actuator lever **27,** slidably mounted on a pin **26** and the top of the gear shaft **11,** thereby to cause said actuator lever **27** to move in the direction towards the center spindle **47.** As the actuator lever **27** is in practice moved towards the center spindle **47,** a bent edge **17***a* of the friction link **17** is kicked by said lever **27** thereby causing the actuating link **16** to rotate about the axis of the link spindle **13** until an engagement portion **16***b* of the link **16** is brought into the path of travel of the projection **6***a* of the geared collar **6** of the turntable **7.** Rotation of the main gear **12** takes place immediately after engagement between the projection **6***a* and the engagement portion **16***b* is achieved while the turntable **7** is rotating. It is to be noted that the engagement portion **16***b* that has been brought into the path of travel of said projection **6***a can be moved out of the path of travel of said projection 6a* shortly before one rotation of said main gear **12** in engagement with the geared collar **6** is completed. This is possible because, shortly before completion of each rotation of the main gear **12,** the friction link **17** that has been rotated together with the actuating link **16** under frictional engagement is engaged as at **17***c* with the geared collar **6,** thereby to pivot about the link axis **13,** accompanying a corresponding rotation of the actuating link **16** with the engagement portion **16***b* mouving out of the path of travel of the projection **6***a.*

A drive plate **29** horizontally slidably suspended from the undersurface of the base plate **3** by means of a plurality of spacer fixtures **30** is provided with an upwardly extending drive pin **32.** The main gear **12** has formed on its undersurface a substantially heart-shaped cam groove **12***b* in which the drive pin **32** is slidably engaged, said groove **12** being eccentrically arranged with respect to the center of rotation of said main gear **12.** Accordingly, each rotation of the main gear **12** results in a reciprocal straight movement of said drive plate **29** in the opposite directions as indicated by the double-headed arrows A and B.

A cam member **33** having a downwardly inclined surface **33***a* is rigidly mounted on the drive plate **29** and, during one reciprocal movement of said drive plate **29,** a lifting structure **35** having a construction as hereinafter described is vertically upwardly and downwardly shifted for vertically pivoting the tone arm **20** about the transverse spindle **20***b.*

Referring to FIG. **4,** the lifting structure **35** comprises a lifting rod **35***c* having a lowermost end **35***a* slidably engageable with the inclined surface **33***a* of the cam member **33** on the drive plate **29,** and the other end having formed therein a blind hole **35***d*, a substantially intermediate portion of which vertically and slidably extends through a sleeve **34** extending through and rigidly carried by the mounting panel **1.** This lifting structure **35** further comprises an adjustment unit for adjusting the height of the pickup stylus **20***c* from the plane of the turntable **7,** said unit including an adjustment cap **37** adjustably threaded on the upper end portion of the lifting rod **35***c*, and a pusher rod **38** slidably inserted within the blind hole **35***d*, an upper portion of which slidably extends through the adjustment cap **37** as shown while the other lower end portion thereof is confined within a space formed by the blind hole **35***d* and the cap **37.** A compression spring **36** is interposed between the bottom of the blind hole **35***d* and the lowermost end face of the pusher rod **38** for upwardly biasing the latter. In this arrangement, by manually rotating the adjustment cap **38** in either direction, the height of the pickup stylus **20***c* from the plane of the turntable **7** or the record on the turntable **7** can be advantageously adjusted irrespective of the operation of the lifting rod **35***c.*

The sleeve **34** has a lower end portion **34***a* reduced in diameter and having a lifting collar **41** supported in position thereon as will be described later. A compression spring **39** is mounted on the lower end portion of the lifting rod **35***c* and has a lower end restricted by a snap ring mounted on said rod **35***c* as shown and the other upper end abutted through a washer **40** against a step formed in the lower end portion of the lifting rod **35***c* as at **35***b*. Another compression spring **42** is mounted on the reduced end portion **34***a* of the sleeve **34** between the upper end portion of the sleeve **34** and the lifting collar **41,** thus acting to downwardly urge said lifting collar **41.**

With the above in mind, it is to be noted that the reduced diameter portion **34***a* of the sleeve **34** and the compression spring **42** loosely extend through an arched slot **21***b* formed in the positioning plate **21** while leaving a clearance Z between said plate **21** and the lifting collar **41** when the lifting rod **35***c* is downwardly shifted. The resiliency of the compression spring **42** is slightly greater than that of the compression spring **39,** but can be overcome by the resiliency of the spring **39** as the latter is compressed, the compression of the spring **39** being achieved as the lowermost end **35***a* of the lifting rod **35***c* slides over the inclined surface **33***a* of the cam member **33** on the drive plate **29.** In other words, as the lifting rod **35***c* is upwardly shifted in the manner as hereinbefore described compressing the spring **35,** the resiliency of the spring **39** as compressed becomes greater than that of the spring **42** whereby the lifting collar **41** is subsequently upwardly shifted compressing the spring **42** while narrowing the clearance Z. As the lifting rod **35***c* is further upwardly shifted, the lifting collar **41** finally contacts the positioning plate **21** thereby to produce a friction contact between said plate **21** and said collar **41.** Upon friction being produced therebetween, subsequent rotation of the positioning plate **21** and hence the tonearm **20** takes place under frictional engagement with the collar **41,** thereby to ensure a steady and smooth rotation of the tonearm **20** which is not affected by any possible vibration given

to the record player during such rotation of the tonearm **20** about the tonearm shaft **20***d*.

The lifting rod **35***c* that has been upwardly shifted in the manner as hereinbefore described will not immediately descend after the cam member **33** moves away from the lowermost end **35***a* of the lifting rod **35***c* such as shown in FIG. **4**, but slowly descends by the effect of the weight of the tonearm **20**, the resiliency of the compression spring **42** as compressed and the resiliency of the compression spring **39** as compressed. This is possible because the portion of the outer peripheral surface of the lifting rod **35***c* housed in the sleeve **34** has silicon oil applied thereto. It is to be noted that the compression spring **39** as compressed will no longer act to downwardly shift the lifting rod **35***c* when the step **35***b* at the lower end portion of said rod **35***c* abuts against the washer **40**.

In the record player as shown, a cuing device is provided for enabling a manual selection of a desired one of pieces of music or like recordings recorded on a record and also for enabling a repeated performance of a single record by manually shifting the tonearm, i.e., manually transferring the pickup stylus **20***c* to the lead-in groove of the record prior to its entry into the lead-out groove of the same record.

Referring to FIGS. **1** and **4**, the cuing device comprises a cuing lever **113** manually pivotable a predetermined angular distance between an inoperative position and an operative position and, during the pivotal movement of said lever **113** to the operative position, the tonearm **20** is forcibly vertically rotated about the transverse spindle **20***b* so as to upwardly lift the pickup stylus **20***c*. The lever **113** has a shaft **114** rotatably extending through a suitable bearing, for example, a covering **116** mounted on the panel **1**, and rigidly connected with a cuing cam member **115** through said shaft **114**. The cuing lever **113** is normally urged to the inoperative position by a tension spring **117** having one end connected therewith and the other end connected with a pillar **116**i a in the covering **116**. The cam member **115** is positioned beneath an arm **118**, either integral with or rigidly secured to the lifting structure **35**, i.e., the lifting rod **35***c*, which slidably engages the arm **118** as the cuing lever **113** is manually pivoted to the operative position as indicated by the chain line in FIG. **4**, thereby permitting the arm **118** and, hence, the lifting rod **35***c* to be upwardly forced. The cuing lever **113** having been pivoted to the operative position will not immediately return to the inoperative position. This is possible because, when the lever **113** is in the operative position, the cam member **115** stands upright, as indicated by the chain line in FIG. **4**, with the tip of said member **115** receiving a downwardly acting force exerted by the lifting structure **35** and transmitted thereto through the arm **118** and, consequently, unless otherwise the downwardly acting force is removed, the cuing lever **113** can be temporarily locked in the operative position. Automatic return of the cuing lever **113** to the inoperative position by the action of the tension spring **117** can be achieved when the lifting structure **35** is completely upwardly shifted with the lowermost end **35***a* of the lifting rod **35***c* completing its slide over the inclined surface **33***a* of the cam member **33** on the drive plate **29**.

From the foregoing, it has now become clear that the tonearm **20** can be manually moved in any direction as desired without causing the pickup stylus **20***c* to laterally skid on the record on the turntable **7**, when the lever **113** is pivoted to the operative position. Furthermore, even after the lever **113** has been immediately returned to the inoperative position from the operative position by the action of the spring **117**, the lifting rod **35***c*, for the reasons as hereinbefore described, slowly descends, while the cam member **33** is moved away from the lowermost end **35***a*, and consequently no shock is imparted to the pickup stylus **20***c* when the tonearm **20** is manually operated so as to engage the stylus **20***c* in the recorded groove of the record.

Referring to FIG. **7**, the drive plate **29** carries on its upper surface a detector plate **43** slidably mounted on said drive plate **29** by means of a plurality of spacer fixtures **44** rigidly secured to said drive plate, said detector plate **43** being slidable thereon independent of the drive plate **29** a predetermined distance defined by a pair of slots **43***a* formed in said detector plate **43** and through which said spacer fixtures **44** extend. The detector plate **43** is normally urged by a tension spring **45** substantially towards the cam member **33** on the drive plate **29**. This detector plate **43** is so mounted on the drive plate **29** that, during the movement of the drive plate **29** in the direction A, the detector plate **43** moves a predetermined distance together with said drive plate **29** and, during the further movement of said drive plate **29** in the same direction, either of the first and second abutments, downwardly and upwardly formed in the detector plate **43** as at **43***b* and **43***c*, respectively, abuts against an inner shaft **46** of a turntable spindle as will be described later or a stop portion **50***a* formed in a rejection link **50** as will be mentioned later and, consequently, further movement of the detector plate **43** does not take place, but permitting the spring **45** to be pulled by the furher movement of the drive plate **29**.

Referring to FIGS. **7** and **8**, the drive plate **29** carries on one end thereof adjacent to the tonearm positioning plate **21** a hook member **51** slidably and pivotally mounted on an upwardly extending pin **52**, said pin **52** being rigidly carried by said drive plate **29** and extending through a slot **51***a* formed in the hook member **51**. This hook member **51** has formed at one end an enclosing member **51***b* integrally sinuously extending from the body of the hook member **51** via a curved portion **51***d* and at the other end a sliding surface **51***c* slidably engageable with a upwardly extending stud **55** rigidly carried by the detector plate **43**. The hook member **51** is normally urged by a tension spring **53** such that, when the drive plate **29** is moved to the direction B, the enclosing portion **51***b* thereof rests on a counter-enclosing member **33***b*, which may be integrally formed with the cam member **33** on the drive plate **29**, while the sliding surface **51***c* thereof is abutted against a rubber damper **51** secured to said cam member **33**, the condition being shown in FIG. **7** and, when said drive plate **29** is moved to the direction A, the enclosing portion **51***b* substantially encircles the counter-enclosing member **33***b* engaged with the curved portion **51***d*, thus forming an engagement space in which a downwardly extending projection **23***a* of the auxiliary positioning plate **23** is engaged, while the sliding surface **51***c* is abutted against the stud **55**, this condition being shown in FIG. **8**.

While the hook member **51** is urged by the spring **53** such as hereinbefore described, the above mentioned conditions are alternately established in response to the reciprocal movement of the drive plate **29** in the fol-

lowing manner. Assuming that the drive plate **29** moves in the direction A, an engaging portion **33***c* integrally formed on the cam member **33** engages the projection **23***a* of the auxiliary positioning plate **23** so as to rotate the latter in the direction as indicated by C in FIG. **7** about the tonearm shaft **20***d* and, at the same time, either of the first and second abutments **43***b* and **43***c* is engaged by the corresponding one of the inner shaft **46** and stop portion **50***a* thereby stopping the movement of the detector plate **43** while permitting the drive plate **29** to move further in the same direction. After the detector plate **43** has been thus stopped and during further movement of the drive plate **29** independent of the detector plate **43** against the force of spring **45**, the stud **55** on the detector plate **43** is slidably engaged with the sliding surface **51***c* of the hook member **51**. Consequently, at the time the one-way movement of the drive plate **29** in the direction A is completed, the hook member **51** that has been positioned as shown in FIG. **7** is pivoted about the pin **52** by the engagement of the stud **55** with the sliding surface **51***c* so as to cause the enclosing portion **51***c* of said member **51** to substantially entrap the projection **23***a* of the auxiliary positioning plate **23** in cooperation with the engaging portion **33***c* and the counter-enclosing member **33***b*, thereby to establish the condition as shown in FIG. **8**.

While the above mentioned one-way movement of the drive plate **29** in the direction A takes place during a first, substantially half rotation of the main gear **12** with the drive pin **31** on the drive plate **29** eccentrically guided along the substantially heart-shaped cam groove **12***b* of said main gear **12**, return movement of said drive plate **29** in the direction B takes place during the latter, substantially half rotation of said main gear **12**. During this return movement of the drive plate **29**, the auxiliary positioning plate **23** accompanying the positioning plate **21** engaged therewith by means of the pin **25** on the auxiliary positioning plate **23** is rotated about the tonearm shaft **20***d* in the direction as indicated by D in FIG. **7** with the downwardly extending projection **23***a* thereof engaged in the engagement space defined by the elements **33***b*, **33***c* and **51***b*. This rotation of the auxiliary positioning plate **23** and hence the positioning plate **21** takes place through a preselected angular distance as will be mentioned later and, after said positioning plate **21** has been rotated the preselected angular distance, the projection **23***a* of the auxiliary positioning plate **23** acts to pull the hook member **51** against the tension spring **53**. As the drive plate **29** moves further in the direction B while in this condition, the hook member **51** is moved against the spring **53** so that the enclosing portion **51***b* slides over the counter-enclosing member **33***b* while said hook member **51** itself pivots about the pin **52**, thereby to release the projection **23***a* from the engagement space and then to establish the condition as shown in FIG. **7** so far as the hook member **51** is involved. During this period, the view of the fact that the tension spring **45** has been expanded, the return movement of the drive plate **29** is accelerated by this spring **45** and thereafter the further return movement of said plate **29** accompanies the corresponding movement of the detector plate **43** until the main gear **12** completes its one rotation.

Referring to FIGS. **2**, **6A–6C** and **7**, a record size selector comprises a selector lever **57** having arched and straight slots therein as at **57***a* and **57***b*, respectively, and slidably suspended from the undersurface of the mounting panel **1** by means of the corresponding spacer fixtures **58** and **58***a* respectively extending through the straight and arched slots **57***b* and **57***a*, the arched slot **57***a* having a plurality of, for example, three, detent recesses **57***d*, **57***e* and **57***f* into which the spacer fixture **58***a* is selectively engaged. The selector lever **57** also has integrally formed thereon or has rigidly connected thereto a selector knob **60** manually operable to any one of 12″, 10″ and 7″ positions which represent the individually standardized diameters of commercially available three types of records, said selector knob **60** being, as shown in FIG. **1**, exposed to the outside of the selector. It is to be noted that, as shown in FIG. **6**, the detent recesses **57***d*, **57***e* and **57***f* correspond to the 7″, 10″ and 12″ positions of the selector knob **60**.

The selector lever **57** has one end adjacent to the arched slot **57***a* connected with one end of a tension spring **59** having the other end connected with the undersurface of the mounting panel **1**, said tension spring **59** extending at right angles to the direction of movement of said lever **57** when said spacer fixture **58***a* is engaged in the detent recess **57***e* with the selector knob **60** positioned at the 10″ position. This arrangement is particularly advantageous in that a pushing force required to move the selector knob **60** from the 10″ position to either the 12″ position to the 7″ position is substantially equal to that required to move the selector knob **60** from the same position to the other position, i.e., the 7″ position or the 12″ position. To this end, the arched slot **57***a* is designed such that the center of curvature of said arched slot **57***a* is located on the imaginary line passing across the center of curvature of the detent recess **57***e* at right angles to the direction of movement of the selector lever **57** and on the side opposed to the pulling direction of the tension spring **59** with respect to said direction of movement of said selector lever **57**, said pulling direction of said tension spring **59** being in parallel relation to said imaginary line.

With particular reference to FIGS. **6**(A) to **6**(B), in the condition wherein the selector knob **60** is at the 10″ position as shown in FIG. **6**(A), the tension spring **59** extends, as hereinbefore described, at right angles to the direction of movement of the selector lever **57** so that a pulling force exerted by the spring **59** merely acts on the lever **57** so as to laterally bias said lever **57** permitting the spacer fixture **58***a* to engage in the corresponding detent recess **57***e*. However, when the selector knob **60** has been moved to either the 12″ position as shown in FIG. **6**(B) or the 7″ position as shown in FIG. **6**(C), the tension spring **59** the lengthwise direction extends at a certain angle $+\theta$ or $-\theta$ with respect to that of the spring **59** while the selector knob **60** is at the 10″ position as shown in FIG. **6**(A) is, in either case, expanded with its pulling force acting on the selector lever **57** so as to return the selector knob **60** to the 10″ position. While the selector knob **60** tends to be thus moved by the spring **59** with its pulling force transmitted thereto through the selector lever **57**, the pulling force of said spring **59** also acts to permit the spacer fixture **58***a* to engage in the corresponding detent recess **57***d* or **57***f* and, therfore, only when an external force is applied to the selector knob **60** so as to move the latter to the 10″ position, can the selector knob **20** be instantaneously returned to such position

by the action of the spring **59.** In addition, as hereinbefore described, the external force required to move the knob **60** to the 10'' position from either of the other two positions is substantially equal to that required to move it to the same position from the other due to the fact that the angles $+\theta$ and $-\theta$ are the same. Furthermore, the external force required is small in value due to the fact that the slot **57***a* is arched as hereinbefore described. By way of example, if the slot **57***a* is straight, each of the detent recesses **57***d* and **57***f* on both sides of the detent recess **57***e* must be made large in depth to ensure a detent stop of the selector knob **60.** In this case, it is evident that not only a relatively great external force is required for operating the selector knob **60,** but also, during the movement of the selector knob **60** to any one of the three positions, it will move outwardly a relatively great distance in the direction perpendicular to the direction of movement of said selector lever **57.**

Still referring to FIGS. **7** and **8,** the base plate **3** carries a boss **61** rotatably upwardly extending therefrom and having an index plate **62** rigidly mounted thereon, an auxiliary index plate **63** being independently rotatably carried by the boss **61** immediately below said index plate **62.** The both plates **62** and **63** are relatively biased in the opposite directions about the axis of the boss **61** by a tension spring **64** whereby a stop **62***a* extending downwardly from the index plate **62** is constantly engaged with an abutment **63***a* on the auxiliary index plate **63** to restrict the relative rotation between the plates **62** and **63.** The auxiliary index plate **63** is provided with a downwardly extending engaging projection **63***b* (FIG. **3**) alternately engageable with first and second edges **29***a* and **29***b*, both provided on the drive plate **29.** On the other hand, the index plate **62** is provided with an upwardly extending engaging projection **62***b* engageable with stop **57***c* rigidly or integrally connected with the selector lever **57** for restricting the rotation of the index plate **62** together with the auxiliary index plate **63** as will be described hereinafter. It is to be noted, however, that the index plate **62** is provided for permitting the tonearm **20** to rotate about the tonearm shaft **20***d* to a preselected position above the record on the turntable **7** depending on the size of the record set on the record size selector of the construction as hereinbefore described. For this purpose, the index plate **62** has three stepped edges **62***c*, **62***d* and **62***e* respectively representing the records of 7, 10 and 12 inches in diameter and engageable with a restrictor on the positioning plate **21** as at **21***c*.

In operation, as the drive plate **29** moves in the direction A, the auxiliary index plate **63** is rotated about the axis of the boss **61** with the engaging projection **63***b* thereof in engagement with the first edge **29***a* of the drive plate **29** while the lowermost end **35***a* of the lifting rod **35***c* slides over the inclined surface **33***a* of the cam member **33** on the drive plate **29.** Due to the fact that the plates **62** and **63** are connected to each other by the tension spring **64** in the manner as hereinbefore described, rotation of the auxiliary index plate **63** accompanies the corresponding rotation of the index plate **62,** the rotation of the index plate **62** being subsequently restricted by the stop **57***c* in engagement with the engaging portion **62***b* of the index plate **62** with the result that a selected one of the stepped edges **62***c*, **62***d* and **62***e* depending on the positioning of the selector knob **60** is brought into the path of travel of the restrictor **21***c* of the positioning plate **21.** The auxilliary index plate **63** further continues to rotate while expanding the tension spring **64,** until the one-way movement of the drive plate **29** in the direction A completed.

Upon commencement of the return movement of the drive plate **19** at which time the projection **23***a* of the auxiliary positioning plate **23** has already been entrapped in the engagement space defined by the elements **33***b*, **33***c* and **51***b* as shown in FIG. **8,** the auxiliary positioning plate **23** and the positioning plate **21** in engagement therewith through the pin **25** on the auxiliary positioning plate **23** are rotated together about the axis of the tonearm shaft **20***d* in response to the return movement of the drive plate **29.** During this return movement of the drive plate **29** in the direction B, the restrictor **21***c* on the positioning plate **21** is, while the positioning plate **21** and the auxiliary positioning plate **23** are rotated together, engaged with the selected one of the stepped edges **62***c*, **62***d* and **62***e* whereby the both plates **21** and **23** are stopped in positions wherein the pickup stylus **20***c* is located above the lead-in groove of the record of a predetermined diameter on the rotating turntable **7.** Thereafter, the projection **21***c* is released from the engagement space in the manner as hereinbefore described and the second edge **29***b* of the drive plate **29** subsequently abuts against the engaging projection **63** so that the auxiliary index plate **63** and hence the index plate **62** are rotated together so as to clear the selected one of the stepped edges **62***c*, **62***d* and **62***e* from the path of travel of the projection **21***c*. At this time, the pickup stylus **20***c* has been already downwardly shifted and engaged in the lead-in groove of the record of the predetermined diameter.

Referring to FIGS. **2, 7, 9**A and **9**B and **10**A and **10**B, a rejection link **50** is loosely mounted on a pin **3***f* on the base plate **3** with a conically wound spring **67** pressing said rejection link **50** towards the upper surface of the base plate **3.** This rejection link **50** normally tends to rotate about the pin **3***f* in the direction as indicated by E by the action of a tension spring **68** disposed between it and the base plate **3,** and has thereon as at **50***b* a slant edge slidably engageable with a slant side edge **65***a* on a rejection lever **65** rotatably mounted on a pin **66** secured to the base plate **3,** said rejection lever **65** also being normally urged about the pin **66** by the action of a tension spring **70,** disposed between it and the base plate **3,** whereby the slant side edge **65***a* of said lever **65** is moved away from the slant edge **50***b* of the rejection link **50.** The rejection link **50** has on its undersurface a shallow projection, as at **50***e*, downwardly extending therefrom and terminating in a shaped opening **3***b* formed in the base plate **3.**

The rejection link **50** is operable in such a manner that, while the drive plate **29** is positioned as shown in FIG. **7,** rotation of the rejection lever **65** against the spring **70,** which is achieved in a manner which will be mentioned later, causes the slant side edge **65***a* thereof to enter between the base plate **3** and the slant edge **50***b* of the rejection link **50.** As the slant edge **50***b* of said link **50** slides over the slant edge **65***a* of said lever **65,** at least a portion of said link **50** in the vicinity of said slant edge **50***b* is, as shown in FIG. **9**(B), upwardly biased against the conically wound spring **67** with the projection **50***e* climbing over an edge **3***c* of the shaped opening **3***b*. During this process, a side edge **50***c* of the rejection link climbs over the top of a bent edge **29***c* at the rear end of the drive plate **29.** Therefore, it is clear

that, upon completion of climbing of the side edge **50***c* of the rejection link **50** over the top of the bent edge **29***c* of the drive plate **29,** the rejection link **50** is instantaneously rotated about the pin **3***f* by the spring **68** with a stop edge **50***a* thereof substantially intermediate the slant edge **50***b* and the side edge **50***c* being positioned in the path of travel of the second abutment **43***c* on the detector plate **43** as shown in FIG. **9**(A). It is to be noted that, for restricting further rotation of the rejection link **50** by the action of the spring **68,** a portion of the rejection link **50** as indicated by **50***d* is adapted to abut against a pillar **69,** rigidly upwardly extending from the base plate **3,** so that the positions as shown in FIG. **9**(A) are established.

Although in FIG. **9**(A) the rejection link **50** is shown as resting on the top of the bent edge **29***c* of the drive plate **29,** a subsequent movement of the drive plate **3** in the direction A permits the rejection link **50** to rest on the upper surface of the base plate **3** as shown in FIG. **19**(B) and the stop edge **50***a* of said link **50** subsequently restricts, as it comes into engagement with the second abutment **43***c* of the detector plate **43,** the movement of said detector plate **43** accompanined by the drive plate **29,** this condition being shown in FIG. **10**(A).

While the condition of FIG. **19**(A) is established and upon the return movement of the drive plate **29** in the direction B, the bent edge **29***c* slidably engages the side edge **50***c* causing the rejection link **50** to rotate in the direction as indicated by F against the spring **68** with the result that the shallow projection **50***e* falls into the shaped opening **3***b*, thereby to establish the initial condition shown in FIG. **7.** It is to be noted that the rejection lever **65** after having been rotated in the manner as hereinbefore described is usually instantaneously returned to the initial position by the action of the spring **70,** further rotation of said lever **65** by the action of the spring **70** being restricted by a stop **3***a* on the base plate **3** and engageable with a side edge of the rejection lever **65** opposed to the slant side edge **65***a* substantially as shown in FIG. **7.**

Referring now to FIGS. **2, 11A, 11B, 12A, 12B, 13A** and **13B**, the base plate **3** carries a seesaw lever **72** pivotally supported by a shaft **71,** both ends of which are respectively journalled in a pair of downwardly extending lugs **3***d* rigidly connected or integrally formed with the base plate **3.** Adjacent to the free end of the seesaw lever **72** remote from the shaft **71,** a pair of rollers **73** are rotatably mounted on said lever **72** on both sides thereof, which are in turn slidably accommodated in respective cam slots **74***a* formed in substantially triangular cam plates **74** rigidly secured to the drive plate **29,** such that the reciprocal movement of the drive plate **29** causes the seesaw lever **72** to pivot about the axis of the shaft **71** with the rollers **73** being guided along the respective cam slots **74***a*.

The free end of the seesaw lever **72** is normally situated in substantial alignment with the axis of the center spindle and is provided with an adjustment screw **75** threadably extending therethrough in substantial alignment with the axis of said center spindle for enabling the position of the lowermost end of the inner shaft **46** to be manually adjusted, and also with a record feeder **76** pivotally carried thereby on a spindle **77,** said record feeder **76** have integrally formed thereon as at **76***a* a hook portion selectively engageable in a notch **46***a* formed in the inner shaft **46** adjacent to its lowermost end. A tension spring **72***c* is interposed between a substantially intermediate portion **22***a* of the seesaw lever **72** and a lug of the record feeder **76** whereby the latter is urged to rotate about the spindle **72** with the hook portion **76***a* thereof engaged with the outer periphery of a tubular spindle housing **47** when the drive plate **29** is moved in the direction B as shown in FIG. **11**(B), rotation of said feeder **76** by the action of the spring **72***c* being restricted by a stop **72***b* the free end of the seesaw lever **72,** with which a portion of the feeder **76** being urged to rotate as hereinbefore described engages as shown in FIG. **13**(B).

The center spindle interchangeably inserted in the sleeve **5** comprises the tubular spindle housing **47,** the inner shaft **46** slidably accommodated within said spindle housing **47,** a primary support generally indicated by **48** and operatively associated with the inner shaft **46** in such a way that, while said primary support **48** normally protrudes radially outwardly outside the spindle housing **47** under the action of a suitable spring member (not shown) housed within the spindle housing and acts to shift the inner shaft **46,** upwardly said primary support **48** can be withdrawn within the spindle housing **47** as the inner shaft **46** is downwardly shifted in a manner as will be described later, and a secondary support generally indiclated by **49** and operatively associated with the inner shaft **46** as will become clear from the latter description.

It is to be noted that the center spindle shown in FIGS. **1, 3, 11A, 11B, 12A, 12B, 13A** and **13B** is of the type called a "multi-play turntable spindle," the fundamental operation of which is well known to those skilled in the art, whereas the center spindle shown in FIG. **18** is the type as called a "single-play turntable spindle." The record player constructed in accordance with the present invention can accommodate either to any one of these two types of the center spindle. However, details of the multi-play turntable spindle such as shown in FIGS. **1, 3, 11A, 11B, 12A, 12B, 13A** and **13B** are disclosed in the pending Patent Application entitled "Turntable Arrangement With Automatic Record Changer Spindle" and assigned to the same assignee as the present application and, therefore, for the sake of brevity, they are herein omitted and reference may be made to the above mentioned pending patent application for them. In any event, the multi-play turntable spindle operates in the following manner: Assuming that one record is being played, a stack of the remaining records mounted on the turntable spindle is supported on the primary support **48.** When the lowermost record in the stack is to be played, the secondary support **49** comes into action and supports all the records in the stack except for the lowermost one. The primary support **48** is then withdrawn within the spindle housing **7** so that the lowermost record that has been supported on the primary support **48** falls down the turntable spindle and on to the rotating turntable **7.**

The above mentioned operation of the center spindle shown in FIGS. **1, 3, 11A, 11b, 12A, 12B, 13A** and **13B** is effected in response to the pivotal movement of the seesaw lever **72** in a manner as will be described hereinafter.

Refferning still to FIGS. **2, 11A, 11B, 12A, 12B, 13A** and **13B**, the center spindle shown is rigidly locked in the sleeve **5** by means of a suitable key and groove engagement (not shown) with lower and upper end portions thereof respectively situated below and above the

mounting panel **1.** In this condition and while the main gear **12** is not rotated and, therefore, the drive plate **29** is moved to the direction B and the seesaw lever **71** is pivoted clockwise about the shaft **71** with its free end shifted upwardly as shown in FIG. **11**(B), the inner shaft **46** is pressed upwardly a predetermined distance with the lowermost end thereof in contact with the adjustment screw **75,** so that a plurality of supporting memers **48***a* constituting the primary support **48** respectively project radially outwardly outside the spindle housing **47** through elongated slots **47***a* whereas a plurality of clamping members **49***a* constituting the secondary support **49** are respectively radially inwardly withdrawn within the spindle housing **47** through short slots **47***b*. The center spindle with the parts thus positioned is ready to receive a plurality of records **28** in a vertically stacked arrangement supported on the primary support **48** as shown in FIG. **11**(B).

Subsequent movement of the drive plate **29** in the direction A in accordance with the first half rotation of the main gear **12** results in a downward shift of the free end of the seesaw lever **72,** permitting the inner shaft **46** to be downwardly shifted a predetermined distance by the weight of the lowermost one of the records **28** transmitted thereto through the primary support **48** now supporting the lowermost record. Shortly before the lowermost record rests on the primary support **48,** the secondary support **49** comes into action in the known manner thereby supporting the records **28** except for the lowermost one of them.

As the inner shaft **46** descends the predetermined distance, the notch **46***a* at the lower end of said shaft **46** emerges outside the spindle housing **47** from the bottom opening thereof. Immediately after said notch **46***a* has emerged outside the spindle housing **47** and during the continued movement of the drive plate **29,** i.e., the continued downward shift of the free end of the seesaw lever **72** activated by the drive plate **29** in the manner as hereinbefore described, the hook portion **76***a* of the feeder **76** slides in contact with the outer periphery of the spindle housing **47** urged by spring **72***c* and finally instantaneously enters the notch **46***a*, thereby permitting the inner shaft **46** to be thereafter forcibly pulled downwards by the record feeder **76** until one-way movement of the drive plate **29** in the direction A completed at which time the free end of the seesaw lever **72** simultaneously completes its downward shift, this condition being shown in FIG. **12**(B). During a period in which the inner shaft **46** is forcibly pulled downwards by the downwardly shifting record feeder **76,** the primary support **48** is gradually withdrawn within the spindle housing **47** in such a manner that the supporting members **48***a* are radially inwardly folded while simultaneously being pulled downwardly and finally permits the lowermost one of the stacked records **28** to fall down the center spindle on to the turntable **7** as shown in FIG. **12**(B) in which the lowermost record released by the primary support **48** is shown as falling down the center spindle. The stacked records except for the lowermost one of them are, of course, held in position by the secondary support **49** now in operation.

On the other hand, after the inner shaft **46** has been shifted downwardly by the weight of the lowermost one of the stacked records **28** with the notch **46***a* emerging from the bottom opening of the spindle housing **47** as hereinbefore described, the path of travel of the first abutment **43***b* of the detector plate **43** is blocked by the inner shaft **56** and the path of travel of the second abutment **43***c* of the detector plate **43** is also, if the rejection link **50** is rotated so as to bring the stop edge **50***a* thereof into the path of travel of said second abutment **43***c*, blocked by said rejection link **50,** whereby further movement of the detector plate **43** carried by the drive plate **29** does not take place while only the drive plate **29** is allowed to move further in the manner as hereinbefore described.

From the foregoing, it has now become clear that the record player is set to play the lowermost record now on the turntable **7** by means of the pickup stylus **20***c* that has been brought to the lead-in groove of said record in the manner as hereinbefore described. Thereafter, the drive plate **29** undergoes the return movement in the direction B and, after it has moved a predetermined distance, both the drive plate **29** and the detector plate **43** are moved together in the direction B in the manner as hereinbefore described. However, during the corresponding return movement of the detector plate **43** accompanying the drive plate **29,** the hook portion **76***a* of the record feeder **76** engaged in the notch **46***a* pushes the inner shaft **46** upwards and finally disengages from said notch **46***a* by the action of the spring **72***b*. During this period, the record feeder **76** is shifted upwardly in accordance with the clockwise pivot of the seesaw lever **72** which is in turn effected by the return movement of the drive plate **29,** thus establishing the initial condition as shown in FIG. **11**(B).

It is to be noted that, where the multiplay turntable spindle is employed, the above mentioned operation is repeated until the uppermost or last record of the stacked records **28** is fed on to the turntable **7.**

Referring still to FIGS. **2, 7, 11A, 11B, 12A, 12B, 13A** and **13B**, a control for selecting a mode of operation of the record player is shown as comprising a control knob **78** slidably guided in a straight guide groove **79***a* of a guide plate **79** secured to the undersurface of the mounting plane **1** with said knob **78** positioned on the upper surface of said mounting panel **1.** This control knob **78** is pivotally connected with one end of an operating rod **80** the other end of which is pivotally connected as at **83** with a substantially Y-shaped operating link **82** rotatably carried by the mounting panel **1** by means of a fixture **81,** whereby a straight movement of the control knob **78** along the guide groove **79***a* causes the operating link **82** to pivot about the axis of the fixture **81.** The operating link **82** is urged to rotate in one direction about the axis of the fixture **81** by the action of a tension spring **85** disposed between the tip of an arm **84** of said link **82** and a portion **86** of the undersurface of the mounting panel **1.** However, the arrangement so far described is designed such that, when the spring **85** is not expanded, the control knob **78** always remains at a neutral position marked OFF.

The operational mode selecting control further comprises a switching lever **88** slidably suspended from the undersurface of the mounting panel **1** by means of pin members **87** extending through respective slots **88***i* formed in said switching lever **88** for slidable support of said lever **88.** This switching lever **88** has integrally formed thereon as at **88***a* a projection loosely engaged in a slot **82***a* formed in the operating link **82** whereby, when the control knob **78** is manually moved to a position marked START, said switching lever **88** can slide in the direction as indicated by the arrow G whereas,

when said knob **78** is moved to any one of positions marked MAN and STOP, said lever **88** can slide in the direction H opposite to the direction G.

It is to be noted that, as clearly shown in FIG. **7**, the lengthwise direction of the slot **82***a* extends at an angle α relative to the imaginary line connecting the axis of the pivot **82** and the axis of the fixture **81** so that the movement of the control knob **78** in the direction towards the START position requires a relatively small pushing force.

One of the pin members **87** rotatably carries thereon a start lever **89** having integrally formed thereon an elastically deformable feeler **89***a* extending across the path of travel of an upward projection **27***b* of the actuator lever **27** for operating the latter so as to cause the main gear **12** to engage with the geared collar **6** of the turntable **7** in the manner as hereinbefore described. This start lever **89** is povotable a predetermined angular distance about the axis of the pin member **87** in the opposite directions as indicated by the arrows I and J in such a way that, when the switching lever **88** is moved in the direction G, a first kicker **88***c* on said lever **88** abuts the start lever **89** thus pivoting the latter in the direction I and, when the same lever **88** is moved in the direction H, a second kicker **88***b* on said lever **88** opposed to said first kicker **88***c* abuts the start lever **89** thus pivoting the latter in the direction J.

A barrier plate **93** is provided for interrupting the successive feed of the stacked records **28** when the control knob **78** is manually moved to either the MAN position or the STOP position, said barrier plate **93** being pivotally secured as at **90** to the undersurface of the base plate **3.** While a substantially central portion of said barrier plate **93** is open as clearly shown, this barrier plate **93** has therein a curved slot **93***c*, opposed to the pivot **90,** for restricting rotation of said barrier plate **93** about its pivot **90** in cooperation with a pin **91** rigidly extending from the base plate **3** through said slot **93***c*. The barrier plate **93** has integrally formed thereon an upwardly extending engagement arm **93***a* engageable with a downwardly extending protrusion **88***d* on the switching lever **88,** and also with a barrier arm **93***b*. A tension spring **92** acts to urge the barrier plate **93** in one direction so as to cause the barrier arm **93***a* of said barrier plate **93** to engage in a second notch **46***b* in the inner shaft **46** substantially opposed to the first notch **46***a*, said second notch **46***b* being open to the outside through a rectangular opening **47***c* formed in the spindle housing **47.** Engagement of the barrier arm **93***a* in the second notch **46***a* of the inner shaft **46** of the multiplay turntable spindle through the rectangular opening **47***c* of the spindle housing **47** actually takes place only when the control knob **78** is held at the MAN position or the STOP position, as shown in FIGS. **13** (A) and (B), thereby preventing the record on the turntable spindle from falling down said turntable spindle on to the rotating turntable **7.** However, when the drive plate **29** is not operated, i.e., moved to the direction B, the barrier plate **93** is rotated against the spring **92** with the engagement arm **93***a* thereof in contact with the corresponding one of the cam plates **74** as at **74***b* and, consequently, the barrier arm **93***b* of said barrier plate **93** disengages from the second notch **46***b* of the inner shaft **46,** as shown in FIG. **11**(A), and, simultaneously therewith, the engagement arm **93***a* disengages from the projection **88***d* of the switching lever **88.**

In any way, if the barrier arm **93***b* of the barrier plate **93** engages in the second notch **46***b* of the inner shaft **46** in the manner as hereinbefore described, not only no one of the stacked records **28** falls down the multiplay turntable spindle on to the rotating turntable **7,** but also the first abutment **43***b* of the detector plate **43** is free to move, accompanied by the drive plate **29,** across the path of travel of the lowermost end of the inner shaft **46** now retained by the engagement between the barrier arm **93***b* and the second notch **46***b*. Once this condition has been established, the aforementioned relative motion between the detector plate **43** and the drive plate **29** does not take place (unless otherwise the control knob **78** is moved to the MAN or START position thereby to bring the stop edge **50***c* into the path of travel of the second abutment **43***c* and, hence, the tonearm **20** is not rotated about the tonearm shaft **20***d*.

For enabling the stop edge **50***c* of the rejction link **50** to be positioned in the path of travel of the second abutment **43***c* of the detector plate **43** in response to the movement of the control knob **78** to the MAN or STOP position, a second protrusion is provided which extends downwardly formed as at **88***e* in the switching lever **88,** which is engageable only with a wing portion **65***b* formed in the rejection lever **65** opposite to the slant side edge **65***a* as clearly shown in FIG. **7.**

Referring now to FIGS. **3, 7** and **14**a–c, a stop plate **94** is frictionally rotatably carried by a lug **43***d* on the detector plate **43** by means of a supporting pin **95** secured to said lug **43***d* of the detector plate **43.** A compression spring **96** is loosely mounted on the supporting pin **43** between said lug **43***d* and said stop plate **94** for imparting friction during the rotation of said stop plate **94.** This stop plate has a pair of first and second arms **94***a* and **94***b* integrally formed on both sides thereof with respect to the supporting pin **95.** The stop plate **94** is operable in the following manner.

Assuming that the drive plate **29** is moved in the direction B together with the detector plate **43** as shown in FIG. **14**(A), the stop plate **29** is rotated in the direction as indicated by the arrow K with the first arm **94***a* abutted against a first notched edge **3***e* of the base plate **3.** Rotation of the stop plate **94** in the opposite direction as indicated by the arrow L takes place only when the drive plate **29** and the detector plate **43** are together moved in the direction A without relative motion therebetween. At this time, the first arm **94***a* of the stop plate **94** is abutted against a second notched edge **3***d* of the base plate **3** opposed to said first notched edge **3***e* as shown in FIG. **14**(C) in which condition the second arm **94***b* of said stop plate **94** obstructs the path of angular travel of an offset plate **103** as will be described later.

On the other hand, in the case where the drive plate **29** and the detector plate **43** undergo relative motion in the manner as hereinbefore described, no engagement of the first arm **94***a* of the stop plate **94** with the second notched edge **3***d* of the base plate **3** takes place as shown in FIG. **14**(B) and, consequently, even if the drive plate **29** completes its movement in the direction A, the path of angular travel of the offset plate **103** will not be obstructed by the second arm **94***b* of the stop plate **94** in a similar manner as in FIG. **14**(A).

As shown in FIG. **15,** the offset plate **103** is rotatably carried by a supporting pin **104** rigidly secured to the mounting panel **1** and has a stop edge as at **103***a*, an up-

wardly bent piece **103***b* loosely accommodated in an arched slot (not shown) formed in the panel **1** for defining the angular distance through which said plate **103** rotates, and an engagement lug **103***c* engageable with the second arm **94***b* of the stop plate **94** only when said stop plate **94** is positioned as shown in FIG. **14**(B). This offset plate **103** is normally urged in one direction by a tension spring **105** so as to bring the engagement lug **103***c* thereof into a position ready to engage with the second arm **94***b* of the stop plate.

For enabling the idler wheel **9** to be brought to a disengaged position, in which condition no rotational force of the capstan **10** is transmitted to the turntable **7** therethrough, upon rotation of the offset plate **103** against the action of spring **105** with the engagement lug **103** pushed by the second arm **94***b* of the stop plate **94,** a transmission lever **100** is provided and is pivotally carried by a supporting pin **101** rigidly secured to the undersurface of the mounting panel **1.** This transmission lever **100** has thereon a bent piece **100***a* engageable with the stop edge **103***a* of the offset plate **103,** a retaining portion **100***b*, an operating edge **100***c* engageable with an actuator **106***a* of a microswitch **106** secured to the undersurface of the mounting panel **1,** a slide pin **100***d* and a presser portion **100***e* engageable with the arm member **8** for selectively engaging and disengaging the idler wheel **9** as will be described later. This transmission lever **100** is normally urged by a tension spring **102** about the supporting pin **101** in one direction such that, so long as the control knob **78** is positioned at the neutral or OFF position, the operating edge **100***c* of said transmission lever **100** depresses the actuator **106***a* thereby to turn the microswitch **106** off, the bent piece **100***a* is disengaged from the stop edge **103***a* of the offset plate **103** and the presser portion **100***e* thereof presses the arm member **8** so as to disengage the idler wheel **9** from the capstan **10** and the flange of the turntable **7.** At this time, the slide pin **100***d* of said transmission lever **100** is collapsibly engaged in a detent stop **88***f* formed in the switching lever **88,** said switching lever **88** having a pair of first and second cam edges **88***g* and **88***i* which are positioned on both sides of said detent stop **88***f*, one of said cam edges **88***i* being stepped as at **88***h*.

The transmission lever **100** is operable in such a way that, when the control knob **78** is moved to either the START position or the MAN or STOP position, the slide pin **100***d* slides over the corresponding cam edge **88***g* or **88***i* from the detent stop **88***f*, causing the transmission lever **100** to rotate about the supporting pin **161** against the action of the tension spring **102.** As said transmission lever **100** is thus rotated, the bent piece **100***a* thereof is engaged by the stop edge **103***a* of the offset plate **103** while the presser portion **100***e* thereof moves out of its engagement with the arm member **8** thereby to permit the idler wheel **9** to engage with the capstan **10** and the flange of the turntable **7.** Simultaneously therewith, the operating edge **100***c* of said transmission lever **100** disengages from the actuator **106***a* of the microswitch **106** so that the actuator **106***a* that has been depressed is released thereby to turn the microswitch **106** on. It is to be noted that, once the engagement between the bent piece **100***a* and the stop edge **103***a* of the offset plate **103** is established, the transmission plate **100** is locked in position with the spring **102** expanded.

The step **88***h* on the cam edge **88***i* is provided for enabling the control lever **78** to be locked in the MAN position once it is moved thereto.

A gear setting lever **97** is rotatably carried by the mounting panel **1** by means of a supporting pin **98** secured to the undersurface of the mounting panel **1,** for locking the main gear **12** in a position with the toothless portion **12***a* thereof in register with the geared collar **6** of the turntable. This setting lever **97** has a hill side, a detent recess and a cam edge respectively formed as at **97***c*, **97***a* and **97***d* and includes an elongated tongue **97***b* integrally formed therewith. This gear setting lever **97** is normally urged to rotate in one direction about the pin **98** by the action of a tension spring **99** such that the detent recess **97***a* thereof, when the main gear **12** is not rotated with the toothless portion **12***a* in register with the collar **6,** receives therein a first pin **12***c* extending downwardly from the main gear **12.** This gear setting lever **97** is rotated in the opposite direction against the action of the spring **99** only when the hill side **97***c* thereof engages with a second pin **12** *d* extending downwardly from the main gear **12,** said second pin **12***d* being positioned forwardly of said first pin **12***c* with respect to the direction of rotation of said main gear. The setting lever **97** is operable in such a manner that, as the second pin **12***d* in the main gear **12** slidably engages to the hill side of said lever **97** during the rotation of the main gear **12,** the top of the elongated tongue **97***b* engages with the retaining portion **100***b* of the transmission lever **100,** causing the latter to rotate against the action of spring **102** with a clearance forming between the bent piece **100***a* and the stop edge **103***a*. Subsequently, the second pin **12***d* falls into the detent recess **97***a* and immediately escapes therefrom so long as the turntable **7** and hence the main gear **12** is rotated. Upon completion of one rotation of the main gear **12** at which time the toothless portion **12***a* thereof is registered with the geared collar **6,** the first pin **12***c* is entrapped in the detent recess **97***a* of the gear setting lever **97** and, therefore, the main gear **12** is locked in one predetermined position.

The microswitch **106** operated in the manner as hereinbefore described is connected in series with the motor (not shown) having its drive shaft rigidly mounted or integrally formed with the capstan **10,** as hereinbefore described, for rotating the turntable **7** through the idler wheel **9** when it is in the engaged position.

The record player thus constructed as hereinbefore fully described functions as follows.

Assuming that a plurality of records **28** are mounted on the multi-play turntable spindle and when the automatic performance of thes records one after another is desired, what is necessary is to manually move the control knob **78** to the START position. If the control knob **78** is thus moved to the START position, the switching lever **88** is moved in the direction G as shown in FIG. **15.** In this condition, not only is the idler wheel **9** is brought into the engaged position, but also the switch **106** is turned on thereby to rotate the capstan **10,** the rotational force of said capstan **10** being transmitted to the turntable **7** through said idler wheel which is in the engaged position. Simultaneously therewith, the retaining portion **100***b* of said transmission lever **100** is brought into position to permit the gear setting lever **97** to freely pivot about the supporting pin **98** without the

tip of the elongated tongue **97***b* contacting said retaining portion **100***b*.

The control knob **78** can be automatically returned to the neutral or OFF position by the action of the tension spring **85.** Even though the control knob **78** has been returned to the neutral or OFF position, neither the switch **106** is turned off, nor the idler wheel **9** is brought back to the disengaged position. This is because, as shown in FIG. **16,** the bent piece **100***a* of the transmission lever **100** is engaged with the stop edge **103***a* of the offset plate **103,** thus preventing the transmission lever **100** from pivoting about the supporting pin **161** so as to permit the slide pin **100***d* to engage in the detent stop **88***f* of the switching lever **88.**

On the other hand, as the control knob **78** is moved to the START position, the start lever **89** is pivoted in the direction I with the free end of the feeler **89***a* thereof pushing the actuator lever **27** in the direction towards the geared collar **6** of the rotating turntable **7,** thereby causing the engagement **16***b* on the actuating link **16** on the main gear **12** to be brought into the path of travel of the projection **6***a* of the geared collar **6.** Subsequently, the engagement between the geared collar **6** and the main gear **12** takes place and a rotational force of the turntable **7** can be, therefore, transmitted to the main gear **12,** thus rotating said main gear **12** about the gear shaft **11** in the direction opposite to the rotational direction of said turntable **7.**

Upon commencement of the rotation of the main gear **12,** the first pin **12***c* on the main gear **12** escapes from the detent recess **97***a*, during which the gear setting lever **97** is pivoted against the force of spring **99** about the supporting pin **98** with the elongated tongue **97***b* thereof being moved to a position such as indicated by the chain line **97***b'* in FIG. **15.**

During one rotation of the main gear **12,** the drive plate **29** undergoes one reciprocal movement in the opposite directions A and B as hereinbefore described. HOwever, in view of the fact that, at the time the control knob **78** has been moved to the START position, the rejection lever **65** is rotated against the force of spring **70** with the slant side edge **65***a* thereof causing the rejection link **50** to pivot about the pin **3***f* with the result that the stop edge **50***a* of the rejection link **50** is brought into the path of travel of the second abutment **43***c* of the detector plate **43,** the relative motion between the drive plate **29** and the detector plate **43** takes place in the manner as hereinbefore described during the movement of the drive plate **29** in the direction A.

After the drive plate **29** has been moved a predetermined distance in the direction A accompanying the detector plate **43,** the second abutment **43***c* of the detector plate **43** abuts against the stop edge **50***a* of the rejection link **50** as shown in FIG. **10**(A) and, at the same time, the first abutment **43***b* of the detector plate **43** abuts against the lower end portion of the inner shaft **46** that has emerged from the bottom opening of the spindle housing **47** under the effect of the load of stacked records **28** resting on the primary support **48.** Thereafter, the relative motion takes place between the drive plate **29** and the detector plate **43** in such a manner that the latter is held stationary while the drive plate **29** moves further in the direction A. On the other hand, incident to the commencement of the movement of drive plate **29** in the direction A, the seesaw lever **72** pivots about the shaft **71** with the record feeder **76** shifting downwardly to permit the inner shaft **46** to descend with the stacked records **28.**

Immediately after the inner shaft **46** has been shifted downwardly, the secondary support **49** comes into action to support the stacked records **28** except for the lowermost one of them which rests on the primary support **48.**

With the above in mind, as the drive plate **29** moves further in the direction A independent of the detector plate **43,** the lowermost end of the lifting rod **35***c* slides over the inclined surface **33***a* of the cam member **33** on said drive plate **29** thereby to shift the tonearm **20** upwardly about the transverse spindle **20***b* while the downward projection **23***a* of the auxiliary positioning plate **23** is entrapped in the engagement space defined by the elements **33***b*, **33***c* and **51***b* in the manner as hereinbefore described. Along therewith, the downward shift of the record feeder **76** continues until the drive plate **29** completes its movement in the direction A, during which the hook portion **76***a* of said feeder **76** engages in the first notch **46***a* of the inner shaft **46** and then forcibly pulls said inner shaft **46** downwardly thereby to permit the primary support **48** to be withdrawn within the spindle housing **47,** with the result that the lowermost one of the records **28** falls by gravity down said spindle housing on to the rotating turntable **7.**

It is to be noted that, as the drive plate **29** moves in the direction A, the barrier plate **93,** urged by the spring **92,** rotates about the pivot **90** with the engagement arm **93***a* thereof in contact with the portion **74***b* of the cam plate **74** carried by the drive plate **29.** However, this rotation of the barrier plate **93** is subsequently restricted by the first protrusion **88***d* of the switching lever **88** with which said engagement arm **93***a* is engaged and, accordingly, the barrier arm **93***b* of said barrier plate **93** does not enter the rectangular opening **47***c* of the spindle housing **47.**

During the return movement of the drive plate **29** in the direction B, the tonearm **20** is rotated about the tonearm shaft **20***d*, the angular distance of rotation of said tonearm **20** being defined by the setting of the record size selector knob **60,** in the manner as hereinbefore described and, simultaneously therewith, the record feeder **76** is shifted upwardly with the hook portion **76***a* being subsequently disengaged from the first notch **46***a* of the inner shaft **46** with the result that the primary support comes into action to support the remaining records while the secondary support is withdrawn within the spindle housing **47.**

As hereinbefore described, the return movement of the drive plate **29** does not cause the second arm **94***b* of the stop plate **94** to engage with the engagement lug **103***c* of the offset plate **103,** but merely causes the rejection link **50** to pivot about the supporting pin **3***f* until the shallow projection **50***e* thereof falls into the shaped opening **3***b* in the base plate **3,** thus clearing the stop edge **50***a* from the path of travel of the second abutment **43***c* of the detector plate **43.**

For a certain period of time thereafter, the lowermost record that has fallen on to the rotating turntable **7** is played. The rotational speed of the turntable proper for the type of the stacked records **28** is defined by the setting of the speed control knob **119** in any known manner.

After the lowermost record has been played and as the pickup stylus **20***c* enters the lead-out groove of the

record, the pin **25** on the auxiliary positioning plate **23** pushes the actuator lever **27** in a similar way to the way said lever **27** is pushed by the start lever **89,** whereby engagement between the geared collar **6** of the turntable **7** and the main gear **12** again takes place in the manner as hereinbefore described.

During the subsequent rotation of the main gear **12,** a similar operation as hereinbefore described takes place. In other words, it is clear that, during the movement of the drive plate **29** in the direction A, the tonearm **20** is shifted upwardly and then brought back to the initial position where said tonearm **20** rests on a tonearm rest **20***e* while the record next to the lowermost one of the stacked records **28** is permitted to fall on to the rotating turntable **7** and, during the return movement of said drive plate **29** in the direction B, the tonearm **20** is rotated about the tonearm shaft **20***d* until the pickup stylus **20***c* is positioned in the lead-in groove of the next lowermost record now on the rotating turntable **7.**

Although the subsequent rotation of the main gear **12** is effected by the pivotal movement of the tonearm **20** in the manner as hereinbefore described without the control knob **78** being again moved to the START position as required at the time the record player is initially set in operation, the relative motion between the drive plate **29** and the detector plate **43** takes place due to the fact that the first abutment **43***b* of the detector plate **43** is engaged with the lower portion of the inner shaft **46** as hereinbefore described.

Assuming now that the last one of the stacked records **28** has been fed on to the rotating turntable **7,** and after the last record has been played out, no load is accordingly imposed on the primary support **48** of the multi-play turntable spindle. Therefore the lowermost end of the inner shaft **46** remains in the spindle housing **47,** thus permitting the passage of the first abutment **43***b* of the detector plate **43** without engaging with the lower end portion of the inner shaft **46.** Due to the fact, no relative motion takes place between the drive plate **29** and the detector plate **43** and, accordingly, at the time of completion of the movement of the drive plate **29** in the direction A together with the detector plate **43,** the stop plate **94** is, as shown in FIG. **14**(C), pivoted about the supporting pin **95** in the direction L with the first engagement arm **94***a* restricted by the notched edge **3***d* of the base plate **3** while the second engagement arm **94***b* thereof is conditioned so as to engage with the engagement lug **103***c* of the offset plate **103.**

As hereinbefore described, the engagement between the second engagement arm **94***b* of the stop plate **94** and the engagement lug **103***c* of the offset plate **103** causes the offset plate **103** to pivot about the supporting pin **104** against the force of spring **105,** with the result that the stop edge **103***a* thereof disengages from the bent piece **100***a* of the transmission lever **100.** Upon disengagement of said stop edge **103***a* from the bent piece **100***a*, the transmission **100** is urged to pivot about the supporting pin **161** by the action of the spring **102.** However, at this time, the second pin **12***d* on the main gear **12** slides over the hill side **97***c* of the gear setting lever **97,** causing the latter to pivot about the supporting pin **98** against the force of spring **99** with the elongated tongue **97***b* pushing the retaining portion **100***b* of the transmission lever **100,** thus forming the clearance between the bent piece **100***a* and the stop edge **103***a* which is now moved away from the path of travel of said bent piece **100***a* by the engagement between the second engagement arm **94***b* and the engagement lug **103***c*. Thereafter, the pivotal movement of the transmission lever **100** about the supporting pin **161** under the force of the spring **102** slowly takes place with the retaining portion **100***b* thereof in contact with the tip of the elongated tongue **97***b* until the first pin **12***c* on the main gear **12** falls in the detent recess **97***a* of the gear setting lever **97** while the second pin **12***d* slides down the cam edge **97***d* of said gear setting lever **97** past the recess **97***a*.

At the time of completion of one rotation of the main gear **12** in which condition not only the pin **12***c* is engaged in the detent recess **97***a*, but also the toothless portion **12***a* of said main gear **12** is registered with the geared collar **6** without receiving the rotational force of the turntable **7,** it is clear that not only the switch **106** is turned off, but also the idler wheel **9** is brought into the disengaged position, thus permitting the various mechanisms of the record player to return to the initial conditions as shown in FIG. **2.**

From the foregoing, it has now become clear that, not only a plurality of records mounted on the multiplay turntable spindle in a stacked arrangement can be automatically played, but also the record player can be automatically set to the initial condition after the last one of said records has been played out.

However, if the operation of the record player is desired to be interrupted during the automatic play of any one of the stacked records, what is necessary is to move the control knob **78** to the STOP position past the MAN position. The control knob **78** that has been moved to the STOP position is, upon removal of an external pushing force applied thereto, automatically returned to the MAN position. This is possible because, as the control knob **78** is moved to the STOP position, the switching lever **88** is moved in the direction H while permitting the slide pin **100***d* on the transmission lever **100** to pass over the step **88***h* of said switching lever **88** and, upon removal of the external pushing force applied to said control knob **78,** said switching lever **88** automatically moves in the direction G by the action of the spring **86,** said movement of said switching lever **88** in said direction G being subsequently restricted by the slide pin **100***d* upon engagement of said pin **100***d* with said step **88***h* as shown in FIG. **17,** in which condition the control knob **78** is stopped at the MAN position.

On the other hand, upon the movement of the switching lever **88** in the direction H in response to the movement of the control knob **78** to the STOP position, the first kicker **88***b* of said lever **88** rotates the start lever **89** about the supporting pin **87** so as to cause the actuator lever **27** to move in the direction towards the geared collar **6.** Accordingly, it is clear that the engagement between the geared collar **6** and the main gear **12** subsequently takes place in the manner as hereinbefore described. Furthermore, the movement of the switching lever **88** in the direction H permits the first protrusion **88***d* to move away from the path of travel of the engagement arm **93***a* of the barrier plate **93** and, therefore, the barrier arm **93***b* thereof engages in the second notch **46***b* of the inner shaft **46** through the shaped opening **47***c* of the spindle housing **47** thereby to restrict the inner shaft **46** from descending in response to the downward shift of the record feeder **76** so that no

one of the remaining records in the stacked arrangement will be fed on to the rotating turntable **7.**

With the above in mind, during the rotation of the main gear **12** effected after the control knob **78** has been moved to the STOP position, the resultant movement of the drive plate **29** in the direction A causes the tonearm **20** to return to the resting position in such a way that the engaging portion **33***c* of the cam member **33** pushes the projection **23***a* of the auxiliary positioning plate **23** to rotate the latter and the positioning plate **21** about the common tonearm shaft **20***d* in the direction C. During this process, since no relative motion takes place between said drive plate **29** and the detector plate **43,** the hook member **51** does not operate while the stop plate **94** is rotated in the manner as hereinbefore described to establish the condition as shown in FIG. **14**(C) at the time of completion of the movement of said drive plate **20** in the direction A accompanying the detector plate **43.**

The return movement of the drive plate **29** in the direction B causes the second arm **94***b* of the stop plate **94** to engage with the engagement lug **103***c* of the offset plate **103** and, accordingly, it is clear that the various mechanisms of the record player can be restored to the initial conditions as shown in FIG. **2.**

It is to be noted that the control knob **78** that has been positioned at the MAN position can be automatically moved to the OFF position. This is possible when the clearance is formed between the bent piece **100***a* and the stop edge **103***a*, at which time the slide pin **100***d* disengages from the step **88***h* of the switching lever **88,** thus permitting the latter to move in the direction G by the action of the spring **85** with the control knob **78** positioned at the OFF position. It is further to be noted that, due to the fact that the transmission lever **100** slowly rotates with the retaining portion **100***b* in contact with the tip of the elongated tongue **97***b* of the gear setting lever **97** rotating about the supporting pin **98** urged by the spring **99,** the slide pin **100***d* correspondingly enters the detent stop **88***f* while the operating edge **100***c* depresses the actuator **106***a* of the switch **106.** This is advantageous in that no incomfortable noise is generated upon entry of the slide pin **100***d* into said detent stop **88***f* of the switching lever **88.**

In the foregoing description, the operation of the record player constructed in accordance with the present invention has been described with respect to the plurality of stacked records **28.** However, it is to be understood that, even if a single record is mounted on the multi-play turntable spindle, the various mechanisms of the record player individually function in substantially the same manner as hereinbefore described. In the case where only one record is to be played, the use of the single-play turntable spindle inplace of the multi-play turntable spindle is recommended.

The use of the single-play turntable spindle in place of the multi-play turntable spindle shows the utility of the MAN position of the control knob **78** as will be described later. If the multi-play turntable spindle is replaced by the single-play turntable spindle such as indicated by **107** in FIG. **18B,** the movement of the control knob **78** to the MAN position from the OFF position enables the tonearm **20** to be manually operated so that the pickup stylus **20***c* can be brought to anywhere on the single record on the turntable **7** and, after such record has been played out, the various mechanisms of the record player will be returned to the initial conditions.

More specifically, assuming that a single record is mounted on the turntable **7** in alignment with the single-play turntable spindle **107** having, as shown in FIG. **18B,** an upper end portion extending through the center hole of said record and the other lower end portion situated within the sleeve **5** and if the control knob **78** is moved to the MAN position where said control knob **78** is temporarily locked by the engagement between the slide pin **100***d* and the step **88***h* of the switching lever **88,** only the transmission lever **100** is operated such that the switch **106** is turned on and the idler wheel **9** is brought to the engaged position. No engagement between the start lever **89** and the upward projection **27***b* of the actuator lever **27** takes place and, therefore, no engagement between the geared collar **6** and the main gear **12** takes place. In other words, only the turntable **7** is rotated by the capstan **10,** the rotational force of said capstan **10** being transmitted to said turntable **7** through the idler wheel **9** in the engaged position.

Accordingly, the tonearm **20** can be manually operated in any desired manner. However, after the record has been played out and upon approach of the tonearm **20** to the single-play turntable spindle **107,** the actuator lever **27** is moved towards the sleeve **5** in the manner as hereinbefore described. Engagement between the geared collar **6** and the main gear **12** subsequently takes place, thus rotating said main gear **12** in the predetermined direction. The subsequent operation is substantially similar to that occurring after the control knob **78** has been moved to the STOP position, as has been described above.

Another embodiment of the present invention is shown in FIGS. **19** to **23** wherein the transmission lever and the switching lever are respectively modified. FIG. **19** shows the condition wherein the control knob **78** is positioned at the OFF position and, hence, the slide pin **100'***d* of the transmission lever **100'** is engaged in the detent stop **88'***f* of the switching lever **88'** whereby the switch **106** is turned off and the idler wheel **9** is in the disengaged position. FIG. **20** illustrates the condition wherein the control knob **78** is moved to the START position. In this embodiment, the control knob **78** once moved to the START position can be temporarily locked thereat by the engagement of the slide pin **100'***d* and another step **88'***j* formed in the switching lever **88'**. More specifically, as the control knob **78** is moved to the START position, the first kicker **88'***c* pushes the start lever **89** causing the latter to rotate in the direction I and is then moved backwards by the action of the spring **85,** moving said lever **88'** a predetermined distance in the direction H until the slide pin **100'***d* engages with the step **88'***j* in which condition the first kicker **88'***c* separates from the start lever **89** thereby to prevent the feeler **89***a* from obstructing the path of travel of the upward projection **27***b* of the actuator lever **27** while said control knob **78** is temporarily locked in the START position. It is to be noted that, due to the fact that the tension spring **102** ensures a firm engagement of the slide pin **100'***d* with the step **88'***j*, the movement of the switching lever **88'** in the direction H urged by the spring **85** so as to position the control knob **78** in the OFF position can be prevented. During this condition, the record on the turntable **7** can be automatically played.

After the record mounted on the single-play turntable spindle or the last one of the stacked records mounted on the multi-play turntable spindle has been played out, the second arm **94***b* of the stop plate **94** positioned as shown in FIG. **14**(C) in the manner as hereinbefore described pushes the bent piece **100'***b* of the transmission lever **100'** causing the latter to rotate against the force of spring **102** about the supporting pin **101.** As the transmission lever **100'** is thus rotated to a position as indicated by the chain line **100'***d'* in FIG. **20,** the slide pin **100'***d* disengages from the step **88'***j*, thus permitting the switching lever **88'** to move in the direction H under the action of the spring **85.** Immediately thereafter, the second arm **94***b* pushing the bent piece **100'***a* enters a bay **100'***b* in the transmission lever **100'** and, simultaneously therewith, the first arm **94***a* abuts against the first notched edge **3***e* of the base plate **3** so that the stop plate **94** is positioned as shown in FIG. **23.** Upon the establishment of the position as shown in FIG. **23,** the transmission lever **100'** is instantaneously rotated by the action of the spring **102** until the slide pin **100'***d* is entrapped in the detent stop **88'***h* of the switching lever **88'** in which condition the switch **106** is turned off and the idler wheel **9** is brought to the disengaged position while the control knob **78** is returned to the OFF position.

FIG. **21** illustrates the condition wherein the control knob **78** is moved to the MAN position. The control **78** once moved to the MAN position is similarly temporarily locked thereat by the engagement between the slide pin **100'***d* and the step **88'***h* of the switching lever **88'** in which condition the switch **106** is turned on and the idler wheel **9** is brought to the engaged position. Return of the control knob **78** to the OFF position takes place in a substantially similar manner as described with reference to FIG. **21.**

In this embodiment shown in FIGS. **19** to **23,** in addition to the automatic return of the control knob **78** to the OFF position, the control knob **78** that has been locked at the START position or the MAN position can be manually returned to the OFF position during the play of the record in which case the slide pin **100'***d* slides over the step **88'***f* or **88'***h*. Accordingly, it is clear that interruption of the play of the record can be achieved only by moving the control knob **78** to the OFF position from either the START position or the MAN position, without returning the tonearm **20** to the tonearm rest **20***e*.

In the case where the interruption of the play of the record and simultaneous return of the tonearm **20** to the tonearm rest **20***e* are desired, what is necessary is to move the control knob **78** to the STOP position. If the control knob **78** is moved to the STOP position, the engagement between the geared collar **6** and the main gear **12** takes place in the manner as hereinbefore described and, accordingly, it is clear that, upon completion of the rotation of the main gear **12,** the transmission lever **100'** can be operated by the second arm **94***b* of the stop plate **94** in the manner as hereinbefore described, whereby the switch **106** is turned off and the idler wheel **9** is brought to the disengaged position while the control knob **78** resting at the MAN position is returned to the OFF position. The rotation of the main gear **12** in this case causes the tonearm **20** to be automatically returned to the tonearm rest **20***e*.

A further embodiment of the present invention is shown in FIGS. **24**(A) and (B). In this embodiment, one surface of the engaging portion **33***c* which faces the projection **23***a* of the auxiliary positioning plate **23** and which contacts said projection **23***a* when the tonearm **20** is to be shifted to the tonearm rest **20***e* is inclined at a certain angle θ with respect to the imaginary line passing at right angles to the direction of movement of the cam member **33** and, hence, the drive plate **29.** The purpose of making the surface of the engaging portion **33***c* inclined is to slowly rotate the tonearm **20** at the beginning of rotation of said tonearm **20** in the direction C and to rapidly rotate the tonearm **20** at the end of rotation of said tonearm **20** approaching the tonearm rest **20***e*.

In this arrangement, at the beginning of return of the tonearm **20** to the tonearm rest **20***e* accompanied by the rotation of the auxiliary positioning plate **23** in the direction C, as shown in FIG. **24**(A), the point T of the projection **23***a* of said plate **23** which is the farthest from the axis of rotation of said plate **23,** i.e., the axis of the tonearm shaft **20***d*, is first contacted by the inclined surface of the engaging portion **33***c* as the drive plate **29** moves in the direction A and said plate **23** is then rotated in the direction C with said point T in sliding engagement with said inclined surface so that the rotational speed of said plate **23** and, hence, the tonearm **20,** is lowered by relation to the speed of movement of the drive plate **29** in an amount corresponding to the angle θ of the inclined surface of said engaging portion **33***c*. On the other hand, as shown in FIG. **24**(B), at the end of the return of the tonearm **20** to the tonearm rest **20***e*, the point S of the projection **23***a* which is the shortest distance from the axis of the tonearm shaft **20***d* is contacted by the inclined surface and, though the rotational speed of the tonearm **20** is therefore accelerated, the speed of movement of the projection **23***a* is advantageously lowered so that the tonearm **20** slowly approaches the tonearm rest **20***e* with no substantial shock generated between said tonearm **20** and said tonearm rest **20***e*.

Accordingly, from the foregoing, it has now become clear, that, by suitably selecting the shape of the engaging portion **33***c*, the optimum speed of return of the tonearm **20** to the tonearm rest **20***e* can be obtained irrespective of the speed of movement of the drive plate **29** which is determined by the shape of the cam groove **12***b*. This is particularly advantageous in that no impairment of the pickup stylus **20***c* occurs.

From the foregoing full description of the present invention, it has become clear that the record player constructed in accordance with the present invention has the various capabilities as hereinbefore described. In view of this, none of the of different preferences need to be omitted since the present record player meets the requirement that the various types must individually have.

Although the present invention has been fully described by way of example, it is to be noted that various changes and modifications will be apparent to those skilled in the art, such changes and modifications being understood to be within the scope of the present invention unless otherwise they depart therefrom.

What is claimed is:

1. In an automatic record player, the combination which comprises a tonearm including a pickup stylus interchangeably carried thereby; a turntable; a turntable drive system comprising an electrical motor for rotating said turntable in one predetermined direction

when said motor is operated; an operational mode control including a control knob manually movable to any one of start, manual and stop positions; an electrical switch for connecting a suitable power source to said motor; means rotatable between first and second positions and including a spring element for normally urging said rotatable means to said first position in which condition said switch is opened, said rotatable means being rotated to the second position when said control knob is moved either to the start position or to the stop or manual position to close said switch thereby to operate said motor; pivotable means rotatable together with said tonearm connected therewith by means of a tonearm shaft and having a projection; a drive plate reciprocatable and including a cam member rigidly carried thereby at one end thereof; transmission means for transmitting a rotational force of said turntable to said drive plate for causing said drive plate to move in one direction during a first portion of an operation of said transmission means; a lifting rod having a lower end slidably engaging said cam member and an upper end for supporting said tonearm and operable in such a manner that, when said drive plate is moved in said one direction, said lifting rod shifts said tonearm upwardly and, when said drive plate is moved in said opposite direction, said lifting rod is allowed to downwardly shift; a record size selector comprising a selector knob movable among first, second and third detent stop positions, that are respectively associated with standardized diameters of **7, 10** and **12** inches of commercially available records, and at least one positioning plate having stepped edges corresponding to said detent stop positions of said selector knob, said positioning plate being pivotable in response to the movement of said drive plate in said one direction thereby to permit any one of said stepped edges, selected by the setting of said selector knob to the corresponding one of the detent stop positions, to be positioned in the path of angular travel of said projection of said pivotable means for enabling the pickup stylus to be automatically engaged in the lead-in groove of a record to be played; a detector plate relatively slidably carried by said drive plate, said detector plate being movable together with said drive plate when said control knob is moved to the stop position past the manual position and capable of undergoing a relative motion with respect to said drive plate, when said control knob is moved to the start position, in such a way that, after said drive plate is moved in a predetermined distance in said one direction, said detector plate is held stationary and said drive plate is permitted to further move in said one direction, said detector plate including a spring element for urging said detector plate in one direction whereby, after said drive plate has been moved a predetermined distance is said opposite direction said detector plate commences to move together with said drive plate further moving in said opposite direction; escapement means operable, when the control knob is moved to the start position to cuase said transmission means to undergo one cycle of the operation thereof, to rotate the tonearm in one direction from the resting position to another position immediately above the lead-in groove of the record to be played in response to the relative motion of said detector plate with respect to said drive plate, said tonearm after having played said record being returned to the resting position by said escapement means when said drive plate is moved in said one direction during a subsequent cycle of operation of said transmission means caused upon entry of the pickup stylus in the lead-out groove of said record, said escapement means being operatively carried by said drive plate adjacent to said cam member and also operable, when the control knob is moved to the stop position past the manual position while the record is being played, to immediately return said tonearm to the resting position in response to the movement of said drive plate in said one direction caused through said transmission means by manually moving said control knob to said stop position; means for causing the relative motion between said detector plate and said drive plate only when said control knob is moved to said start position; means for locking said rotatable means in said second position when said rotatable means is rotated to said second position; and a stop plate carried by the detector plate and frictionally rotatable between first and second positions, said stop plate being normally maintained in the first position when the relative motion between the detector plate and the drive plate does not take place and rotated to the second position when said relative motion takes place, said stop plate in said second position being capable of engaging with said locking means upon completion of the movement of said drive plate in said opposite direction thereby permitting said switch to be turned off with said rotatable means rotated to said first position.

2. The record player as claimed in claim **1,** wherein said lifting rod includes means for giving contact pressure to said pivotable means, when said lifting rod is in the upwardly lifted position with said lower end thereof sliding over said cam member, thereby to prevent said pivotable means and, hence, the tonearm, from fluttering during rotation thereof.

3. The record player as claimed in claim **1,** wherein said lifting rod further includes an adjustment device for adjusting the height of the tonearm with respect to the plane of the turntable.

4. The record player as claimed in claim **1,** wherein said turntable drive system further comprises an idler wheel, a capstan rigidly mounted on a drive shaft of said motor and having at least three different diameter portions and a speed selector knob manually movable among first, second and third detent positions which respectively correspond to said three different diameter portions of said capstan and represent the standardized speeds of 33⅓, 45 and 78 round per minute of rotation of the turntable, said idler wheel capable of being brought into an operative position by said rotatable means, when said control knob is moved either to the start position or to the manual or stop position, thereby to transmit the rotational force of said capstan to said turntable and brought back to an inoperative position when said rotatable means is rotated to said first position.

5. The record player as claimed in claim **4,** wherein said idler wheel is provided with an adjustment device for manually adjusting the height of said idler wheel with respect to any one of said different diameter portions of said capstan.

6. The record player as claimed in claim **1,** further comprising a cuing device for manually forcibly bringing the tonearm to the upwardly shifted position, said cuing device comprising a pivotably lever pivotable between operative and inoperative positions, a tension

spring for urging said pivotable lever to said inoperative position a guide member having one end rigidly connected with the lifting rod, said pivotable lever having one end formed as a handle and the other end slidably engageable with the other end of said guide member whereby, only when said lever is manually pivoted to the operative position against the tension spring with said other end thereof lifting said guide member, the lifting rod is forcibly upwardly lifted and, when said lever is allowed to return to the inoperative position with said other end thereof separating from said guide member, said lifting rod is allowed to downwardly shift.

7. In an automatic record player, the combination which comprises a tonearm including a pickup stylus interchangeably carried thereby; a turntable; a turntable drive system comprising an electrical motor for rotating said turntable in one predetermined direction when said motor is operated; an operational mode control including a control knob manually movable to any one of start, manual and stop positions; an electrical switch for connecting a suitable power source to said motor; means rotatable between first and second positions and including a spring element for normally urging said rotatable means to said first position in which condition said switch is opened, said rotatable means being rotated to the second position when said control knob is moved either to the start position or to the stop or manual position to close said switch thereby to operate said motor; pivotable means rotatable together with said tonearm connected therewith by means of a tonearm shaft and having a projection; a drive plate reciprocable and including a cam member rigidly carried thereby at one end thereof; transmission means for transmitting a rotational force of said turntable to said drive plate for causing said drive plate to move in one direction during a first portion of an operation of said transmission means; a lifting rod having a lower end slidably engaging said cam member and an upper end for supporting said tonearm and operable in such a manner that, when said drive plate is moved in said one direction, said lifting rod shifts said tonearm upwardly and, when said drive plate is moved in said opposite direction, said lifting rod is allowed to downwardly shift; a record size selector comprising a selector knob movable among first, second and third detent stop positions that are respectively associated with standardized diameters of 7, 10 and 12 inches of commercially available records, and at least one positioning plate having stepped edged corresponding to said detent stop positions of said selector knob, said positioning plate being pivotable in response to the movement of said drive plate in said one direction thereby to permit any one of said stepped edges, selected by the setting of said selector knob to the corresponding one of the detent stop positions, to be positioned in the path of angular travel of said projection of said pivotable means for enabling the pickup stylus to be automatically engaged in the lead-in groove of a record to be played; a detector plate relatively slidably carried by said drive plate, said detector plate being movable together with said drive plate when said control knob is moved to the stop position past the manual position and capable of undergoing a relative motion with respect to said drive plate, when said control knob is moved to the start position, in such a way that, after said drive plate is moved a predetermined distance in said one direction, said detector plate is held stationary and said drive plate is permitted to further move in said one direction, said detector plate including a spring element for urging said detector plate in one direction whereby, after said drive plate has been moved a predetermined distance in said opposite direction said detector plate commences to move together with said drive plate further moving in said opposite direction; escapement means operable, when the control knob is moved to the start position to cause said transmission means to undergo one cycle of the operation thereof, to rotate the tonearm in one direction from the resting position to another position immediately above the lead-in groove of the record to be played in response to the relative motion of said detector plate with respect to said drive plate, said tonearm after having played said record being returned to the resting position by said escapement means when said drive plate is moved in said one direction during a subsequent cycle of operation of said transmission means caused upon entry of the pickup stylus in the lead-out groove of said record, said escapement means being operatively carried by said drive plate adjacent to said cam member and also operable, when the control knob is moved to the stop position past the manual position while the record is being played, to immediately return said tonearm to the resting position in response to the movement of said drive plate in said one direction caused through said transmission means by manually moving said control knob to said stop position; means for causing the relative motion between said detector plate and said drive plate only when said control knob is moved to said start position; means for locking said rotatable means in said second position when said rotatable means is rotated to said second position; a stop plate carried by the detector plate and frictionally rotatable between first and second positions, said stop plate being normally maintained in the first position when the relative motion between the detector plate and the drive plate does not take place and rotated to the second position when said relative motion takes place, said stop plate in said second position being capable of engaging with said locking means upon completion of the movement of said drive plate in said opposite direction thereby permitting said switch to be turned off with said rotatable means rotated to said first position; a multi-play turntable spindle a tubular spindle housing a having a lower end portion formed with an opening, an inner shaft having a lower end portion formed with first and second notches, the first one of which is in register with said opening when said inner shaft is upwardly shifted within said spindle housing, a primary support operatively carried by said inner shaft and operable in such a manner that, when said inner shaft is in the upwardly shifted position, said primary support comes into action to support a plurality of records to be played mounted on said turntable spindle and a secondary support operatively associated with said primary support and operable in such a manner that, when said primary support is withdrawn within said spindle housing, said secondary support comes into action to support the stack of records except for the lowermost one of them which is then permitted to fall down said turntable spindle on to the turntable; a spindle drive mechanism including a seesaw lever having one end pivotally connected with a fixed framework and the other end carrying thereon a record feeder, and at least one cam plate rigidly se-

cured to the drive plate and having a substantially arched slot along which said other end of said seesaw lever is guided in response to the movement of the drive plate so as to selectively upwardly and downwardly shift said record feeder, said record feeder having a pivotable hooking member engageable in said second notch of said inner shaft during the downward movement of said record feeder thereby to forcibly lower the inner shaft whereby the lowermost one of the stacked record mounted on the turntable spindle is permitted to fall down said turntable spindle on to the turntable with said primary support withdrawn within said spindle housing and said second support in position to support the stacked records except for the lowermost one of them; and a barrier means for restricting the inner shaft from downwardly shifting when the control knob is moved to either the manual position or the stop position past the manual position while permitting the record feeder to undergo idle operation.

8. The record player as claimed in claim **7,** wherein said record feeder includes an adjustment device for manually adjusting the positioning of the inner shaft within said spindle housing to ensure that, when said feeder is upwardly shifted, said inner shaft is upwardly shifted with the secondary support withdrawn within the spindle housing whereby insertion and removal of the records can be facilitated.

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