

Nov. 15, 1960

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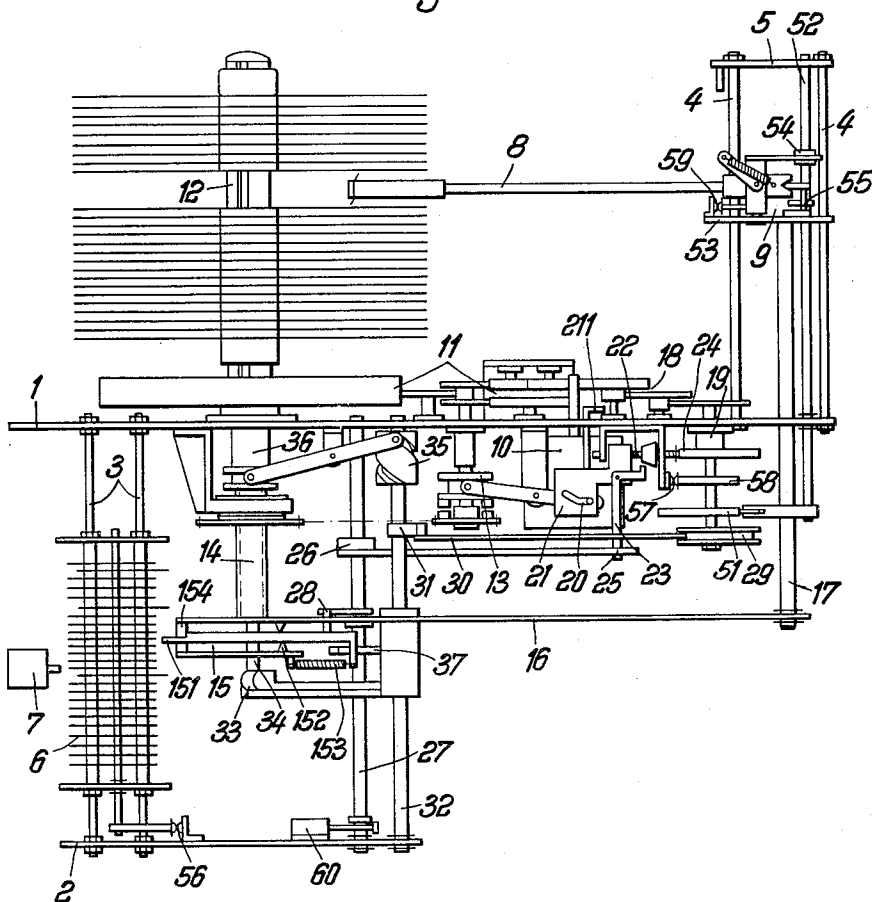
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AUTOMATIC RECORD CHANGER FOR PHONOGRAPHS

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7 Sheets-Sheet 1

Fig. 1



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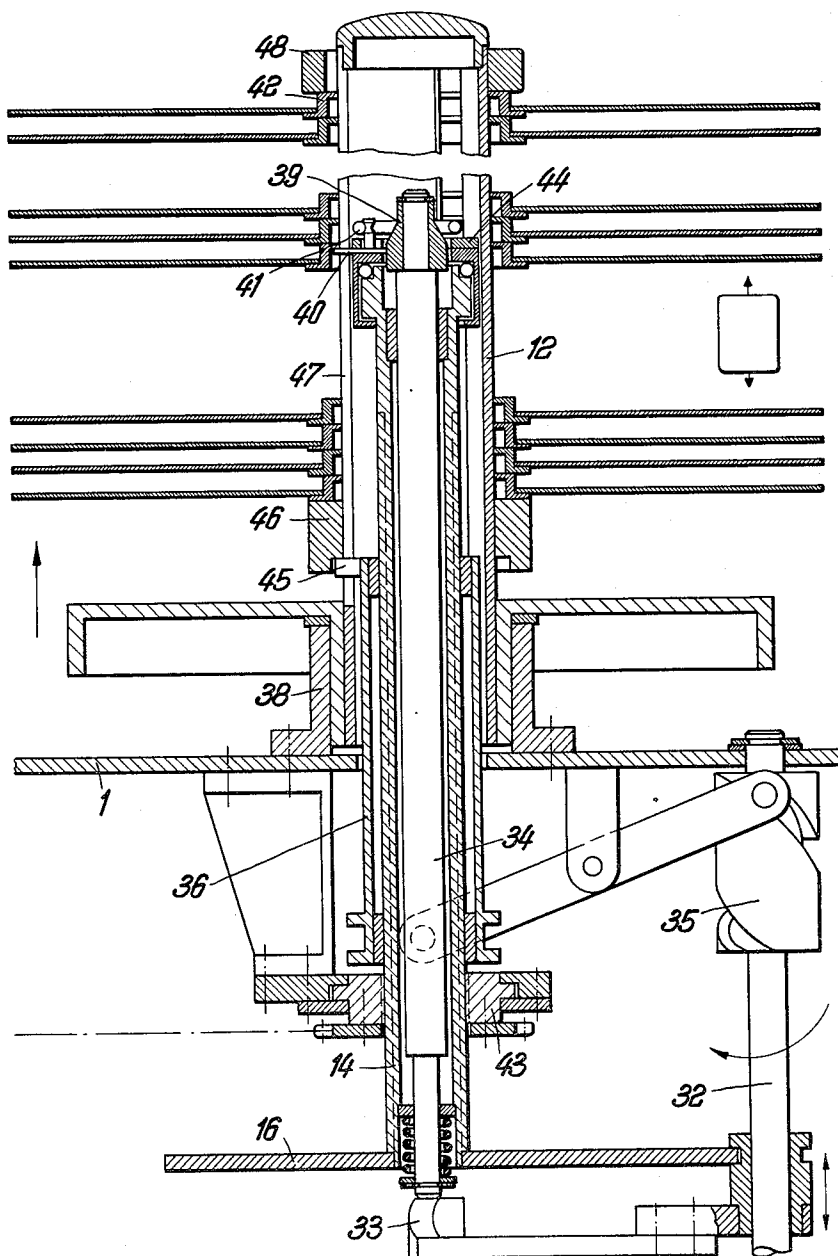
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Fig. 2



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Fig. 3

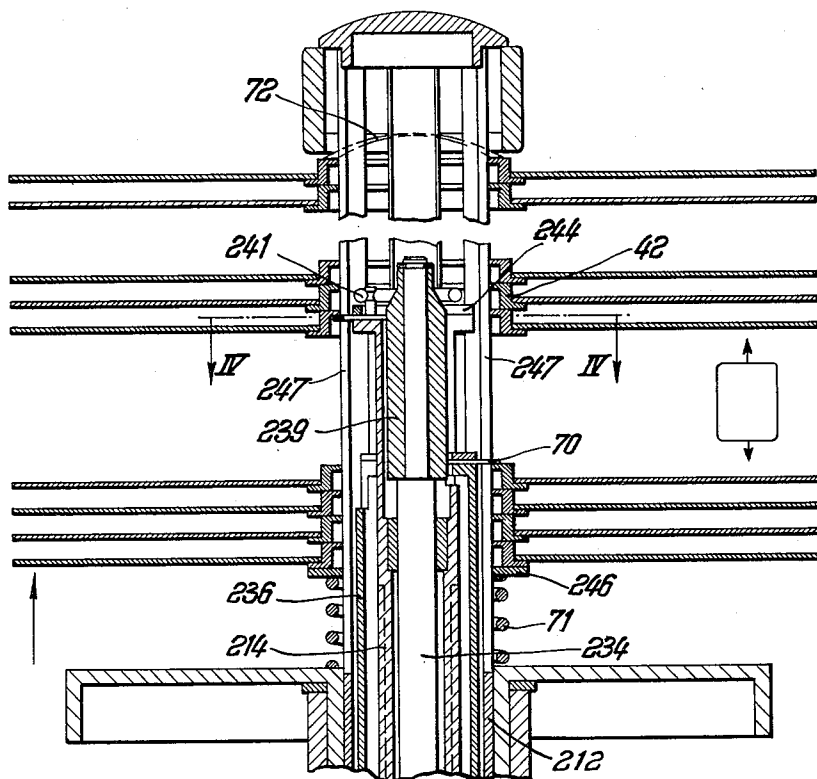


Fig. 5

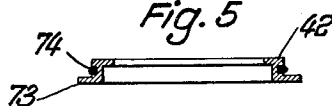


Fig. 4

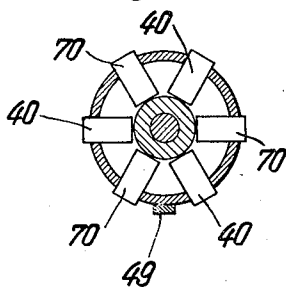
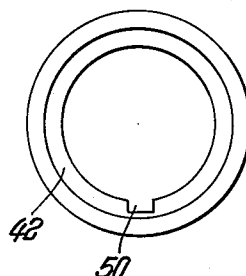


Fig. 6



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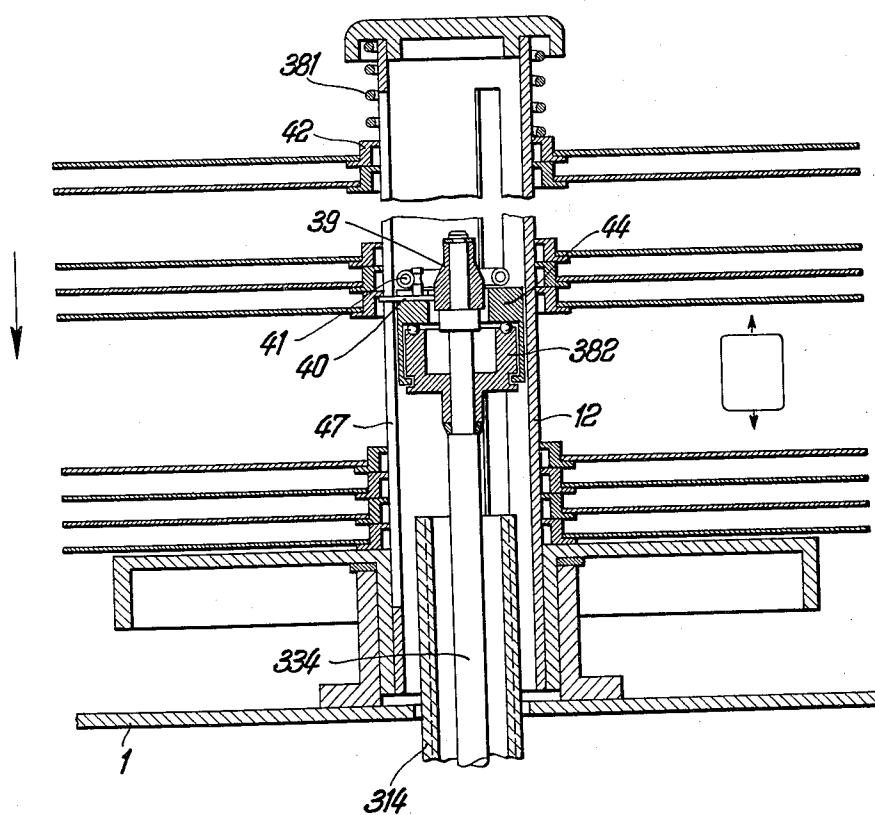
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Fig. 7



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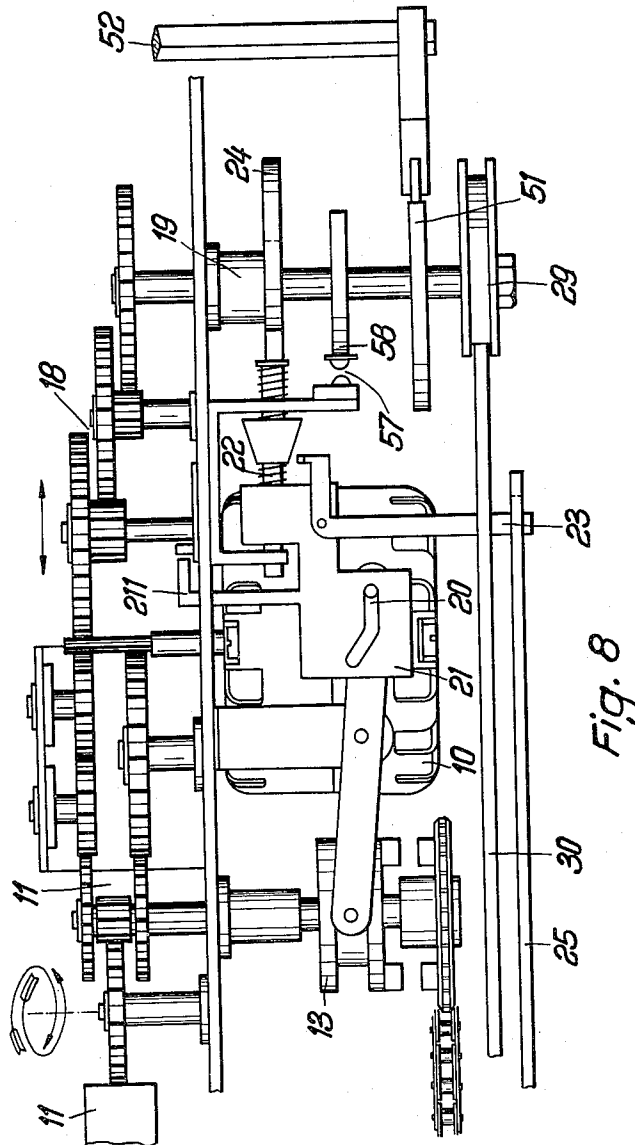


Fig. 8

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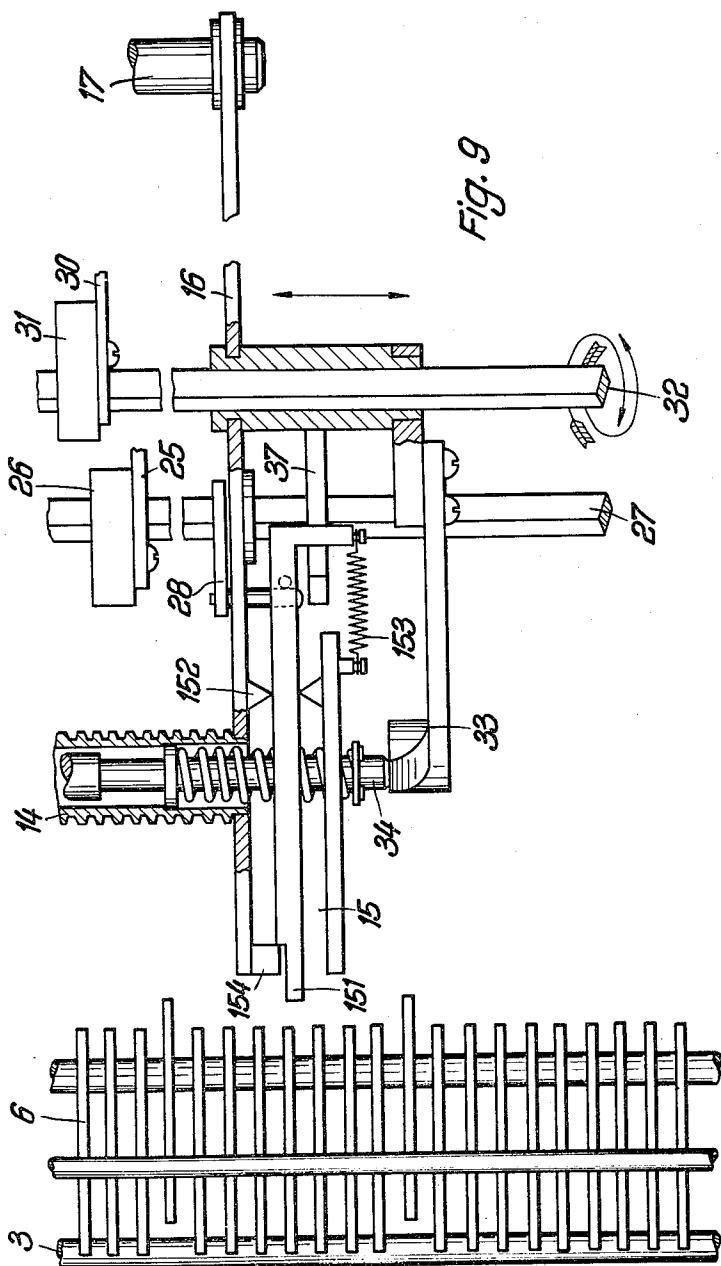
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AUTOMATIC RECORD CHANGER FOR PHONOGRAPHS

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AUTOMATIC RECORD CHANGER FOR PHONOGRAPHS

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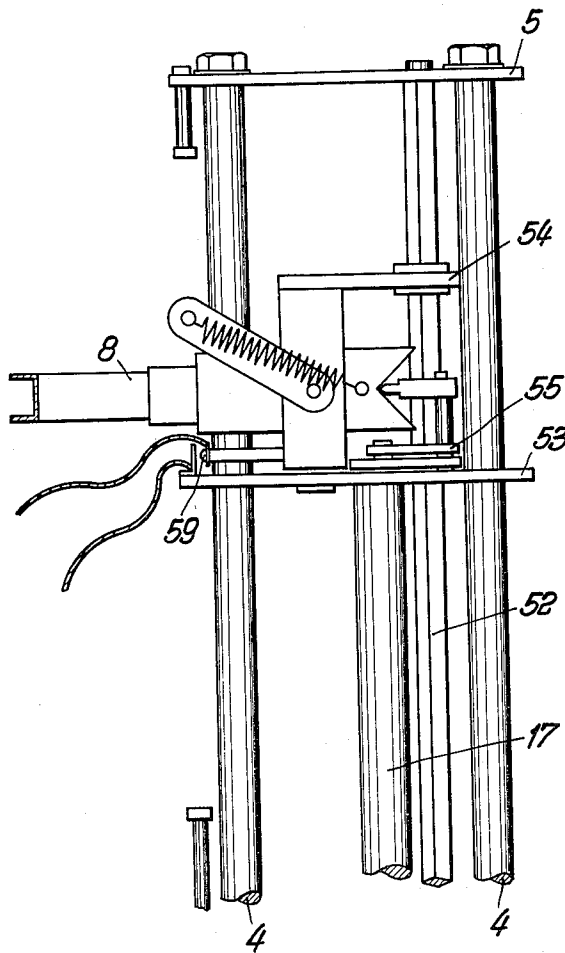


Fig. 10

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AUTOMATIC RECORD CHANGER FOR
PHONOGRAPHS

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3 Claims. (CL 274—10)

This invention relates to automatic phonographs, and especially to new and useful improvements in automatic phonographs of the type adapted to play both sides of a record selectively chosen from a plurality thereof.

More particularly, this invention relates to automatic phonographs of the stated type wherein provision is made for selectively subdividing a stack of records rotatably supported by a rotatable spindle for playing either the upperside of the upmost record of the lower part of the subdivided stack or the underside of the undermost record of the upper part of the subdivided stack.

The principal object of this invention is to provide an automatic phonograph of the stated type including a rotatable spindle supporting a stack of records and comprising in novel arrangement means for subdividing the stack of records into two sections, supporting one of said sections in its place, displacing the other section along the axis of said spindle for forming a temporary working space for the tone arm and positively replacing said other section along said axis for reuniting said stack of records after performance of a play.

Another and equally important object of this invention is to provide an automatic phonograph of the stated type including a rotatable spindle for supporting a stack of records and means for rotating it including means for selectively changing the direction of rotation of said spindle for playing either the upperside or the underside of a preselected record.

Another object of this invention is to provide an automatic phonograph of the stated type having a rotatable spindle for supporting a stack of records each provided with a centering hub and coupling means arranged on said spindle keying said records to said spindle for joint rotation.

These and other objects of the invention and the various features and details of the construction, arrangement and operation thereof are hereinafter described in general and further fully set forth and described in detail with reference to the accompanying drawings.

Whilst in the hitherto known types of automatic phonographs on subdividing the stack of records for selected play of one of them the records are displaced without control and by forming working spaces of different width for the tone arm according to the invention all records constantly remain under the influence of operational elements of the selector control confining the stack of records to two predetermined arrangements, namely the closed neutral or starting position and the playing position resp., wherein the stack is opened for forming the working space for the tone arm at the preselected place. This constant control of the stack of records gives the special and unique advantage that there is no need for vertically arranging the spindle supporting the stack of records for subdividing the stack by gravity or the weight of the records resp., as it has been necessary with all hitherto known record selector mechanisms for records arranged along the axis of the turntable. As it will be later described in detail the principle of in-

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vention can be used for stacks of records of any spacial orientation. Thus, e.g. the axis of the stack may be arranged horizontally.

The means for supporting said one section of the subdivided stack of records remaining in its place will hereinafter be called the resting section as well as the means for orientating said other section of the subdivided stack of records to be displaced—which will hereinafter be called the wandering section—may engage the records either at their outer or their inner peripheral edges. The use of one or the other of these kinds of engagement depends on the size of the record and the general design of other operational elements of the selector control.

The kind of operation of said orientating means may be different. In phonographs with a vertically arranged stack of records said orientating means may comprise a supporting member arranged for vertical displacement for the undermost record of the stack whereupon the other records of the wandering section will lean by gravity and thus participate in its displacement.

In those cases where the weight of the records shall not or cannot be used—such as with horizontally arranged axis of rotation—as the displacing power the orientating means are provided with a source of energy holding together the wandering section. Thus, according to a special embodiment of the invention, the orientating means for the wandering section comprise a member for supporting its undermost record, said member being carried by a spring resting on the framework and displacing means engaging its uppermost record. In this embodiment the displacing means determines the position and the width of the tone arm working space and the supporting spring compresses the wandering section. Furthermore, it is possible to elastically connect said member for supporting the undermost record to said means for supporting the resting section.

If in a manner known as such either the underside of the undermost record of the resting section or the upperside of the uppermost record of the wandering section shall be selectively played by a double needle tone arm according to a special embodiment of the invention both the means for supporting the resting section and the means for orientating the wandering section are connected to a shaft inside the stack of records for common rotation therewith, so that all records of the stacks are always rotating in the same sense, namely in the one direction if the upperside of a record is played and in the reverse direction if the underside of a record is played.

Preferably the spindle supporting the stack of records consists of a tube-like member and at least the means for supporting the resting section comprise elements inside said tube-like member and adapted to be moved radially outwards and inwards across slots arranged axially in said tube. The orientating means for the wandering section may be arranged in a similar manner or may comprise elements engaging the outer peripheral edges of a record as it has already been mentioned hereinbefore.

When playing records provided in known manner with centering hubs it is preferred to provide for coupling means between the stack supporting spindle and said centering hubs for keying the records to the spindle for joint rotation. These coupling means may comprise a rib arranged axially along said spindle and corresponding grooves arranged at the inner peripheries of said centering hubs.

In order to guarantee a co-rotation of records having an inner opening of maximum gauge width and therefore loosely fitting the centering hub this hub preferably is provided with a flange for supporting the record and an elastic member overlaying the record to generate a forced

coupling between the record and said centering hub and thus said supporting spindle.

Now, some embodiments of the invention will be described with reference to the accompanying drawings, in which

Fig. 1 is a diagrammatic side elevational view of an automatic phonograph provided with a record selector installation according to the present invention, showing only the constructional elements important for operation,

Fig. 2 is a partial sectional view of the record stack carrier of the installation shown in Fig. 1,

Fig. 3 is a partial sectional view of another embodiment of a record stack carrier similar to Fig. 2,

Fig. 4 is a sectional view taken along the line IV—IV of Fig. 3 showing the radial displacement of the members supporting the two sections of the subdivided stack,

Fig. 5 is a sectional view of a record centering hub,

Fig. 6 is a top plan view of such a hub, and

Fig. 7 is a partial sectional view of still another embodiment of a record stack carrier similar to Fig. 2,

Fig. 8 is an enlarged side view of the driving mechanism for the record stack spindle,

Fig. 9 is an enlarged side view of the selector register and of the switching device for said driving mechanism partly in section, and

Fig. 10 is an enlarged side view of the tone arm mounting.

Referring now to the drawings and more particularly to Figs. 1 and 2 thereof, the record selector installation according to this invention comprises a framework consisting of the two panels 1 and 2 and the two pairs of supporting columns 3 and 4 connected by the top panel 5. On the column pair 3 is mounted the selector register 6 of a record preselector mechanism of usual design. This register 6 is operated in known manner by selector head 7 shown diagrammatically which may be of the electromagnetic type. The other pair 4 of columns serves to guide the tone arm adapted to be moved up and down and swung in and out. The elements generating these swinging movements are designated by the reference figure 9.

To the underside of the upper panel 1 there is fastened the main driving motor 10. Through a train of gears 11 this motor continuously rotates the spindle 12 supporting the stack of records and journaled in the panel 1 and simultaneously is adapted to move up and down a square-threaded hollow spindle 14 through a shifting clutch 13. The train of gears 11 comprises elements adapted to change the direction of rotation in dependence on the selector installation by means known as such and therefore not shown for reasons of simplifying the drawings. The spindle carries at its upper part the means 40 supporting the resting section of the stack of records which will be described hereinafter in connection with Fig. 2 and at its lower part the feeler member 15 engaging the selector register 6 of the record selector installation. This feeler member 15 is connected by the connecting member 16 partly plate-shaped and partly rod-shaped to the column 17 lifting the tone arm for joint up and down movement. Furthermore, said feeler member 15 is provided with a feeler lever 151 fulcrumed between knife-edges 152 for both axial displacement and swinging movement and biased by a spring 153 outwards, namely towards the selector register 6. In its normal position the feeler lever 151 is resting against an extension 154 depending from the feeler frame 15. The motor 10 also drives the cam column 19 through a second train of gears 18. The two-armed lever operating the shifting clutch 13 carries at its right end a feeler engaging a cam 20 of a control slide 21 mounted on a bracket of the framework for cross-wise movement. This slide 21 is under the influence of three elements: firstly a spring 22 tends to shift it from its neutral position toward the outer working position shown in Fig. 1, secondly a release pawl tends to hold it in its neutral posi-

tion, and thirdly a cam 24 mounted on the column 19 for adjusting its different working positions. The release pawl 23 is connected to the feeler member 15 through a lever 25, a crank 26, the cam column 27 and a pin clutch 28, so that it releases the slide 21 when the feeler lever 151 is moving towards the register 6. Furthermore, the slide 21 closes and opens the train of gears 18 rotating the cam column 19 by a projection 211.

A further cam carried by the column 19 is connected to a control shaft 32 through a lever 30 and a crank 31, said shaft 32 carrying a three dimensional cam 33 controlling a lifting rod 34, another three dimensional cam 35 controlling a supporting tube 36 and a lever 37 retracting the feeler lever 151.

Now, the construction of the record supporting and displacing installation shall be described with reference to Fig. 2 of the annexed drawings. In a bearing 38 arranged on the panel 1 the following constructional elements are coaxially journaled cited in their order from inside to outside: the lifting rod 34, the hollow spindle 14, the supporting tube 36 and the record stack shaft 12.

The lifting rod 34 is provided at its upper end with a rotatable cone-shaped head 39 adapted to press the plate-shaped elements 40 retaining the undermost record of the resting section of the stack 41 radially outwards into the area of the centering hubs 42 of the records against the action of a retracting spring.

The radial distribution of these retaining elements 40 is shown in Fig. 4.

The hollow spindle 14 is keyed to the connecting element 16 mentioned hereinbefore and provided with a square external thread. A nut screwed thereon is adapted to be rotated by the motor through the shifting clutch 13 hereinbefore described and a chain drive for thus lifting or lowering resp. the spindle. The support 44 of the retaining elements 40 rests in a ball bearing at the upper end of the spindle.

The supporting tube 36 carries at its lower end the coupling collar for the lever operated by the cam 35 and at its upper end three radially projecting studs 45 supporting a ring member 46 serving to carry the undermost record of the wandering section of the stack.

The record stack spindle 12 consists of a tube provided with axially extending slots 47 in its convex surface, said slots corresponding in width and radial arrangement with the retaining elements described hereinbefore, so that these elements can pass through them and enter into the record centering hubs 42. The spindle carries at its lower end the last member of said train of gears 11 and thus is rotated by the motor 10. Because the retaining elements 40 as well as the studs 45 supporting the ring member 46 participate in this rotation, also all records, namely those of the upper resting section as well as those of the lower wandering section are rotated. Normally, the mutual friction of the records by weight is sufficient for taking along all records. In the embodiment shown in Fig. 2 the friction is intensified by an imposed weight 48.

However, it is also possible to enforce a keyed drive of all records by providing the spindle 12 with an axially extending rib 49, see Fig. 4, and the record centering hubs 42 with a corresponding notch 50, see Fig. 6, at their inner peripheries.

Now, the remaining constructional and operational elements of the record selector installation shall be described with reference to Fig. 1.

A further cam 51 mounted on the control column 19 rotates by aid of a feeler a shaft 52 controlling two levers 54 and 55 pivoted on the carrier slide 53. The lever 54 oscillates in known manner the tone arm 8 into the working space between the two record stack sections and out of it after the play, and the lever 55 serves also in known manner for advancing the tone arm 8 against the underside of the undermost record of the upper rest-

ing section or against the upperside of the uppermost record of the wandering section.

Two further switches 56 and 57 are provided for controlling the well-timed switching in and out and operating of the motor 10. Switch 56 is controlled by the selector register 6, and switch 57 is controlled by a further cam 58 mounted on the control column 19. A third switch 59 is mounted on the tone arm carrier slide 53 and controlled by the lateral oscillation of the tone arm for operating the control column 27 by aid of an electromagnet 60.

The kind of operation of the record selector installation with the hereinbefore described constructional and operational elements is as follows:

For starting a desired play the auditor starts with moving by aid of a system of rods not shown the selector head 7 into the place described by the title of the play or else and then operates an electric switch for thrusting out the armature of the selector head and thereby thrusts one of the slides of the selector register 6 into the path of movement of the feeler lever 151, closing the switch 56 and thereby starting the drive motor 10. The motor rotates the record shaft 12 carrying the stack of records closed at that time by aid of the train of gears 11 and simultaneously lifts the hollow spindle 14 and thereby the feeler member 15 by aid of the clutch 13 closed at that time, the corresponding train of gears and the nut 43. As soon as the feeler lever 151 engages the selector slide thrust out by the preselection it is primarily pivoted a bit against the strength of the spring 153 for becoming disengaged from the projection 154 and afterwards at once pressed outwards by said spring 153 for pushing back with its edge said thrust out selector slide. Simultaneously the pawl 23 is released by aid of the pin clutch 28, the control column 27, the crank 26 and the lever 25, and the control slide 21 moves towards the left in the sense of Fig. 1 under the influence of the spring 22 and opens the clutch 13. In this way the hollow spindle 14 and the retaining elements 40 carried thereby as well as by aid of the connecting elements 16 and 17 the tone arm 8 are brought to rest at a level corresponding with the position of the record giving the desired play in the stack of records. By said pushing back of the selected selector slide the switch 56 is again opened, however, simultaneously the cam gear 18 is thrown in by the control slide 21 and thereby the switch 57 is closed by the cam 58 becoming operative so that the motor 10 remains energized. Furthermore, the control shaft 32 is turned by aid of the cam 29, the lever 50 and the crank 31. Hereby at first the three dimensional cam 33 lifts the lifting rod 34 for an amount that its cone-shaped head 39, see Fig. 2, moves the retaining elements 40 outwards and into the centering hub 42 of the record situated at that level. In the following step the supporting tube 36 is pulled down by aid of the control shaft 32 and the three dimensional shaft 35. However, only the section of the stack of records underneath the record held by the projected retaining elements 40 can follow this downward movement, the stack of records thus being subdivided at the preselected level. The downward movement of the supporting tube 36 is proportioned so that finally the upperside of the uppermost record of the wandering section is at the correct level of operation with respect to the tone arm 8. During the rotation of the control shaft 32 also the feeler lever 151 is brought back into its neutral position by the lever 37 against the strength of the spring 153 and again retained in this position by the projection 154.

As the next step the tone arm control shaft 52 is rotated by the cam 51 for firstly introducing the tone arm into the working space between the two stack sections by aid of the lever 54 and then advancing it against the record surface to be played by aid of the lever 55.

Immediately afterwards the cam 24 releases the con-

trol slide 21 to enter a medium position for again disengaging the control column gear 18. Now, the playing of the record is started. At the end of the play the tone arm operates the switch 59 of the electromagnet 60.

Hereby the control shaft 27 is rotated so that the shifting clutch 21 returns into its former position shown in Fig. 1. Hereby the control column gear 18 is again engaged, the cam 51 becomes again operative and returns the tone arm into its neutral position. In the following the cam 29 becomes operative and actuates the supporting tube 36 in the previously described manner, but in the opposite direction for again closing the stack of records. Then also the lifting rod 34 is lowered by the cam 33 for again releasing the retaining elements 40 from the centering hub 42 by aid of their springs 41.

Finally, the control slide 21 is moved into its neutral position far to the right in the sense of Fig. 1 by the cam 24 and thus the train of gears 18 of the control column 19 is stopped and the clutch 13 again brought back into its initial position of engagement. In this moment the cam 58 has a position for opening the switch 57 and thus de-energizing the drive motor 10.

Now, one circle of play is finished, and the record selector installation is ready for selecting and playing another record.

If e.g. by primarily selecting a plurality of plays a further selector slide is thrust out before the end of a play the switch 56 remains continuously closed so that in spite of switch 57 having been opened at the end of the first play the motor 10 keeps rotating and thereby the feeler lever 151 remains operative and starts the next play in immediate sequence in the previously described manner.

For simplifying the drawings the record selector installation shown in Fig. 1 and previously described has not been provided with a mechanism for changing the direction of rotation necessary for playing the underside of a record. As it has already been mentioned this can be performed by reversing the gear train 11. Such mechanism are known and principally comprise a reversing controller or a reversing gear actuated by the record selector installation.

In Fig. 3 is shown another embodiment of the record stack supporting spindle using an additional source of energy in the form of a coil spring for subdividing the stack of records instead of the own weight of the records. The altered embodiment chiefly comprises the same constructional and operational elements like the embodiment previously described and shown in Fig. 2. Therefore, equal or equally operative constructional elements have been characterized in Fig. 3 by the same reference figures like in Fig. 2 with the index 2... added.

Along the axis of the record stack spindle 212 the following constructional elements are arranged in the order from inside to outside: the lifting rod 234, the square threaded hollow spindle 214, the supporting tube 236 and the record stack spindle 212. The retaining elements 240 for the resting section can be moved outwards through holes 247 provided in the stack spindle 212 and into the record centering hubs 42 by aid of the cone-shaped head 239 of the lifting rod 234 against the strength of the spring 241 as it has been described in connection with the embodiment shown in Fig. 2.

However, contrarily to that embodiment shown in Fig. 2 a system of leaf-shaped slides 70 is mounted in the supporting tube 236 at a level corresponding with the working space of the tone arm. These slides have the same shape like the retaining elements 240 and are likewise adapted for being moved radially outwards through the longitudinal slots 247 of the record stack spindle 212. This spindle 212 is surrounded along its lower end by a coil spring 71 anchored at one side on the spindle, e.g. on the last member of the gear train 11, see Fig. 1, and urging upwards the second stack with its other end by aid of an intermediate plate 246. When the supporting tube

236 is lowered in the hereinbefore described manner it takes along the wandering section limited by the slides 70 against the strength of the spring 71 thus keeping together this record section for joint rotation. For also securely keeping together the resting section retained in previously described manner by the retaining elements 240 a disc spring 72 is inserted between the uppermost record and the head of the record stack spindle 212. It is not absolutely necessary, however advantageous to arrange the keying rib shown in Fig. 2 on this spindle 212.

Evidently the coherence and the joint drive of all records of the closed or subdivided stack are also guaranteed when the record stack spindle is not in the shown vertical position, but in any other, e.g. horizontal position. Such an embodiment not especially shown by drawing has numerous advantages.

Figs. 5 and 6 show a preferred embodiment of a record centering hub. This hub is provided with a somewhat projecting flange 73 for supporting the record and a groove for receiving a spring element, e.g. split ring 74 shaped and arranged with respect to the flange 73, so that a record can be clamped inbetween. Fig. 6 also shows the key-groove 50 described hereinbefore engaged by the key-rib 49 arranged at the record stack spindle 12 and thus guaranteeing a safe co-rotation of the record carried by said centering hub.

Fig. 7 shows still another embodiment of the record stack supporting spindle having the same principal construction like the embodiments shown in Figs. 2 and 3. Therefore, in Fig. 7 the completely equal elements were characterized by the same reference figures and equivalent elements were differentiated by the index figure 3 The speciality of the embodiment shown in Fig. 7 consists in that the record stack primarily remains in closed arrangement on the turntable and only the hollow spindle 314 together with lifting rod 334 and the retaining elements 40 mounted thereon move upwards to bring said elements 40 on the level prescribed by the record selector installation. Then the retaining elements 40 are introduced into the centering ring 42 of the selected plate in the hereinbefore manner. During the next step the lifting rod 314 is again moved upwards by suitable cams for lifting the record engaged by the elements 40 and all other records above said engaged record in the stack. This is in contrary to the former embodiments wherein the section of the stack underneath said engaged record was lowered. The height of lifting is controlled so that again the working space necessary for introducing the tone arm is provided. By a suitable construction of the head 382 of the lifting rod 14 care is taken that the retaining elements 40 are not influenced during this upwards movement. The section lifted by the lifting rod 314 is compressed by a coil spring 381 inserted between the head of the record stack spindle 12 and the centering hub of the uppermost record. After the performance of the play the lifting rod 314 and the stack section carried therefrom are lowered by aid of suitable cams and the retaining elements 40 are withdrawn in the hereinbefore described manner for making the record stack ready for the next record selection and play.

It will, of course, be understood that any suitable device may be employed for selecting a record and/or for controlling the movements of the elements of the record stack displacing and subdividing mechanism as described hereinbefore. Instead of a record selector there may also be used a control mechanism for automatically playing the records in a fixed sequence such as the sequence given by the arrangement in the stack or else. Also, it will be

appreciated that although only a few embodiments of the invention have been illustrated and described herein, it will be apparent to those skilled in the art that the invention is not so limited but that various changes may be made therein without departing from the spirit of the invention or the scope of the appended claims.

We claim as our invention:

1. In an automatic phonograph having a pick-up of a tone arm, a record selector mechanism comprising a hollow spindle, means for rotating the spindle at record speed in a direction selected according to the side of the record to be played, means to receive a stack of records arranged on the spindle for axial displacement thereon for exposing the side of a record to be played to be contacted by the pick-up of the tone arm, means in said spindle to be rotated therewith and to be axially displaced therealong into a preselected axial position and, when at said location, to be moved radially out a distance to contact a record positioned at said location and to be moved radially back into their positions within said spindle, a tone arm axially displaceable along an axis arranged spaced from and parallel with the axis of said record spindle and provided with a pick-up on one side and a pick-up on the other side thereof, means for moving the tone arm into a position wherein one of said last-mentioned pick-ups is able to play a desired side of a record and for moving back said tone arm into its initial position after the completion of said desired play, means for axially displacing both said spindle-carried means and said tone arm simultaneously and equally along their respective axis into axial positions wherein one of said tone arm pick-ups is able to play a desired side of a record and back into their initial positions after the completion of said desired play, and means for providing a working space for said tone arm at said location of the side of the record to be played before the playing after said spindle-carried means has been axially displaced and radially moved out of said spindle and before the start of said play and to again close a working space generated by said means after the completion of said desired play.

2. In an automatic phonograph according to claim 1, wherein said means for providing the working space for the tone arm is able to displace said spindle-carried means, when radially moved out, together with records which are in contact with said moved out means along said spindle axis for a distance equal to the width of said working space before the start of said desired play and to return said means and said records into their positions maintained before said displacement after completion of said desired play.

3. In an automatic phonograph according to claim 1, wherein said means for providing the working space of the tone arm is able to displace the part of said record stack arranged within the axial space between said initial position of said spindle-carried means and their desired axial position for a distance equal to the width of said working space before the start of said desired play, and to return said part of said record stack into its position maintained before said displacement after completion of said desired play.

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